iRMX®
Command Reference

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Quick Contents

Notational Conventions

Most of the references to system calls in the text and graphics use C syntax instead of PL/M (for example, the system call **send_message** instead of **send$message**). If you are working in C, you must use the C header files, *rmx_c.h*, *udi_c.h*, and *rmx_err.h*. If you are working in PL/M, you must use dollar signs ($) and use the *rmxplm.ext* and *error.lit* header files.

This manual uses the following conventions:

- Syntax strings, data types, and data structures are provided for PL/M and C respectively.
- All numbers are decimal unless otherwise stated. Hexadecimal numbers include the `H` radix character (for example, `0FFH`). Binary numbers include the `B` radix character (for example, `11011000B`).
- Bit 0 is the low-order bit. If a bit is set to 1, the associated description is true unless otherwise stated.
- `Data structures and syntax strings appear in this font.`
- **System call names and command names appear in this font.**
- PL/M data types such as BYTE and SELECTOR, and iRMX data types such as STRING and SOCKET are capitalized. All C data types are lower case except those that represent data structures.
- The following OS layer abbreviations are used. The Nucleus layer is unabbreviated.

AL	Application Loader
BIOS	Basic I/O System
EIOS	Extended I/O System
HI	Human Interface
UDI	Universal Development Interface

- Whenever this manual describes I/O operations, it assumes that tasks use BIOS calls (such as **rq_a_read**, **rq_a_write**, and **rq_a_special**). Although not mentioned, tasks can also use the equivalent EIOS calls (such as **rq_s_read**, **rq_s_write**, and **rq_s_special**) or UDI calls (**dq_read** or **dq_write**) to do the same operations.

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Using Commands 1

This manual describes the command interface to the iRMX® Operating Systems (OS): the iRMX III OS, iRMX for PCs, and iRMX for Windows. It describes how to use the commands, and contains information about line-editing and terminal control characters. In addition, this manual provides methods for verifying and correcting the data structures of iRMX named or physical volumes.

The introductory sections of this manual assume you are familiar with the terminal characteristics of your monitor and the keyboard from which you enter commands. Later sections, such as those on using **diskverify** in interactive mode, require an understanding of iRMX volume structure.

How to Use This Manual

The information in this manual applies to a variety of user levels, system types, and configurations. You will need to choose the information appropriate to your system. Some system types covered by this manual include:

- Installations running on PC bus, Multibus I, or Multibus II systems
- ICU-configurable iRMX systems, which may vary from the standard device types and OS layers described in this manual
- iRMX for Windows and iRMX for PCs systems: descriptions of configuration issues don't apply to preconfigured iRMX for Windows, but discussions of loading device drivers and user jobs, and modifying *:config:* files do apply
- Single-user systems, which need little or no file protection and user password protection
- Multiple-user systems, including systems operating on a network, which may need to strictly enforce file and system access

Use these guide to determine which parts of this manual you should read:

If you are:	Refer to:
A new user	Chapters 1 and 2 and Appendix E
An experienced user	Chapter 2 and Appendices A-F
Responsible for managing the system	Appendices A, B, and C, in addition to other chapters
Using the SBX 279 Graphics interface	Appendix D, in addition to other chapters

Commands Available on Your System

Figure 1-1 shows the layers of the iRMX OS that provide commands:

Command Line Interpreter (CLI)
DOS/Windows
iRMX-NET networking software
Human Interface (HI)

The figure also shows the layers of the OS necessary to support these command-level layers:

Nucleus
Basic I/O System (BIOS)
Extended I/O System (EIOS)
Application Loader
VM86 Dispatcher
Remote File Driver (RFD)

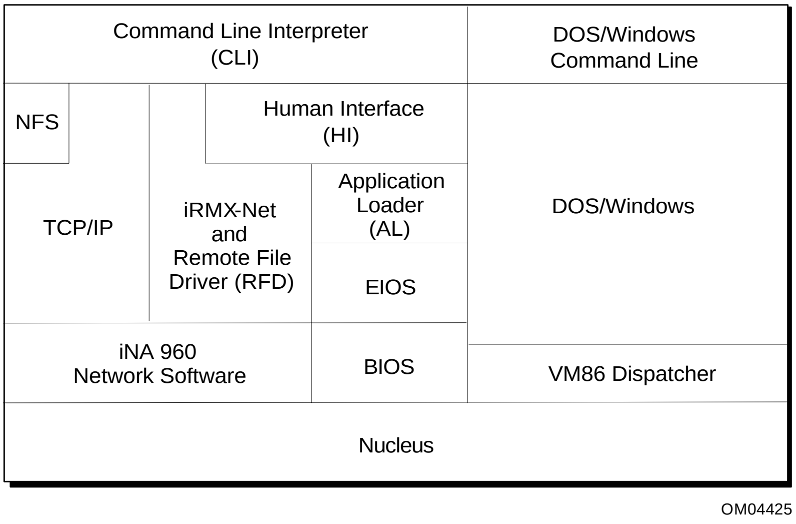


Figure 1-1. iRMX Operating System Layers that Provide Commands

The commands in Chapter 2 are labeled according to their source or function: CLI, HI, DOS, NET (iRMX-NET), TCP/IP, and NFS commands. The commands available to you depend on your type of system:

- If you use iRMX for Windows or iRMX on a PC, all the OS layers are part of the system. You may choose not to install the networking software; in this case the NET and/or TCP/IP and NFS commands are not available, depending on what network you install. Some of the HI and NET commands in Chapter 2 are not provided in iRMX for Windows. These commands are noted in that chapter.
- If you use an ICU-configurable system, the command-providing layers must be configured into the system to support the command-level layers. The iRMX-NET and TCP/IP subsystems are also optional in these systems.
- In any system, it is possible to replace the CLI with a user-written command interface program. In such a system, the CLI commands are not available.
- In any system you may selectively install individual HI and NET commands, which are simply HI commands provided by the iRMX-NET software. Each command is a separate executable file. You may also write new commands.

Except where noted, this manual assumes that all commands provided by your type of installation are available.

The Human Interface (HI)

The HI provides single- or multi-user support for one or more terminals. When the system is booted, the HI initializes each terminal and begins running an *initial program*, which is an interactive HI job. The initial program can be your custom command interface or the iRMX CLI.

The HI initializes terminals as either static or dynamic. A *static terminal* always has a specific user associated with it. You do not log on or off such a terminal; you simply begin entering commands. A *dynamic terminal* is one where you must log on and provide a user password. Each logon session begins a new HI interactive job.

HI commands are executable files loaded and run by the CLI (or other command interface). Each command is a separate file stored on disk.

You can use the **dir** command to display the names of the HI system commands, utilities, or development tools available on your system. Enter the commands shown below:

```
dir :system:
dir :utils:
dir :lang:
```

See also: Logging on, *Installation and Startup*
CLI initial program, *System Concepts*
static and dynamic terminals, *System Configuration and Administration*
dir command, Chapter 2

The Command Line Interpreter (CLI)

The CLI is an application running under the HI. It enables operators to communicate with the OS by entering commands. The CLI takes each HI command as it is entered, divides it into a program name and parameters, runs the program indicated by the command name, and passes the parameters to the program. CLI commands are internal to the CLI, not separate files on disk.

The CLI provides such features as type-ahead, command-line editing, and I/O redirection: taking input from or sending output to a file or device on the command line.

Three HI commands, **logon**, **super**, and **submit**, are similar to CLI commands by the same name. The duplicate HI commands are for use with a custom command interface, but lack CLI features such as aliasing, line-editing, and background processing.

Networking Software

The iRMX-NET networking software provides connections across a network to other systems that use OpenNET software. OpenNET is Intel's implementation of an ISO-TP4 network and is available for such diverse OSs as MS-DOS (through MS-Net), iRMX, UNIX, and VAX/VMS.

The iRMX-NET software also provides a set of HI commands that allow you to perform such operations as managing the network attributes of the system, locating a system by name, restarting the network software on the network controller board, or loading a boot file to the network controller on a remote system. The network software can perform many of these functions automatically during initialization.

In addition to, or instead of, iRMX-NET, you may install TCP/IP software, which includes its own set of utilities. This manual includes the TCP/IP commands. If you do install TCP/IP, you can also choose to install NFS software to get transparent file access across the net.

See also: *Network User's Guide and Reference*
TCP/IP and NFS for the iRMX Operating System

Understanding the File Systems

You can use commands more effectively with an understanding of the basic file systems. These terms are used in relation to file names, and are explained in more detail in later sections:

Pathname	The designation used by the OS to find or specify the location of a file or directory in the file tree. The forward slash (/) is the usual separator in iRMX pathnames.
Logical name	A short identifier or symbolic name for a pathname, command string, device, etc. Logical names are usually surrounded by colons, and are used to simplify command entry.
Volume	A physical device for storing files. The volume might be a hard disk, a partition on a disk, a RAM disk, or a diskette or tape. The diskette is associated with the name of the disk drive, and the tape is associated with the name of the tape drive.
Prefix	The beginning reference in a pathname, usually a volume name or a logical name.
Wildcards	Characters (* and ?) used to replace some or all of the characters in a filename. Wildcards are most often used to specify several files in a single reference within a command.

File Types

The iRMX environment has five types of files: named, DOS, physical, stream, and remote. If you use NFS software, there is also an NFS file driver.

Named files	Divide the data on storage devices into individually accessible units. Users and programs refer to these files by name when they want to access information stored in them. When operating from the command line, you access named files more often than any other file type.
Physical files	Enable the OS to deal with an entire I/O device as a single file. The HI accesses backup volumes and devices such as line printers and terminals in this manner. It also accesses secondary storage devices (such as disk drives) as physical devices when formatting them. When operators access physical files, it is usually in a manner that is transparent to them (such as copying a named file to the line printer or formatting a disk).
Stream files	Enables communication between programs. Two programs can use a stream file for communication if one program writes information to the stream file while another program reads the information.
Remote files	Are the same as named files. However, remote files reside on a remote system connected to the network. No special semantics are needed to access remote files, but file access permissions may be different from local files. These are files made available through the iRMX-NET Remote File Driver.
DOS files	Are named files in the DOS file system format. They are accessed through the EDOS file driver on iRMX for Windows and the DOS file driver on all other iRMX platforms. All iRMX users have access to all DOS files.
NFS	Any file available on a remote system that is made available through the NFS File Driver. In a generic sense, these are also remote files.

When you create files, use DOS conventions to name DOS and EDOS files: a prefix of up to eight characters, followed by a dot (.) and a three-character suffix. On other files, use the iRMX convention of up to 14 characters and no suffix. The characters in file and directory names must meet the rules of both the DOS and iRMX OSs. They can include letters (**A** through **Z**), numbers (**0** through **9**), and any of the these characters:

. _ $ ~ ! # % & @ - { }

They cannot include spaces or any of these characters:

: / ^ * ? " ' | , = + < > ( ) [ ] ;

There are two uses for the term *named files*. One is the generic sense, where any files in a file hierarchy are established with individual names. In this sense, remote and DOS files and directories are named files. However, there is also a *named file driver,* which only operates on iRMX named files, not remote or DOS files (these use their own file drivers). If a command parameter refers to files as named, as in the **format** and **attachdevice** commands, the term refers to the named file driver. Otherwise, the term *named files* in this manual can encompass any file that is not a physical file.

See also: File types, *System Concepts*

The OS treats both data files and directories as files. It also treats devices as files, after you use the **attachdevice** command to establish a logical name for the device. Thus, when a command parameter gives you the option to write to a file, you can write to a printer or terminal device by specifying the logical filename associated with the device.

See also: Logical names, in this chapter

Named File Tree

Figure 1-2 shows a simple named file tree. In this figure, *:vol:* is a logical name for the volume, which also represents the root directory of the tree. Within the root directory are two directories named *dept1* and *dept2*. *Dept1* has two subdirectories, *user1* and *user2*. *Dept2* contains a single file, *myfile*. The *user1* directory contains two files, *fileA* and *fileB*, while *user2* contains *fileC*.

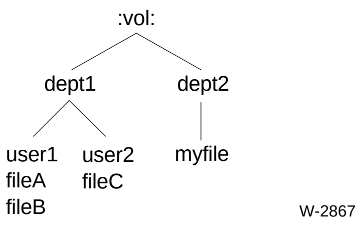


Figure 1-2. Example File Tree Structure

File Access and User IDs

All named files have an associated owner and list of users who have various permissions to access the file. The file's owner and accessors are stored as user ID numbers. If a file is owned by the World user, any user has complete access to the file. If a file can be accessed by the World user, any user has the type of access permissions granted, including the right to read, overwrite, append, and/or delete the file. Directories have similar access rights, which apply not only to the directory itself, but to files (and other directories) stored in it.

When you use a command to create a file (for instance, by copying a file or specifying an output file in a command), your user ID is listed as the file's owner. You can use the **dir** command with the long parameter to look at your access rights to files, or with the extended parameter to display all the owners and accessors of a file, along with the associated access rights. You use the **permit** command to establish accessors and access rights.

See also:	Creating files and copying files, *Installation and Startup*

All files managed by the DOS or EDOS file drivers are owned by the World user, from the point of view of the iRMX OS. The DOS file system supports read-only or read/write attributes for files. Directories cannot be made read-only.

If your system is configured to include the iRMX-NET networking software, any user on the system who gains access to the HI through logon automatically becomes a verified user. In the OpenNET network system, a verified user can access files on remote systems through iRMX-NET. On a TCP/IP network, users can access files on remote systems through NFS, which has its own verification process.

See also:	Access rights**, permit** command, Chapter 2

Using Pathnames

If the directory where you are currently working is on another volume, you must specify the volume name to refer to a file. For example, to refer to *myfile* from another volume, you would specify the file as:

```
:vol:dept2/myfile
```

The forward slash (/) is the standard iRMX filename separator. When you specify a logical name at the beginning of the pathname, you cannot use a slash between the logical name and the next component of the pathname.

However, if your current working directory is on *:vol:*, you do not need to specify *:vol:* as the root directory part of the pathname. You could refer to *myfile* from anywhere on the volume with the pathname:

```
/dept2/myfile
```

The slash at the beginning of the pathname specifies the root directory of the current volume. Both *:vol:dept2/myfile* and */dept2/myfile* are considered full pathnames to the file, as long as the beginning logical name refers to the root directory of the volume.

You can also specify a file with a pathname that is relative to your current working directory. For example, if your current directory is *user1*, you can refer to *fileA* simply as filea. In iRMX, to refer to *fileC*, you could use a circumflex (^) operator:

```
^user2/filec
```

In iRMX, each circumflex tells the OS that the next path component resides up one level in the file tree. When you use a circumflex in the pathname, you do not use the / separator at that point in the pathname. For example, from the *user1* directory, you could refer to the *myfile* file with either of the these pathnames:

```
/dept2/myfile
^^dept2/myfile
```

The pathname does not need to end in the name of a data file. You use the same sort of pathnames to specify directories as to specify files.

In the DOS and EDOS file drivers, the dot-dot (..) operator works in a similar manner.

The *:$:* logical name, discussed later in this chapter, determines the location of your current working directory.

See also:	Logical names, in this chapter
	specifying pathnames, in your DOS documentation

Using the Copy Command with Multiple Pathnames

When specifying pathnames in a command's input and output lists, remember these rules:

- If you specify multiple input pathnames and a single output pathname for the **copy** command, file concatenation takes place.
- If you specify multiple input pathnames and one output pathname that is a directory rather than a file, the HI copies all the input files into the directory. Each file keeps its original name in the new directory.
- If you specify multiple output pathnames, you must specify the same number of input pathnames as output pathnames. Specifying more input pathnames than output pathnames results in an error message. For example, these commands return error messages:

```
-copy a,b,c to d,e <CR>   (invalid)
-copy a,b to c,d,e <CR>   (invalid)
```

When the sequence of data in a concatenated file is important, remember that all operations are performed in the sequence you specify in the command line.

Using Wildcards in Filenames

Wildcards are characters used to specify several files in a single reference within a command. Use wildcards in any position in a filename to replace some or all of the characters in the name.

You cannot use wildcards in the directory path part of a pathname, but if the last component of a pathname is a directory name you may use a wildcard in that directory name. Thus the name *system/app1/*file* is valid, but *system/app*/infile* is not.

The wildcard characters are * and ?:

? The question mark matches any single character. The HI selects every file that meets this requirement. For example, the name *file?* implies all of these files:

file1
file2
filea

* The asterisk matches any number of characters (including zero characters). The HI selects every file that meets this requirement. For example, the name *file** implies all of these files:

file1
file.obj
file
filechange

You can use multiple wildcards in a single name. For example, the name **if?.** matches every file containing the sequence *if* followed by any character and a period. This could include all of these files:

rmxifc.lib
ifl.p28
lnkifc.

The ***** character matches as close to the end of the pathname as possible. For example, suppose the directory contains the file *abxcdefxgh*, and you enter:

```
copy *x* to :prog:*2*
```

The first asterisk matches the characters *abxcdef* and the second asterisk matches the characters *gh*. The command creates a new file in the *:prog:* directory named *abxcdef2gh*.

Many commands use input and output pathnames as parameters. You can use wildcards in both input and output pathnames. For example:

```
copy a* to b*
```

In this command, the *a** represents the input pathname and *b** represents the output pathname. The HI searches the appropriate directory for all files that begin with *A*. It copies each file to a file of the same name, but beginning with *B*, as shown below:

Original Files	**Copied Files**
alpha	*blpha*
a112	*b112*
a	*b*

In some commands you can specify lists of input and output pathnames, separated by commas. For example:

```
copy a,b,c to d,e,f
```

This command copies *a* to *d*, *b* to *e*, and *c* to *f*. If you use wildcards in any one of the output pathnames, you must use the same wildcards in the same order in the corresponding input pathname. This means that if you use both the ***** and the **?** characters, their ordering must be the same in both the input and output pathnames. For example, this command is valid:

```
copy a*b?c*, x to *de?fgh*i, y
```

However, this command is invalid because the wildcards are out of order:

```
copy a*b?c* to *de*fgh?i
```

If you use wildcards in an input pathname, you can omit all wildcards from the corresponding output pathname to concatenate files. For example, suppose a directory contains files *a1*, *b1*, and *c1*. This command is valid:

```
copy *1 to x
```

It copies files in this manner:

```
a1 to x
b1 after x
c1 after x
```

However, if *x* is a directory, the HI does not concatenate files, but makes copies of the files in the *x* directory.

See also: **copy** command, Chapter 2

Specifying Hidden Files

An iRMX hidden file is any file whose name begins with *r?* or *R?*. Ordinarily, you cannot specify a hidden file in a pathname because the HI interprets the question mark as a wildcard. To specify a hidden file, surround the pathname or the question mark with single or double quotes. For instance:

```
copy 'r?logon.csd' to :co:     or
copy r'?'logon.csd to :co:
```

The **dir** command has an invisible parameter that lets you list the hidden files in a directory.

See also: **dir** command, Chapter 2
specifying filenames, in your DOS documentation

Entering Commands

When you enter a command, line wraparound is not permitted. The maximum line length is 76 characters, excluding the prompt, and no more than 79 characters including the prompt. All characters exceeding the maximum line length are ignored. To enter a line that exceeds 79 characters, create a continuation line by using an ampersand (&) as the last character in the line. If you continue a line, do not break the line in the middle of a command or a parameter. You may enter as many continuation lines as necessary.

The CLI does not recognize continuation marks, comment characters, or quotation marks within its own commands. These characters, however, are recognized by HI commands. If the result of a CLI command causes execution of an HI command, the HI command is governed by HI syntax. For example, **background** is a CLI command but **copy** is an HI command. You may use a semicolon as shown below to include a comment in the **copy** command. This command executes **copy** as a background job:

```
background copy hi.txt to output.txt ;hi.txt contains tables
```

To execute a command, press <Esc> to execute the whole command line, or press <CR> to execute only the beginning part of the command, up to the letter under the cursor.

Command Syntax

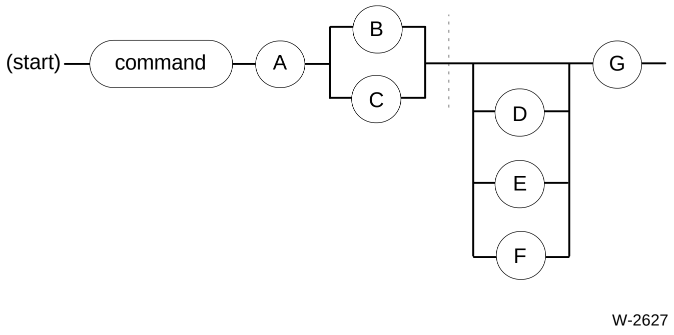
The notation used for command syntax is shown below. Unless otherwise instructed, you may enter any item in upper- or lower-case, or a combination of the two. A few commands, for example **grep**, include a parameter that can be case-sensitive; these are noted in the text. Include any punctuation shown except brackets ([ ]), ellipses (...), and the vertical bar (|); these are described below. Commas are usually used to separate items in lists, such as input and output paths. Parameters (such as query) are usually separated with a space. However, when the syntax includes a comma (,) or equals sign (=), using spaces to separate items is optional.

Syntax

```
command variable [optional] [choice= item1|item2]
          [repeated [item] [, repeated [item]]...]
```

command	Enter any item printed like this exactly as it is shown.
variable	For items printed in italic, enter a substitute, such as the name of a file or a control character from a list of possible choices.
[optional]	Items surrounded by brackets indicate an optional parameter. If you enter this parameter do not include the brackets.
[choice= *item1*|*item2*]	For items separated with a vertical bar, enter only one of the items. You may enter choice=*item1* or choice=*item2*, but not both.
[repeated [item] [, repeated [item]]...]	Items followed by an ellipsis (...) indicate that the item may be repeated more times than it is shown. For this example, any of these would be valid entries: repeated repeated item repeated, repeated, repeated repeated item, repeated, repeated item

A few commands with many parameters have an additional syntax diagram. The parameters are listed along a track, as shown below. Enter the track at the top left and follow it through to the exit. Mandatory parameters are shown in line with the track. Optional parameters are shown below the track (you may follow the main track or follow the path through the option and return to the main track). Where you have a choice of parameters, the track branches through them.



A vertical dotted line indicates that the following parameters may be entered in any order as long as they obey the rest of the syntax. Parameters preceding the dotted line must be entered in the order they appear. In this example:

- A is a required parameter and you must enter it immediately after the command.
- Either B or C is required. Whichever parameter you enter must follow A.
- D, E, and F are all optional but you may select only one. If you select one of these parameters, you may enter it before or after G.

Using the To, Over, and After Parameters

Many commands include the option of writing output to one or more files. The syntax is [to|over|after *pathname*], where you have a choice of writing to, over, or after a specified file. If you don't specify this parameter at all, the output is displayed onscreen (to the *:co:* device). You may use the parameter to direct the output to a named file or to a device such as a printer (*:lp:*). When writing to a file, use this parameter as follows:

to	The command assumes the specified output file does not exist. If the file already exists, the command displays a message similar to: <pathname>, already exists, overwrite? In response, enter Y to overwrite the existing file. Enter R to overwrite not only this file but any remaining files in an output list, without further prompting. If you do not wish to overwrite the file, enter any other character or a carriage return. If this is the only output file specified, the command does not complete. If you are writing to a list of files, this particular file is not overwritten, but other files in the list are written.
over	If the output file exists, it is overwritten without a prompt; if not, it is created.
after	Output is appended to the end of an existing file; the current file contents are preserved. If the file does not exist, it is created.

Note
You cannot use to, over, and after with TCP/IP and NFS commands. You cannot, for example, use these parameters with the **rcp** command.

Abbreviating Parameters

Many of the command parameters have full names that may be abbreviated. Generally, you can abbreviate these parameters by entering the first letter or enough letters to distinguish one parameter from another. For example, when entering a command that contains a query parameter you could simply type q. The abbreviation is listed in the command syntax and the parameter description is shown as:

```
    q(uery)
```

Other parameter abbreviations may not be a simple truncation of the name. For example, the **format** command has a setbadtracks parameter; one possible abbreviation is sbt. The parameter description shows this as:

```
    s(etbadtracks) (or sbt)
```

This indicates that you could enter s, setbadtracks, or sbt.

Abbreviating Command Names

Some command names have abbreviations or aliases already provided. These are listed in the Command Summary Table (in parentheses after the command name), and in the table of System Aliases. In addition, the syntax descriptions give the abbreviations along with the full name, as options. For example:

`ad|attachdevice` means that ad may be entered for attachdevice

Aliases must always be followed by a space, not a tab.

Recalling and Editing Commands

The CLI allows you to continue typing commands as the current command is being processed, and to edit commands on the command line. You may edit a command you are currently typing or recall a previous command and edit it. You may also recall a previous command and re-issue it without editing.

There are a several ways to recall a previous command. One method is to use the <Up-Arrow> and <Down-Arrow> keys to scroll through the command list stored in a history buffer. For each keystroke, the previous or next command is displayed on the command line, with the cursor at the end of the line. You can also use the **!** and **history** commands.

See also: **!** and **history** commands, Chapter 2

To edit a command, use <Left-Arrow> and <Right-Arrow> to move within the line. As you type new characters the following characters are advanced, not overwritten.

When the cursor is in the command, there are two ways to invoke it. If you press the enter key (<CR>), only the part of the command up to the cursor is invoked. If you press <Esc>, the entire command line is invoked, regardless of the cursor position.

When you reinvoke a previous command, it becomes the current command at the end of the history buffer, and you are no longer scrolled upward in the command list.

Using Command Search Paths

Each HI command is an executable file stored on disk. When you specify a command, you are actually invoking the filename, and the HI must locate the file in the directory structure. Typically, you don't invoke a command by its full pathname (although you may), so the HI searches for the file in a set of directories called a search path.

The number of directories searched and the order of search are set in the system configuration for ICU-configurable iRMX III.

This table shows the default search paths in the standard definition files. The directories shown are logical filenames, which are described later in this chapter. These directories are searched in the order shown.

Table 1-1. Directory Search Paths for Commands

iRMX III	iRMX for Windows
:prog:	:prog:
:utils:	:utils:
:util286:	:util286:
:system:	:system:
:lang:	:lang:
:icu:	:$:
:$:	:rmx:
/etc	/etc

If you write your own commands, you can take advantage of the order in which the OS searches directories. For example, suppose you write your own **copy** command that provides different functions than the HI **copy** command. If you want to invoke your program whenever you use the **copy** command, place your program in a file called **copy** in your *:prog:* directory. The OS searches the *:prog:* directory before searching the *:system:* directory (which normally contains HI commands) and runs your **copy** program instead of the default HI command.

If you have multiple versions of a command, you can specify the directory pathname as part of the command name, to specify the particular version you want.

Creating Command Aliases

You may use the **alias** command to retrieve a command from one of the directories, as well as to create a shorter name for the command. For example, you might define the **attachfile** command with an alias using this command:

```
alias af = :system:attachfile
```

In this case, every time you enter af, the OS replaces it with :system:attachfile and invokes the **attachfile** command found in the *:system:* directory. The OS does not search for the command in the search path. (This particular alias is already the standard alias for **attachfile**.)

If you are a DOS user, you can use this facility to make commands similar to the ones you use in DOS. For instance, you could use the command above, but define :system:attachfile as cd, the DOS command to change the working directory. However, keep in mind that the commands are not an exact match; **attachfile** also performs other functions, such as assigning a logical name to a file.

See also: Logical names, in this chapter
Quick Reference to Commands for equivalent commands in DOS and iRMX OS
table of system aliases and **alias** command, Chapter 2

Aliases are useful to reduce the work of entering commands and command sequences that you use often. You can also use aliases in submit files, which are command files used with the **submit** command, similar to DOS batch (*.bat*) files.

You can also use **alias** to assign parameters to commands. For instance, you can define:

```
alias C =  :util386:RUN86 :LANG:IC386
```

Then you can enter the alias C with a filename, such as *myfile.C*:

```
C myfile.C
```

The CLI executes:

```
:util386:RUN86 :LANG:IC386 myfile.C
```

You can nest aliases up to five levels. For instance, you can define:

```
alias C = :util386:RUN86 :LANG:IC386
alias CNL = C #0.PC nolist
```

Then you can enter:

```
CNL source
```

The CLI executes:

```
:util386:RUN86 :LANG:IC386 source.PC nolist
```

Redirecting I/O

You may use I/O redirection to replace the command's standard input and/or output with a file. Specify I/O redirection is with angle brackets, < for input and > for output, which are recognized by the CLI. Normally, input to a command is from the keyboard and output is to the screen. These are designated as *:ci:* (console input) and *:co:* (console output). I/O redirection replaces the command's *:co:* and *:ci:* with the specified file. When you redirect output, error messages and program output are written to the specified file. When you redirect input, command input is read from the specified file. This option is particularly useful when you execute the **background** command. By redirecting output messages to a file, you free the terminal for other operations. To use I/O redirection, include either or both of these parameters anywhere in the command line:

<*infile*
>*outfile*

Where:

infile	The name of the input file that replaces the terminal as standard input.
outfile	The name of the output file that replaces the terminal as standard output. If the file already exists, it is overwritten.

The examples below illustrate the use of the I/O redirection feature.

1. This example uses I/O redirection with the **background** command to redirect screen output created by the **copy** command to a file called *copy.log*:

   ```
   background copy myfile to yourfile  > copy.log
   ```

2. This example uses I/O redirection to change the source of input from the keyboard to a file named *in.dat* and to redirect the output to a file named *out.dat*:

   ```
   myprog < in.dat > out.dat
   ```

To use angle brackets for anything other than I/O redirection, surround them with single or double quotes.

Using Commands on Directories

A directory contains a list of all files assigned under its name. Display the contents of a directory by using the **dir** command. Optional **dir** command parameters also allow you to access and display other pertinent information about each file, such as file size and other file attributes.

Displaying Files with the DIR Command

The iRMX **dir** command does not work exactly like the DOS **dir** command. In the iRMX OS, if you just type **dir**, it displays all files in the current directory (*:$:*), as in DOS. If, however, you include command line parameters, you must type `$` to specify the current directory.

For example, to display just the file *myfile* in the current directory, you cannot enter `dir myfile`. You must enter `dir $ myfile`. The **dir** command always interprets the first command line parameter as a directory, so when you type `dir myfile`, it attempts to display the contents of a subdirectory named *myfile* under the current directory. Similarly, if you want to display all invisible files in the current directory, you cannot enter `dir i` (the "invisible" switch), you must enter `dir $ i`.

Creating a New Directory

You create new directories by using the **createdir** command. You must specify names for the new directories. Directory names are limited to 14 characters.

To create two directories named *mytest* and *NUTEST*, enter:

```
-createdir mytest,NUTEST <CR>
```

The HI responds:

```
mytest, directory created
NUTEST, directory created
-
```

Once you create directories and data files, you can enter their pathnames in either lower-case or upper-case characters in subsequent commands; the HI commands are not case-sensitive.

Referring to a Directory

To access any file or directory within the parent directory, you must specifically identify the path in your command, in the form of a pathname.

For example, assume your working directory has a directory named *nutest* under which you have another directory named *samp*. *Samp*, in turn, has a data file named *test*. *Nutest* is the parent directory for the *samp* directory and *samp*, in turn, is the parent for the *test* data file. In a command, the pathname for the *samp* directory would be *nutest*/*samp*, where the slash characters separate the individual hierarchical components of the pathname. The pathname for the *test* data file would be:

```
nutest/samp/test
```

If the files are contained in your default directory, you can refer to them without specifying a logical name as a prefix. When you enter this pathname, the HI automatically appends the prefix *:$:* to the beginning:

```
nutest/samp/test
```

However, if the files are contained in a directory other than your working directory, you must enter the complete pathname for the file. For example, if the files reside on a device whose logical name is *:AD3:*, you must include this logical name as the prefix portion of the pathname, as follows:

```
:AD3:nutest/samp/test
```

If you omit the *:AD3:* portion, the HI assumes the files reside in your working directory.

Do not use the *:S:* logical name as a parameter for a command unless the command description says it is allowed; most commands will not work properly.

Once you have added files to a specific directory, every subsequent operation involving those files must specify a preceding directory name and the slash separator unless you change your default directory.

See also: Logical names, in this chapter

Creating a Directory Within a Directory

To create new directories in other directories, thereby expanding the file hierarchy, use the **createdir** command. For instance, if you have a directory named *mytest*, and you want to create the subdirectory *urtest*, enter:

```
-createdir mytest/urtest  <CR>
```

The HI responds:

```
mytest/urtest, directory created
-
```

If the directory resides on a device (for example, *:f6:*) other than your default device, you must also specify the logical device in the directory pathname.

Changing Your Working Directory

If there are many levels in your directory structure, the pathnames in your commands can become inconveniently long. To avoid having to specify long pathnames, you can use the **attachfile** command to change your working directory closer to the level of the files you are using. For example, you could change your working directory to the *urtest* directory, as follows:

```
-attachfile mytest/urtest <CR>
```

The HI responds:

```
mytest/urtest attached AS :$:
-
```

Now you can refer to files in the *urtest* directory without a preceding pathname. The HI assumes the files reside in the *urtest* directory, because you have attached *urtest* as your working directory.

You can use the **attachfile** command to change your working directory to any directory. To return to your original default directory, called the home directory, enter:

```
-attachfile <CR>
```

or

```
-af <CR>
```

The HI responds:

```
:HOME:, attached AS :$:
```

This command uses the default parameters and has the same effect as:

```
attachfile :HOME: as :$:
```

The *:home:* logical name represents your original default directory; therefore the command returns *:$:* to its original value.

If you use several directories at one time, you can also use the **attachfile** command to assign short logical names to these directories. By using the logical name in the pathname, you shorten the length of the pathname you enter each time you specify a directory.

See also:	Logical names, in this chapter

Renaming Directories

A directory can be renamed to a new pathname on the same volume, but not to an existing pathname. To rename a directory whose pathname is *alpha/beta* to the new pathname *alpha/bee*, enter:

```
-rename alpha/beta to alpha/bee <CR>
```

The HI responds:

```
alpha/beta renamed to alpha/bee
```

Once you rename a directory, all files listed under that directory will also have their pathnames changed. If your system has other programs that use data files listed under the old directory name, those programs will never find the files. In such a case, you must either rename the directory to its original name or modify the programs.

Deleting a Directory

You can delete unused directories from secondary storage with the **delete** command. Enter:

```
-delete mytest <CR>
```

This command only works if there are no files or subdirectories in the *mytest* directory. If you previously created the *mytest/urtest* directory, the HI responds with an error message; the HI will not delete a directory that is not empty.

However, there is a powerful command called **deletedir** that you can use to delete the entire contents of a directory, including all subdirectories, files, and the directory itself. **Deletedir** should be used with caution, since this single command can have far-reaching consequences.

See also: **delete** and **deletedir** commands, Chapter 2

Using Commands on Volumes

You can use all HI file-handling commands except **rename** to manipulate files across volume boundaries. You can copy files or directories from one diskette or hard disk to another one mounted on a different drive.

You access a different volume by entering the logical name for the device (the drive on which the volume is mounted) as the first item in the pathname. To list the root directory of a volume mounted on a drive whose logical name is *:f1:*, enter:

```
-dir :f1: <CR>
```

The HI might respond with:

```
01 JAN 90  00:00:00
directory OF  :f1:  ON VOLUME disk2
able      baker     chuck
```

To copy the *able* file from the volume mounted on *:f1:* to the *mytest* directory (if it resides in your working directory), enter:

```
-copy :f1:able to mytest <CR>
```

The HI responds:

```
:f1:able copied to mytest/able
```

To delete files *able* and *baker* from the *:f1:* volume, enter:

```
-delete :f1:able,:f1:baker <CR>
```

The HI responds:

```
:f1:able, deleted
:f1:baker, deleted
```

A volume prefix must be specified for each pathname in any command that crosses volume boundaries.

Formatting a New Volume

To use a new diskette or hard disk volume, you must format the volume before you can write any information in it. The volume must be attached with **attachdevice**, using the physical parameter, and formatted. There are exceptions to this general rule:

- You cannot format a remote volume (including volumes accessed through NFS). It must be formatted locally on the remote system.
- Typically, you do not use the **format** command to format a tape, nor do you access files on a tape with most commands. Use the **backup** and **restore** commands to format, create files on, and retrieve files from a tape.

After a volume is formatted, you can attach it as a named, remote, or DOS volume and create files and a directory structure on it.

See also: **attachdevice**, **format**, **backup**, and **restore** commands, Chapter 2

As an example of formatting, assume that you place a new diskette in a disk drive, and attach the drive with the logical name *:f:*, as a named device:

```
-attachdevice ah as :f: named <CR>
```

Enter:

```
-format :f: <CR>
```

The HI responds:

```
volume () will be formatted as a NAMED volume
   granularity         = 512        map start =301
   interleave          =   5        sides     = 2
   files               = 200        density   = double
   extensionsize       =   3        disk size = mini
   save area reserved  = no
   bad track/sector information written = no
   MSA bootstrap information written = no
   System 120 bootstrap loader chosen = no
   volume size         = 318K

volume formatted
```

This formatting example exercised all the default options. It did not specify a volume name as a parameter of **format**. A volume name is not required; however, for diskettes, a volume name gives you a method of identifying a volume in case the diskette label gets lost or destroyed.

The granularity, interleave, extensionsize, mapstart, and files parameters tell the **format** command how you want the physical space on the volume allocated and accessed for maximum efficiency. Using the default parameters caused the example to be formatted with these attributes:

- Since the device is attached as a named device, the named parameter is the default with **format**. It specifies that you will be using the volume only to handle named files and directories. If you specified the physical parameter (in either **attachdevice** or **format**), the entire volume would be treated as a single, large physical file. Once you format the volume as named or physical, you can only use it for that purpose. If you specified the DOS parameter, the entire volume would be formatted with the DOS file system.

- The granularity parameter specifies the minimum number of bytes to be allocated for each increment of file size on the volume. The default granularity is the granularity of the physical device. Once the volume granularity is defined, it is applied to every file you create on the volume.

  See also: Uniform and standard granularity diskettes,
  Installation and Startup

  For example, assume the default volume granularity for your device is 1024 bytes. Each time you create a new file on the volume, the I/O System automatically allocates 1024 bytes of primary storage to that file, whether or not the file requires the full 1024 bytes. If the size of your file exceeds 1024 bytes, the I/O System will increment your file size by still another block of 1024 bytes, and so on, until the end-of-file is reached.

- The interleave parameter default specifies that you want an interleave factor of 5. The interleave factor defines the number of physical sectors that occur between sequential logical sectors. This value maximizes access speed for the files on a given volume, depending upon the use for the volume and the device configuration of your system.

  The interleave parameter is the only optional parameter that is meaningful for volumes formatted for physical files; the files, extensionsize, and granularity options are ignored in **format** commands that specify a physical file format for the volume.

- The files parameter default specifies that you wish to create a maximum of 200 user files on the volume. Although the actual number of files you can specify is 1 through 65,528, at a practical level one of your determining factors will be the incremental file size you specify in the granularity parameter.

- The extensionsize parameter default specifies that you wish to create three bytes of extension data for each file. The HI requires that at least three bytes of extension data be available. Other system programs included in your system may require larger values.
- The mapstart parameter gives the volume block number where the fnode and map files start. If you do not specify a number, the HI places the fnode and map files in the center of the volume.

Using TCP/IP and NFS Commands

The Posix, TCP/IP, and NFS commands do not necessarily have the same kind of syntax as iRMX commands or as TCP/IP commands when used on other OSs.

Executing TCP/IP Commands

The syntax of TCP/IP commands in this manual assumes you have submitted the */etc/tcpalias.csd* file, which sets up aliases for the commands. For example, the **ftp** command is an alias for **psh ftp**.

If you have not submitted this alias file, prefix each Posix-dependent command line with **psh** and all other command lines with */etc/* when you invoke these commands. For example::

```
psh uname -S intel1 -N intel1

/etc/hostname intel1
```

Case Sensitivity in TCP/IP and NFS Command Syntax

Unlike other iRMX commands, the syntax for TCP/IP and NFS commands is case-sensitive. You can invoke the command names in upper- or lowercase since the commands are utilities invoked by iRMX. However, you must enter the parameters and internal commands in the case shown, except for items such as iRMX filenames.

Executing OS Commands From a Posix Shell

You can execute iRMX commands from a Posix program, such as **psh**, from a shell escape from **ftp**, or from your own Posix application. However, do not execute any iRMX command that does

```
attachfile :$:
```

Entering this command does not work under Posix and creates unpredictable behavior.

Creating and Using Logical Names

Although you can use pathnames to refer to files, you can also create symbolic names that correspond to files or devices. These symbolic names are called logical names. You use the **attachdevice** command to create logical names that represent devices. You use the **attachfile** command to create logical names that represent data files or directories. You may also create logical names when configuring the system. After creating a logical name, you can refer to the entity it represents by specifying the logical name. You can use the **logicalnames** command to view all the current logical names. The rules for logical names are:

- Each logical name must contain between 1 and 12 ASCII characters, excluding the colons surrounding the name.
- The characters must be ASCII printable characters (hexadecimal values 021H to 07EH, inclusive).
- The logical name cannot include a colon (**:**), slash (**/**), circumflex (**^**), asterisk (*****), question mark (**?**), or any of these characters:

  ```
  "   '   |   ,   =   (   )   [   ]   ;
  ```

- When you specify a logical name in a pathname, you must surround it with colons. Some commands do not require that you specify the colons surrounding logical names that represent devices.

See also: **attachdevice**, **attachfile**, and **logicalnames** commands, Chapter 2

Creating Logical Names for Devices

By using device logical names as the prefix portion of your pathname specifications, you can refer to any file on any device. For example, suppose your system contains two diskette drives and you use the **attachdevice** command to attach the devices as *:f0:* and *:f1:*. If you have a diskette containing the file */dept2/myfile* in drive *:f0:*, you could access the file with this pathname, using *:f0:* as the prefix of the pathname:

```
:f0:dept2/myfile
```

If the diskette were in drive *:f1:*, you would access the file as:

```
:f1:dept2/myfile
```

You can use the **dir** command to list the root directory of the *:f1:* device as follows:

```
dir :f1: <CR>
```

See also: Using devices, *Installation and Startup*

Creating Logical Names for Files

The OS establishes a number of logical names for files during system initialization. These are listed later in this chapter. You may create additional logical names for files with the **attachfile** command.

A logical name for a file provides a shorthand way of accessing that file. For example, suppose you have a file that resides several levels down in the file tree, such as:

```
:f1:dept1/tom/test-data/batch-2
```

In this command, *:f1:* is the logical name for the device that contains the file. You can establish a short logical name for this long pathname, such as *:batch:*, by attaching the file with the name *:batch:*. Whenever you want to refer to the file in a command, you can specify the logical name instead of the pathname.

If a logical name refers to a directory instead of a data file, you can use the logical name as a prefix of a pathname. For example, consider the same pathname:

```
:f1:dept1/tom/test-data/batch-2
```

Suppose you attach the pathname *:f1:dept1/tom/test-data* as logical name *:test:*, so it is a logical name for the directory *test-data*. To refer to file *batch-2*, you could use the pathname :

```
    :test:batch-2
```

Where Logical Names are Stored

When the OS creates logical names at initialization time, or as a result of the **attachfile** or **attachdevice** commands, it places the logical name into an object directory, along with a token for a connection to the file or device.

See also:	Connections, *System Concepts*

This process is referred to as cataloging the logical name. The object directory that receives this information determines the scope of the logical name (that is, who can use the logical name). Object directories fall into three categories:

Local object directory	Some logical names are cataloged in the object directory of a command's job. When you invoke a command (such as **dir**), the OS creates a job for that command and catalogs certain objects in its object directory. A command that you create and invoke might also use system calls to catalog logical names in its own object directory. Logical names cataloged in a local job can only be used in the context of that job. They remain valid only until the job exits or is deleted.
Global object directory	Each interactive job (each user session's job) is called the global job for that user session. This is the initial job for each user session created by the HI. When you use **attachfile** to create logical names for files, the OS catalogs the logical names in your global job's object directory. Likewise, if you invoke any commands that issue **attachfile** commands (as in a file used by the **submit** command), the OS catalogs the logical names in your global job's object directory. You and the commands you invoke can use the logical names cataloged in your interactive job. Other users have no access to these logical names. Logical names in your interactive job remain valid for the life of your job or until they are detached.

When you invoke the **background** command, the CLI creates a global job for commands invoked within the background environment. All logical names that were valid when the **background** command was entered are also valid in the background environment.

Root object directory	When you use **attachdevice** to create logical names for devices, the OS catalogs the logical names in the root directory. Logical names cataloged in the object directory of the root job can be accessed by every user. Logical names in the root object directory remain valid until they are detached or the system is reinitialized. When you use the `system` option of the **attachfile** command, the logical name is cataloged in the root directory and is available to all users.
See also:	Cataloging, jobs, object directories, *System Concepts*

Whenever you (or commands you invoke) use a logical name, the OS searches for the logical name in the local object directory. If the logical name is not defined there, it looks in the parent job's (global) object directory and finally, if necessary, in the root object directory. It uses the first such logical name it finds.

Because of this order of search, you can override the system logical names (those cataloged in the root object directory) by attaching the same logical name, representing a different file or device, during your interactive job. For example, suppose you use the **attachfile** command to attach a file with the logical name *:utils:*. Whenever you specify *:utils:*, the OS refers to your file and not the one represented by the same logical name in the root object directory.

Logical Names Created by the Operating System

The OS establishes logical names that you can use without first having to create them. The HI catalogs system-wide logical names in the root object directory. These logical names are available to all users, and they represent the same file or device for all users. The number of logical names created and their identities depend on the system configuration.

These logical names are available on iRMX systems that use the standard software definition files:

:bb:	A device treated as an infinite sink (byte bucket). Anything written to :*bb*: disappears, and anything read from :*bb*: returns an end-of-file. The :*bb*: device has the same effect as the DOS NUL device.
:config:	A directory in which the HI expects to find user configuration files, named *:sd:rmx386/config*.
:lang:	A directory used to store language products, such as assemblers, compilers, and linkers, named *:sd:lang286*.
:sd:	The system device. You should never change the default logical name for the system device.

:stream:	The stream file connection. To create a connection to a stream file, you must use this logical name as the prefix portion of the pathname.
:system:	The directory containing the HI commands, named *:sd:sys386*.
:utils:	A directory used to store 32-bit utility programs , named *:sd:util386*.
:util286:	A directory used only in iRMX III OS and iRMX for Windows to store 16-bit utility programs, named *:sd:util286*.
:work:	A directory that Intel language translators and utilities use to store their temporary and work files.

These logical names are available on iRMX III systems only:

:icu:	The directory containing the Interactive Configuration Utility files (not used in iRMX for Windows), named *:sd:rmx386/icu*.
:lp:	A logical name for the line printer.
:rmx:	The directory containing the iRMX libraries, plus the configuration files for iRMX for Windows, named *:sd:rmx386*.

These logical names are cataloged in each user's global object directory, and are the same for iRMX for Windows and iRMX III. These names represent different files or devices for each user.

:$:	This represents the path to your current working directory, and is also called your default prefix. If you do not specify a logical name (a prefix) or a / at the beginning of a pathname, the OS automatically uses *:$:* as the prefix, assuming that the file resides in the directory corresponding to *:$:*. You use the **attachfile** command to change the directory corresponding to *:$:*, and hence, your working directory.
:home:	This is your default home directory, which you enter when you log on to the system. Initially, *:home:* and *:$:* represent the same directory. You can re-enter your home directory by issuing the **attachfile** command with no parameters; this sets *:$:* equal to *:home:*.
:prog:	A directory in which to store your programs.

These logical names are cataloged in the local object directory of each user and each command that a user invokes. These logical names can have different meanings for each user and each command.

:ci:	The terminal keyboard, or console input. Each user's *:ci:* refers to the terminal associated with that user.
:co:	The terminal screen, or console output. Each user's *:co:* refers to the terminal associated with that user.

On initialization, the HI may create additional logical names, specified as configuration parameters. Contact your system manager for more information about the logical names initially available to you.

See also: **logicalnames** command, Chapter 2

Error Messages

Each command can generate a number of error messages. The messages that apply to a specific command are listed with that command. This list includes general HI and iRMX-NET error messages that may appear with many of the commands. In addition to a displayed message, condition codes from system calls to parts of the OS may be reported. Condition codes are typically displayed as a hexadecimal value and a mnemonic (for example, 0085:E_LIST).

See also: Condition codes, *System Call Reference*

General HI Error Messages

command not found

There is no command file with the pathname you specified, and the HI cannot find the file in any of the directories it automatically searches.

<pathname>, delete access required

You do not have delete access to the file. If this is a remote file, a user at the remote system has removed delete access. You cannot change the delete access locally; a user at the remote system must grant delete access before this command succeeds.

<logical name>, device does not belong to you

The specified device was originally attached by a user other than World or you.

<pathname>, file does not exist

The specified pathname does not represent an existing file.

<pathname>, invalid file type

A data file was specified for an operation that required a directory, or vice versa.

<logical name>, invalid logical name
: The specified logical name contains unmatched colons, is longer than 12 characters, or contains invalid characters.

<pathname>, invalid pathname
: The specified pathname contains invalid characters, or a path component of the pathname does not exist or does not represent a directory.

*, invalid wildcard specification
: A pathname contains an invalid wildcard specification. For example, the parameter requires one pathname only, but more than one file meets the wildcard specification. Wildcards cannot be used in the directory path part of the pathname.

<logical name>, is not a device connection
: The specified logical name does not represent a connection to a physical device.

<logical name>, logical name does not exist
: The specified logical name is not cataloged in a global object directory, either for your interactive job or for the root job.

parameters required
: The command cannot be entered without parameters.

program version incompatible with system
: The command cannot run successfully because it is incompatible with this version of the OS. The command expects to obtain information from internal tables that are not present.

<parameter>, unrecognized control
: The parameter you entered is not valid for the command.

<pathname>, update or add access required
: Either you cannot overwrite the file because you do not have update access to it (for remote files, update and append access is required), or you cannot create a new file because you do not have add-entry access to the parent directory.

<condition code:mnemonic>, while loading command
: The condition code and mnemonic indicate an error encountered when the OS attempted to load the command into memory from secondary storage.

<parameter>, <condition code:mnemonic>
: This condition code was encountered while processing the indicated parameter.

<condition code:mnemonic>
: This condition code was encountered while executing the command.

004BH : E_PASSWORD_MISMATCH

Your current password and user ID are not valid for the remote access you are attempting. For example, on the remote system the user ID associated with your user name has a different password.

02D0H : E_UDF_IO

An error occurred while accessing a remote User Definition File. The UDF must have World read access.

General iRMX-NET Error Messages

Cannot communicate with iRMX-NET File Server

The File Server does not respond. Either the server was not configured into the system or the iNA 960 transport software was not loaded successfully.

Communication resources are busy

The iNA 960 transport software is out of resources.

Fatal Error

A fatal unrecoverable error has occurred in MIP. It may be because iNA transport software is not responding or may be due to hardware failure.

Internal Software Error. Try command later.

All internal tables are currently full; the command may succeed if tried again later.

iRMX-NET does not respond

The iRMX-NET software is not yet running. This error indicates an initialization problem occurred that prevented the iRMX-NET job from starting. Reboot the system and look for error messages during initialization.

No user mailboxes are available

The limit for the number of external mailboxes has been reached. The Number of External Mailboxes option is a configuration parameter in the MIP configuration. The application could be changed to use fewer external mailboxes, or in configurable systems the number of external mailboxes could be increased.

Unexpected iRMX error occurred

MIP encountered an unexpected iRMX error; verify the OS configuration.

❑❑❑

Command Descriptions 2

Command Descriptions

This chapter provides a command summary table, in which the commands are divided into functional groups. Then each command is described in detail, with the commands arranged in alphabetical order.

Command Summary

Table 2-1 lists the commands described in this chapter. The table is divided into these sections:

- CLI Commands
- HI Volume Management Commands
- HI File Management Commands
- HI General Utility Commands
- HI System Management Commands
- DOS Utility Commands
- iRMX-NET Commands
- TCP/IP and NFS Commands

See also: Equivalent DOS and iRMX Commands, *Quick Reference to Commands*

Table 2-1. Command Summary

CLI Commands	
!	Recalls a specified command line
alias	Assigns an alias abbreviation to a command
background	Executes a command as a background job
changeid	Changes the Super user to a different user ID
dealias	Deletes an alias
exit	Leaves the Super user mode
history	Displays the last 40 command lines
jobs	Displays a list of background jobs by their job ID number
kill	Cancels a background job
logoff	Ends a user session
set	Alters CLI environment values (terminal name, memory sizes, prompt)
submit	Executes commands listed in a file
super	Changes the operator to Super, the system manager
HI File Management Commands	
attachfile (af)	Associates a logical name with a file (changes the working directory)
case	Converts the name of a file from upper- to lower-case
copy	Displays or copies one or more files
copydir	Copies one or more directory trees
createdir (crdir)	Creates one or more new directories
delete	Deletes one or more files or empty directories
deletedir	Deletes one or more directory trees
detachfile (df)	Removes the association of a logical name with a file
dir	Lists a directory's filenames and, optionally, file attributes
find	Searches for files with names that match a given pattern
grep	Searches files for strings matching a pattern, displaying matching lines
permit	Grants or rescinds user access to a file
rename	Changes the names of files or directories
skim	Displays text files one screenfull at a time
sort	Displays or copies a file with lines sorted alphanumerically
touch	Changes file time stamps
translate	Displays or copies a file, converting upper- or lower-case characters
tree	Displays a directory hierarchy
uniq	Displays or copies a file with repeated lines removed

continued

Table 2-1. Command Summary (continued)

HI General Utility Commands	
addloc*	Merges information from a located file with a bootloadable file
aedit	Invokes the AEDIT text editor
console**	Dynamically changes the SDM console device to redirect the I/O streams
date	Displays or sets the system date
debug	Transfers control to the SDM monitor to debug an iRMX application
esubmit	Executes commands from a file based on conditional statements
help	Displays a help file for commands or user-added utilities
keyb	Configures the console keyboard for a specific country
locdata*	Produces a located file for use with the addloc command
logicalnames	Displays the logical names available to the user
memory	Displays the memory available to the user
make	Automates the creation of large programs
mkdep	Assists the make command in creating makefiles or appending dependencies to a given makefile
modinfo	Displays or changes memory pool values in an OMF86 or OMF286 module
path	Displays the pathname for a file
pause	Displays a message and waits for a carriage return
physname	Displays system DUIB names and information
remini	Translates an *rmx.ini* file into iNA 960 load file format
rmextdbg	Improves binding efficiency by removing unneeded entries from object modules and producing a smaller version of the file
sleep	Suspends execution for a given number of seconds
submit	Executes commands from a file (for non-CLI users)
sysinfo	Displays information about the boot system currently running
time	Displays or sets the system time
timer	Times the execution of a command and displays elapsed time
traverse	Executes a command repetitively in a directory tree
version	Displays the version numbers of commands
whoami	Displays the current user ID

*Either not available or not useful in DOSRMX and iRMX for PCs

continued

**For DOSRMX systems only

Table 2-1. Command Summary (continued)

HI Volume Management Commands	
attachdevice (ad)	Attaches a new physical device to the system under a logical name
backup	Copies named or DOS files to a backup volume
detachdevice (dd)	Removes a physical device from system use and deletes its logical name
deviceinfo	Displays size and space information about a volume
diskverify	Verifies the data structures of named and physical volumes
format	Writes format information on an iRMX or DOS volume
mirror	Provides disk mirroring operations for managing hard disk mirror sets
pci	Sets a threshold at which I/O requests to a PCI server are buffered
rdisk	Partitions a PCI hard disk
restore	Copies files from a backup volume to a named or DOS volume
retension	Retensions a tape
HI System Management Commands	
accounting	Tracks logon activities at dynamic terminals
bootdos	Activates the primary DOS partition and resets systems
cli	Invokes a loadable version of the Command Line Interpreter
connect	Binds a locked terminal device to a logical name, making it accessible
disconnect	Deletes a logical name for a locked terminal, making it inaccessible
ic	Reads and modifies interconnect space registers in a Multibus II system
initstatus	Displays initialization status of HI terminals
jobdelete	Deletes a running interactive job
lock	Prevents the HI from automatically creating an interactive job at a terminal
logoff	Ends a user session (for non-CLI users)
password	Changes user passwords or creates new users
pcnet	A NetBIOS driver that provides the interface to iNA-based iRMX-NET
shutdown	Shuts down the system in an orderly fashion
super	Changes the operator to the Super user (for non-CLI users)
sysload	Loads loadable device drivers or user jobs
term	Displays or modifies terminal attributes
unlock	Unlocks a terminal that was locked, and starts the HI logon sequence

continued

Table 2-1. Command Summary (continued)

DOS Utility Commands	
bootrmx	Activates the primary iRMX partition and resets systems
loadrmx	Loads the iRMX OS
rdisk	Partitions a DOS hard disk
rmxtsr	Allows the iRMX OS to obtain DOS and AT ROM BIOS services
iRMX-NET Commands	
bcl*	Converts an ASCII file into a special binary file for remote booting
deletename	Removes server names and addresses from the local Name Server table
domain	Sets the search domain of subnets the iRMX Name Server can access.
findname	Finds the server name where a name or address object is cataloged
getaddr	Returns the local system's Ethernet address
getname	Returns the system name for a specified Ethernet address
inamon	Reads and sets NMF objects, performs echo tests, or manages routing
lanstatus	An alias for the netinfo command
listname	Lists names and values of objects in the local Name Server table
load	Downloads boot software and starts the network controller board
loadname	Adds names and addresses from a file to the local Name Server table
modcdf	Adds or deletes iRMX client systems in the Client Definition File
netinfo	Displays the address, subnet ID, and iNA 960 information for network controllers
offer	Extends public directory access to remote users
pcnet	A NetBIOS driver that provides the interface to iNA-based iRMX-NET
publicdir	Displays pathnames of public directories on the server
remove	Denies public directory access to remote users
setname	Enters server names and addresses in the local Name Server table
unloadname	Removes server names and addresses from the Name Server table
unxlate*	Displays information about the format of a file translated with xlate
xlate*	Produces a bootloadable image from an object module file

*Either not available or not useful in DOSRMX or iRMX for PCs

continued

Table 2-1. Command Summary (continued)

TCP/IP and NFS Commands	
arp	Displays or modifies address resolution tables
enetinfo	Displays Ethernet information
ftp	User interface to File Transfer Protocol
netstat	Shows network status
ping	Tests communication between two hosts
route	Manipulates network routing tables
rpcinfo	Reports Remote Call Procedure (RPC) information (NFS command)
share	Enables mounting of local NFS resources by remote clients
showmount	Reports NFS-shared and mounted devices
telnet	User interface to TELNET protocol
unshare	Restricts mounting of local NFS resources by remote clients

Note
There is no mount command for NFS; use the **attachdevice** command instead.

!

Recalls a previously-entered command line by either its number or the beginning letter(s) of the command. The CLI searches backward in the history buffer from the most recently entered command, and displays the first matching command on the command line. You may edit the line; the command is not executed until you press <CR> or <Esc>.

Syntax

`!`*`variable`*

Parameter

`variable`

The command line number (0-999) or the beginning letter(s) of the command to be recalled. The variable must immediately follow the ! character without a separating space, unless you are recalling a command line that began with a space.

Additional Information

To display the line numbers associated with previous commands, use the **history** command before using **!**. To recall a command line by its number, for example line 29, enter:

```
!29 <CR>
```

When recalling a command by letter rather than by number, enter enough letters to specify the line uniquely. The CLI recalls the most recent command line that begins with the letters you specify. For example, if your previous commands were:

```
format :d:
ftn286 myfile.f28
```

and you enter:

```
!F <CR>
```

the CLI displays:

```
ftn286 myfile.f28.
```

If you want to recall the **format** command line, enter:

```
!fo <CR>
```

Error Messages

`<prefix>, history line not found`
: The command prefix you entered does not appear in the history buffer.

`<number>, history number not found`
: The number you entered cannot be found in the history buffer.

`<number>, history number out of range`
: The number you entered is greater than 999.

`<number>, illegal history number`
: Your entry is not a legal number. It may include non-numeric characters.

accounting

Displays, creates, or truncates the :*config:account.log* file, which contains the logon and logoff history of dynamic terminals.

⇒ **Note**
You can use this command in an esubmit file or **rq_c_send_command** system call if the form of the command does not require user input. If the command requires user input in an **rq_c_send_command** system call, it will fail. However, you can use a form of the command that requires user input in an esubmit file if you use the `eoresponse` and `coresponse` subcommands.

See also: **esubmit** command, in this chapter

Syntax

```
accounting [create] [save = num]
```

Parameters

`create` Creates a new accounting file to store the logon and logoff history. You must be the system manager to use this parameter.

`save =` *`num`*
Reduces the size of the accounting file by saving only the most recent *`num`* entries, where *`num`* is a decimal number. All earlier entries are deleted from the file. You must be the system manager.

Additional Information

For the **accounting** command to be effective, the system manager must first use the `create` parameter to create an empty :*config:account.log* accounting file. The `create` parameter places special information in the file that is used by the **accounting** command. You must use this command, not a text editor, to create the :*config:account.log* file. If you attempt to create the file and it already exists, **accounting** displays this message:

```
:config:account.log, already exists, overwrite?
```

Enter `Y` or `R` to delete the existing file and create a new, empty file. Enter any other character to leave the existing file intact.

Once the file exists, the HI records all logon and logoff activities in the file. Any user may invoke the **accounting** command with no parameters to display the log, which begins with the most recent activity.

If the :*config:account.log* file becomes too large or contains unnecessary information, the system manager can use the `save` parameter to save only the most recent information. When invoked with the `save` parameter, **accounting** displays this message, indicating the decimal number of events saved and discarded. The command then lists the events still recorded in the accounting file.

```
<n> events saved; <m> events deleted
```

To stop the OS from keeping track of logon and logoff activity, delete or rename the *:config:account.log* file.

The example below illustrates the format of the **accounting** display:

```
user   user      terminal
  ID   name      device name  date         time      event

    0  bob        .t2.        13 AUG 86   16:22:50  logoff
world  newuser    .t1.        13 AUG 86   14:45:00  logoff
world  newuser    .t1.        13 AUG 86   13:01:10  logon
    0  bob        .t2.        13 AUG 86   11:05:45  logon
    0  bob        .t2.        13 AUG 86   11:05:15  logon error 004B
```

The columns in the example above contain this information:

`user ID`	ID of the user who logged on or off at a dynamic terminal
`user name`	Logon name used
`terminal device name`	Physical name of the terminal, as defined during configuration of the BIOS and as attached by the HI. Periods surround each name.
`date`	Date of the logon or logoff activity
`time`	Time of the logon or logoff activity

`event` One of these may be listed:

logon	The user logged on the terminal.
logon error	The user unsuccessfully attempted to log on; the resulting condition code is also listed.
logoff	The user logged off the terminal.
logoff job deleted	The user was logged off as a result of the **jobdelete** command terminating a job or the **shutdown** command stopping the system.
logoff carrier lost	A terminal connected to a modem lost the carrier.

Error Messages

`<condition code:mnemonic>, account.log is not available`

The *:config:account.log* file exists but is not currently available for reading or writing. The **accounting** command terminates when this occurs.

`:config:account.log, file does not exist`

The accounting file does not exist.

`not a valid accounting log file`

The *:config:account.log* file exists, but it is corrupted, doesn't contain accounting information, or wasn't created with the `create` parameter. Use the **accounting** command with the `create` parameter to create a new file.

`only the system manager may change the accounting log file`

Someone other than the system manager attempted to use the **accounting** command with the `create` or `save` parameters. Use the **super** command to become the system manager.

`program version incompatible with accounting log file`

The :*config:account.log* file contains accounting information that is incompatible with this version of the **accounting** command.

`<condition code:mnemonic>, while attaching accounting log file`

The **accounting** command encountered this condition code while attempting to attach the existing accounting file.

`<condition code:mnemonic>, while creating accounting log file`

The **accounting** command encountered this condition code while attempting to create a new accounting file.

addloc

Integrates a data file created by the **locdata** command with an existing bootloadable application file, to produce a new bootloadable file and a map file.

> **Note**
> You can use this command in an esubmit file or **rq_c_send_command** system call if the form of the command does not require user input. If the command requires user input in an **rq_c_send_command** system call, it will fail. However, you can use a form of the command that requires user input in an esubmit file if you use the `eoresponse` and `coresponse` subcommands.

See also: **esubmit** command, in this chapter

Syntax

addloc *datafile*, *sysfile* to|over *outpath*

Parameters

datafile
: Pathname of the located data file produced by the **locdata** command. Multiple or wildcard pathnames are not allowed.

sysfile
: Pathname of a bootloadable application file in object module format (OMF286 or OMF386). This must be a file created by the Builder utility (BLD286 or BLD386, which is invoked by the iRMX ICU). Multiple or wildcard pathnames are not allowed.

`to|over`
: Specify `to` create a new file or `over` to overwrite an existing file.

outpath
: The pathname of the file that is to receive the combined information from *datafile* and *sysfile*. This is a new bootloadable file in object module format. Multiple or wildcard pathnames are not allowed. The base filename (not including a filename extension) is limited to ten characters because the **addloc** command creates a print file of the same name with the extension *.mpa*.

Additional Information

You can use the **locdata** and **addloc** commands together to create an application that automatically loads part of itself into a RAM disk when the system boots.

Generally, to use a RAM disk you configure a system with an area of RAM dedicated to the RAM disk. When the system boots, you attach the RAM disk memory to your system, format it, and move data into and out of it just as you would with any other secondary storage device.

If you want to use a RAM disk to store part of the application system (for instance, the HI commands), the stored data must be available in the RAM disk area when the system boots. This data cannot be copied into the RAM disk until you have configured the application system into a bootable file, because the RAM disk area doesn't exist until you define it through the configuration process. Therefore, you must integrate a copy of a RAM disk data structure into an existing application system bootfile.

Addloc and **locdata** can create this new bootloadable version of the application system, which includes a copy of the RAM disk data structure. A map file is also produced, giving information about the new bootloadable file and the process that created it. When this new file is booted, the RAM disk data structure is loaded into memory in the area defined for the RAM disk during configuration.

See also: **locdata** command, in this chapter

When you invoke **addloc**, if the first parameter is a file that has not been processed by **locdata**, or if the second parameter is a file that has not been created by the Builder utility, **addloc** issues this error message and exits without processing the data:

```
usage:  addloc <located data file>, <system file> to/over
<outpath>
```

When processing is complete, **addloc** displays one of these messages:

```
<located data file> added to <system file> to <outpath>
```

```
<located data file> added to <system file> over <outpath>
```

Addloc also creates a print file with the filename extension *.mpa*. Thus if the bootloadable file produced by **addloc** is named *newsys.386*, the print file is named *newsys.mpa*. The print file contains a header that includes the name of the input and output files, the address space used by the system file and the located data file, and the base address of the located data file. Following the header is a list of any error messages **addloc** may have generated.

Error Messages

`addloc, two input files only`
: **Addloc** requires two input files; you specified more or fewer.

`addloc, one output file only`
: **Addloc** requires one output file and you specified more.

`addloc, missing parameters`
: In the invocation line you omitted one or more required parameters.

`after, is an illegal preposition for addloc`
: The **after** preposition in your invocation line, is not a legal **addloc** preposition.

`<string>, illegal preposition`
: The preposition in the invocation line is not a legal **addloc** preposition.

`<filename> file format is xxx`

`<filename> file format is yyy`
: If two input files are used, they must be of the same OMF type. The `xxx` and `yyy` in the message give the OMF type.

`<pathname>, output file same as input file`
: **Addloc** does not allow the input filename to be used as the output filename.

`<pathname>, print file same as output file`
: The output filename you specified has the same name as the print file with the *.mpa* extension.

`<pathname>, output pathname too long`
: The name of the file you specified in the output pathname exceeded ten characters.

`<pathname>, write error`
: A system error caused an incorrect number of bytes to be written to the output file. Retry the command.

`<pathname>, read error`
: A system error caused an incorrect number of bytes to be read from the input file. Retry the command.

`<pathname>, not a located data file`
: The file was not processed by **locdata**.

`<pathname>, not a bootloadable file`
: The system file was not a system image file.

In addition to the error messages listed above, **addloc** produces the three warning messages listed below. After each message, **addloc** lists the file that caused the warning, the physical address, and the length of the section containing the faulty parameter.

`OVERLAPPING AREAS IN MEMORY`
: The section read from the system file overlaps memory that was assigned to the located data stream. Although the process continues, the output is invalid.

`BAD SEQUENCE`

The located data file contains a section that is not contiguous to the previous section. Although the process continues, the output is invalid.

`BAD CHECKSUM`

One of the input files you specified has a bad checksum. Output is invalid.

aedit

Invokes the AEDIT text editor.

Syntax

```
aedit [first_input_file[,second_input_file]]
```

Parameters

first_input_file

The file you want to edit. If you do not specify a file, AEDIT creates a new file, and prompts you for a name when you use the **quit** command.

,second_input_file

The name of the second input file to edit. You can switch between the files with the **other** command.

Additional Information

AEDIT is an interactive, screen-oriented text editor. In addition to performing basic word-processing operations such as cursor movement and inserting, deleting, or overtyping text, you can use AEDIT to:

- Find any string of characters
- Substitute one string of characters for another string
- View and edit two files or two portions of the same file simultaneously
- Move or copy sections of text within a file or between files
- Create macros to execute several commands at once, thereby simplifying repetitive editing tasks
- Perform arithmetic functions
- View lines over 80 characters long

AEDIT also provides a set of commands that you can use in the invocation line to further control the editor's actions and output.

See also: AEDIT invocation and commands, *Programming Techniques and AEDIT Text Editor*

When you invoke AEDIT, the editor displays this prompt at the bottom of the screen:

```
-??- system-id AEDIT Vx.y Copyright yyyy Intel Corp.
Again   Block   Calc   Delete   Execute   Find   -find   --more--
```

The question marks (-??-) at the beginning of the first line indicate that AEDIT is waiting for input. Exclamation points (-!!-) in the same position indicate that AEDIT is executing a command. A vertical bar (`|`) marks the end of the file; it is initially in the upper left corner of the screen in a new file.

The `--more--` at the end of the second line indicates that there are more commands available. Use the <Tab> key to see additional commands.

These are the basic cursor movement keys:

Arrows	The four keys labeled with directional arrows, <Left>, <Right>, <Up>, and <Down>, are the cursor control keys .
<Home>	The <Home> key provides faster cursor movement. Press an arrow key followed by <Home> to page backward or forward through a file, or to move rapidly to the beginning or end of a line. You can also use <Home> to enter the re-edit mode for line-edit prompts.
<Return>	The <Return> key moves the cursor to the beginning of the next line in **insert** and **xchange** modes, and at the main command level. It also terminates the line-edit prompt.

These are basic AEDIT commands:

I or i	Enters **insert** mode. You must enter **insert** mode to type text onto the screen. To exit **insert** mode and return to the main command level, press <Esc>.
<Backspace>	Deletes the character to the left of the cursor, if you are at the main command level or in **insert** mode.
<Tab>	Rotates the menu prompt line to display the next line of commands. In **insert** or **xchange** modes, <Tab> inserts the <Tab> character (or optionally, replaces it with an equivalent number of blank spaces).
<Esc>	The <Esc> (escape) key exits modes, terminates commands, and returns the editor to the main command level.

To exit from the editor, press `Q` for **quit**. This prompt appears at the bottom of the screen:

```
      -??- no input file
Abort                Init                  Write
```

`W` saves the file, and if this is a new file AEDIT will prompt you for an output file name. `A` aborts the session without saving.

See also: **init** command, *Programming Techniques and Tools*

Error messages

These are some of the more common error messages:

`illegal invocation`
You attempted to invoke AEDIT with an illegal invocation line, or used an illegal invocation under **quit init**.

`illegal command`
You entered an illegal and/or unknown command, which AEDIT ignores.

`insufficient memory`
AEDIT does not have enough RAM memory.

See also: Error messages in AEDIT manual, *Programming Techniques and AEDIT Text Editor*

⚠ **CAUTION**
AEDIT converts filenames to uppercase. This may cause confusion if you use AEDIT to edit and save a NFS file residing on an OS that has case sensitive filenames.

alias

Creates an alias for a command string, or displays the definition of an existing alias.

Syntax

`alias [`*`abbreviation`*`] [= `*`command`*` [#`*`parameters`*`]]`

Parameters

`abbreviation`

When defining an alias using the = *`command`* syntax, this is the short term that becomes an alias for the specified command. When displaying alias definitions, the abbreviation may contain a wildcard (*) as the final character.

`=` *`command`*

A command string that may contain command-line parameters as well as the command.

`#parameters`

Up to ten formal parameters, specified as #0 to #9, that are replaced by actual parameters when you invoke the alias.

Additional Information

You may create an alias for any command or command string, including the **alias** command. Once the alias abbreviation has been assigned, the CLI recognizes the abbreviation as if it were the entire command. The alias stays in effect until you enter either a **dealias** or a **logoff** command.

You may define an alias that refers to another alias. Aliases can be nested in this fashion up to five times. You may also change an existing alias. For example, if the alias *m=mer* is defined, you can change it to *m=merrr* by entering:

```
alias M = MERRR  <CR>
```

The CLI changes the alias and issues this message:

```
<abbreviation>, former alias removed
```

The default size for the table that stores aliases is 2K bytes. If you need more or less space to store aliases, use the **set** command to modify the size of the table.

When you invoke an alias that contains formal parameters, each actual parameter on the invocation line replaces a formal parameter, in order. You need not enter the same number of actual parameters as there are formal parameters. For example, if there are three formal parameters and you enter two actual parameters, a null string replaces the third formal parameter. If you enter more actual parameters than there are formal parameters, the extra parameters are considered another command parameter.

To display all currently defined aliases, enter **alias** with no parameters. To display the definition of a single alias, specify the abbreviation on the command line. For example, to display the definition of the **ad** alias, enter:

```
alias ad
```

You may use the * wildcard character at the end of the abbreviation to display a group of alias definitions. For example, to display all aliases that begin with the letter M, enter:

```
alias m*
```

If the list of displayed aliases requires more than one screen, the CLI displays one screen followed by this message:

```
display more ? ([y] or n)
```

To see more alias definitions, enter `Y` or simply <CR>. Otherwise enter `N`.

Certain aliases are automatically defined for you by the OS. These aliases are in submit files (refer to the **submit** command) that run when you log on to the system. System aliases are the same for all users and are required for all iRMX configurations. These are defined in the *:config:alias.csd* file, and should not be changed. Other aliases are defined in your *:prog:alias.csd* file. Any alias that you enter on the command line is no longer defined the next time you log on. To permanently store an alias, enter it in your *:prog:alias.csd* file. You may change any of the default aliases in the *:prog:alias.csd* file.

Table 2-2 lists the system aliases in the *:config:alias.csd* file.

Table 2-2. System Aliases in the *:config:alias.csd* File

Alias	Command	
ad	attachdevice	
af	attachfile	
cd	attachfile	
crdir	createdir	
dd	detachdevice	
del	delete #0 q	
df	detachfile	
install	submit :config:cmd/instal(#0)	
installrmx	submit :config:cmd/rmxinstl(#0)	
lf	dir	
tinstall	submit :config:cmd/tinstall(#0)	
md	createdir	
mkdir	createdir	
mksys	submit :config:cmd/mksys(#0)	(not for DOSRMX)
pwd	path	
Alias	**DOS-hosted tools**	**iRMX-hosted tools**
asm386	run86 /intel/bin/asm386.exe	run86 :lang:asm386
bnd386	run86 /intel/bin/bnd386.exe	run86 :lang:bnd386
bld386	run86 /intel/bin/bld386.exe	run86 :lang:bld386
ic386	run86 /intel/bin/ic386.exe	run86 :lang:ic386
lib386	run86 /intel/bin/lib386.exe	run86 :lang:lib386
map386	run86 /intel/bin/map386.exe	run86 :lang:map386
plm386	run86 -fixplm /intel/bin/plm386.exe	run86 -fixplm :lang:plm386

Table 2-3 lists default aliases in the *:prog:alias.csd* file. To find the aliases for your system, refer to the section in the table labeled "All Platforms" and the section for the system bus type. The default aliases for DOSRMX are those in the "PC Bus" section, even if you install DOSRMX on a Multibus I or II platform.

Table 2-3. Default Aliases in the *:prog:alias.csd* File

ALL PLATFORMS

Alias	Command
a	alias
aed	aedit
bk	background
h	history
logs	logicalnames
ls	dir $ sort
lpr	bk(100,100) copy #0 to :lp:
m	skim
more	skim
pmw	permit #0 drau u=world
s	submit
sh	shutdown w=0
trv	traverse

DOSRMX - SPECIFIC

Alias	Command
ada	attachdevice a as :a:
adah	attachdevice ah as :a:
adam	attachdevice am as :a:
adamh	attachdevice amh as :a:
adb	attachdevice b as :b:
adbh	attachdevice bh as :b:
adbm	attachdevice bm as :b:
adbmh	attachdevice bmh as :b:
adf	attachdevice a as :f:
dda	detachdevice :a:
ddb	detachdevice :b:

MULTIBUS I - SPECIFIC

Alias	Command
adf	attachdevice wmf0 as :f:
adv	attachdevice g279_0 as :vdi: physical
ddv	detachdevice :vdi: force

MULTIBUS II - SPECIFIC

Alias	Command
agents	ic -c agents
agentreset	ic -c reset #0 local
adf	attachdevice wqf0 as :f:
adv	attachdevice g279_0 as :vdi: physical
coldreset	ic -c reset 0 cold
d	dir $ i l
ddv	detachdevice :vdi: force
icread	ic -c get #0 #1 #2
icwrite	ic -c set #0 #1 #2
monitor	ic -c reset -p monitor #0 local
myslot	ic -c myslot
nmi	ic -c nmi #0 software
nmiforce	ic -c nmi -e #0 software
offline	ic -c kill #0
p	path
reboot	ic -c reset -p bootstrap #0 local
sysreset	coldreset
warmreset	ic -c reset 0 warm

Examples

1. To assign an alias called PLM, with a formal parameter, enter:

   ```
   alias PLM = :lang:plm386 #0.p38 nolist  <CR>
   ```

   Then, to compile a file called *mine.p38* in the current directory, enter:

   ```
   plm mine  <CR>
   ```

   The CLI replaces the formal parameter `#0` with `mine` and executes the command as if you had entered `:lang:mine.plm386 p38 nolist`.

   If you enter:

   ```
   plm mine pagewidth(132)  <CR>
   ```

   The CLI executes this, adding `pagewidth(132)` as an additional command parameter. The CLI does not echo this command on the screen:

   ```
   :lang:plm386 mine.p38 nolist pagewidth(132)
   ```

2. To use the nested alias feature, define these aliases:

   ```
   alias PLM=:lang:PLM386
   alias PNL=PLM #0.P38 nolist
   ```

   Now when you enter:

   ```
   PNL source  <CR>
   ```

   The **alias** command replaces `PNL` with `PLM #0.P38 nolist`, assigns `source` to `#0`, replaces `PLM` with `:lang:PLM386`, and executes:

   ```
   :lang:source.plm386 p38 nolist
   ```

Error Messages

`alias, wrong alias syntax`
: The command syntax is not correct.

`<parameter>, alias not found`
: The alias you entered is not in the list of declared aliases.

`<parameter>, wildcard is allowed only in the last character`
: You tried to list aliases with a wildcard character that was not the last character in the string.

`<parameter>, wildcard not allowed in alias abbreviation`

You declared an alias with a wildcard. You can use wildcards only to display a list of aliases, not to define them.

`alias, no space in alias table`

The alias table is full. No more aliases can be assigned unless you increase the size of the alias table with the **set** command or delete some aliases.

arp

Displays and modifies the address resolution tables used by the Address Resolution Protocol (ARP). These tables translate between the Ethernet addresses used at the hardware level and the Internet addresses used by TCP/IP software.

Syntax

```
arp -a
arp –d inet-addr
arp –s inet-addr phys-addr
```

Parameters

`-a`	Displays the entire contents of the ARP table.
`-d`	Deletes an entry from the ARP table.
	`inet-addr` A host name or Internet address.
`-s`	Modifies or adds an entry in the ARP table.
	`phys-addr` The physical address of the network interface. Specify an Ethernet address in this hexadecimal form: `hh:hh:hh:hh:hh:hh`

Additional Information

At network initialization, ARP places a complete and permanent entry in the ARP table for every configured Ethernet interface. Because permanent entries cannot be deleted, these entries remain in the table until the network is taken down. Once the initialization is complete, arp dynamically adds and updates host entries based upon information received from arp modules on other network hosts. As the table fills, older entries are deleted and the space is reallocated for more recently used addresses.

You typically use **arp** to display the current contents of the table. You should add and delete entries only for hosts that do not implement the ARP protocol; modifying the contents of dynamically maintained entries has unpredictable effects.

The first form of the **arp** command, using the `-a` option, displays the entire contents of the ARP table. For example:

```
-   arp -a
    host2.intel.com inet 128.215.12.21: Ethernet 00.aa.00.02.1c.2a
    host1.intel.com inet 128.215.12.20: Ethernet 00.aa.00.02.13.38
```

```
-   ayers.intel.com inet 128.215.18.242: Ethernet 00.aa.00.02.29.bb
    -
```

For each entry, the command displays the official host name, the Internet address (preceded by the word `inet`), the Ethernet address (preceded by the word `Ethernet`) and the status of the ARP table entry. The Ethernet address is a six-digit hexadecimal value. The status is a comma-separated list of codes, with these meanings:

INCOMPLETE	Incomplete: contains only an Internet address.
COM	Complete: contains both Internet and Ethernet addresses.
PERM	Permanent: cannot be deleted from table by arp.
PUBL	Publishable: can be published in proxy for a non-ARP host; it can be used to answer an ARP request from another host.

The second form of the **arp** command uses the `–s` option to create or modify an ARP table entry. This example adds an entry for host name `lee`. The Internet address 128.215.18.185 could be substituted for the host name in the command. When you specify `lee`, **arp** gets the Internet address from the name `lee` in the */etc/hosts* file. The screen display in response to the command indicates that the entry was successfully added to the table.

```
- arp –s lee 02:07:01:00:10:76
lee.intel.com inet 128.215.18.185: Ethernet 02.07.01.00.10.76 {COM,PERM,PUBL}
-
```

Entries added like this are always permanent.

If a host on the network does not implement ARP, choose one or more of the other network hosts to act as proxy for the non-ARP host.

You can use **arp** at the command line any time after network initialization. However, you typically add entries by placing the command in the network startup script *tcpstart.csd*. When you add an ARP entry in this way, also add the official host name and its Internet address to the *:config:hosts* file, so the correct name-to-address translation can be made during network initialization. Because the entry is permanent, it cannot be deleted by the ARP module when the table is full. The entry remains in the ARP table until the network is taken down or until you explicitly remove it with an **arp -d** command.

Diagnostics

Exit status is zero for normal termination or a positive number for error termination.

`arp: cannot get arptab size:` *`error message`*
The size of the ARP table could not be retrieved for the given reason.

`arp: can't get memory for arptab`
: Could not allocate enough local memory to store the retrieved ARP table.

`arp: error reading arptab:` *`error message`*
: The given error occurred while reading the ARP table.

`arp: invalid arptab size (`*`size`*`)`
: The retrieved ARP table size was either less than 0 or greater than 1000.

`arp: open failed for DEV_ARP:` *`error message`*
: An arp minor device could not be opened for the given reason.

`cmd``:` *`error message`*
: The given error occurred while trying to execute the command.

`cmd``: not in ARP table`
: The command failed because the specified entry was not in the ARP table.

`cmd``: must have SYSPRV`
: The command failed because it requires superuser privileges.

`cmd``: no interface for internet address`
: The command failed because the destination network was unreachable.

`cmd``: No room in ARP table, try later`
: The ARP table is full; the entry was not added.

`Default flags set to ATF_COM and ATF_PERM`
: An invalid flag was supplied to the **set** command, the default was used.

`Only ethernet/ieee types supported.`
: An invalid or unsupported type was supplied to the **arp set** command.

`phys_addr``: bad format`
: An invalid physical address was supplied to the **arp set** command.

`inet_addr``: bad value`
: An invalid Internet address was supplied to the **arp set** command.

attachdevice

Attaches a physical device to the OS and associates a logical name with the device. **Attachdevice** catalogs the logical name in the root object directory, making the logical name accessible to all users. This command dynamically builds a table of all file drivers in the system. Devices may be attached to the resident file drivers that are configured into the system, or loadable file drivers that have been loaded with the **sysload** command.

Syntax

```
ad|attachdevice physical_name as logical_name
      [file_driver|n|p|r|nfs|e|d] [d(elay)] [w]
```

Parameters

physical_name

Physical device name of the device to be attached to the system, up to 14 characters long. For file drivers that do not require DUIBs (Device Unit Information Blocks) such as NFS, this name may be up to 255 characters long. This name must be the name defined at system configuration time. With NFS, this name includes the hostname:/symbolic name as defined on the NFS server system.

`as` Preposition required for the command.

logical_name

A 1- to 12-character name (excluding colons) to be associated with the device. Colons surrounding the logical name are optional, but if used must be in pairs (:*logical_name*:).

file_driver

A 1- to 14-character name of the attached file driver. The file driver may be either resident or loaded. File driver abbreviations are allowed for loadable file drivers. The `file_driver` parameter will match to the first file driver name that it either matches or is a substring of. The pre-defined abbreviations are:

`n(amed)`

The volume mounted on the device is already formatted for the iRMX named file driver. Volumes that can contain named files are diskettes or hard disks. If `named`, `physical`, `remote`, `nfs`, `edos`, or `dos` is not specified, `named` is the default.

`p(hysical)`

The volume mounted on the logical device is considered to be a single, large file. Examples include printers, terminals, and tape drives.

`r(emote)`

The volume mounted on the logical device is an iRMX-NET remote file server. If you specify remote with the physical name of a remote server, a logical name is created for the virtual root directory of the server. The logical name is used to transparently access files residing at the server. The server, rather than the consumer, associates the appropriate device drivers with the devices residing at the server system. As a result, client systems do not require DUIBs attached for remote servers. The `world` switch is always supported for consumer-based connections and is supported for server-based connections if the remote server has defined a user named World with a carriage return password.

`nfs`

Specifies the NFS file driver job running on the client. Attaching devices through this driver allows you to transparently access the remote logical device as if it were local to the client. The device you are attaching to must be defined as NFS-shared by the remote host.

`e(dos)`

For DOSRMX only, specifies the encapsulated DOS (EDOS) file driver, enabling iRMX users to access shared DOS files. The `edos` parameter includes the delay and world parameters. Physical device names used with this parameter include a_dos through z_dos, which are equivalent to DOS drives A: through Z:.

`d(os)`

For all iRMX OS versions except DOSRMX, specifies the native DOS file driver, enabling iRMX users to access DOS volumes. Physical device names used with this parameter include c_dos through z_dos, which are equivalent to DOS drives C: through Z:.

`d(elay)`

The device is attached logically, but not physically attached until the first access.

`w(orld)`

The World user (ID 65535) is the owner of the device. Any user can detach the device. If you omit this parameter, your user ID is listed as the owner of the device. In this case, only you and the system manager can detach the device. In DOSRMX, access to all DOS volume is always done as World.

Additional Information

To use a device you must attach it, unless it is attached by the system during initialization. For example, before you use the **format**, **backup**, or **restore** commands, you must attach the appropriate device. Likewise, any time you put a diskette in its drive, you must attach the drive device. For general access of a hard disk or diskette, such as reading or writing files, you may attach the device under a generic physical device name. However, to format a hard disk or diskette, you must attach it under a specific physical (DUIB) name that specifies the device characteristics.

When you invoke **attachdevice** with no parameters, it displays a usage message and the available file drivers. If no file driver is specified on the command line, the command will attempt to attach the device using in order the `named`, `dos`, and `edos` file drivers (if available) until a successful attach occurs. It also prints the name of the file driver it has attached to. If an unformatted device is encountered, the command will default to the `named` file driver so that a `named` **format** command can occur.

See also: **physname** command, in this chapter
supplied drivers and physical device names, Appendix E
format command, in this chapter

Devices must have their characteristics listed as a BIOS DUIB before they can be attached with the **attachdevice** command. One frequent use of the **attachdevice** command is to attach a new device, such as a disk drive or a printer that was configured into the boot system but was not attached. DUIBs can be specified during configuration or with a loadable device driver.

See also: **sysload** command, in this chapter
Appendix C, Using the ICU to Configure User-written Device Drivers, *ICU User's Guide and Quick Reference*

Unless you are the World user (ID 65535) or specify the `world` parameter, once you attach a device only you and the system manager can detach it. This prevents users from detaching devices belonging to other users and prevents you from accidentally detaching system volumes. However, if you are the World user or specify the `world` parameter, any device that you attach can be detached by any other user.

To see what devices are currently attached, use the **logicalnames** command.

The `named` parameter refers to the iRMX named file driver, which maintains the directory hierarchy of named files on an iRMX-format volume. A `remote`, `edos`, `dos`, or `nfs` volume also contains named files, but not maintained by the iRMX named file driver on the local system. Volumes maintained by the named file driver on remote systems must be attached as `remote` (if accessed through iRMX-NET) or `nfs` (if accessed through NFS) from this system.

If you try to attach a device maintained by the named file driver that has not been shut down properly, you receive this message:

```
<logical_name>, device was not shut down properly
```

The number of retries to attach a device is set in the configuration. The command repeats the attempt to attach the device, and returns either when it has attached the device or has failed the configured number of attempts.

See also: **detachdevice** and **logicalnames** commands, in this chapter

NFS Support

Specifying `nfs` as the attached file driver allows you to attach a NFS-shared device on a remote host running NFS. The device will appear as local to your system. This allows you to access remote files either from the command line or programmatically. When the NFS client job initializes, many shared devices will be automatically mounted (attached) through the startup files. To see which devices are already mounted, use the **showmount** command.

See also: **showmount** command, in this chapter
Attaching NFS Devices, *TCP/IP and NFS for the iRMX Operating System*

Attaching Diskette Devices

Each time you change a diskette in the drive, you must reattach the drive. Removing a diskette from the drive destroys any connections that may have existed to files on that device, and logical names that represent files on the volume are no longer valid. Detach the files and detach the device before removing the diskette.

⚠ **CAUTION**

On volumes managed by the DOS and iRMX named file drivers, the file structure of the second diskette can be destroyed if you change diskettes without detaching and reattaching the device. Avoid attaching remote diskette volumes; a user at the remote system might change diskettes without your knowledge.

See also: Switching diskettes, *Installation and Startup*

To transfer files between low-density and high-density 5.25" diskettes in Multibus I or II systems, use the uniform granularity device name `wdf0`, rather than the standard granularity device `wmf0`.

In DOSRMX, volumes attached with the `named` parameter are iRMX-format and managed by the iRMX named file driver. DOS users cannot access the diskette drive until it is detached.

Volumes attached with the `edos` parameter are DOS-format and managed by the DOS file system. After initially attaching the device, you can access DOS-format diskettes from either DOS or the iRMX OS. You need not detach and reattach the device when you change diskettes. You should, however, detach any files on the diskette that you have attached as logical names.

See also: **attachfile** and **detachfile** commands, in this chapter

Error Messages

`<physical_name>, cannot attach device`
There is a hardware problem.

`<physical_name>, cannot be attached as <type> device`
The specified device cannot support the specified type of files (named, physical, remote, nfs, EDOS, or DOS). **Attachdevice** does not attach the device. For example, the `named` option is not valid for a device such as a line printer.

`<physical_name>, device already attached`
The specified device has already been attached; **attachdevice** does not re-attach it.

`<physical_name>, device is already attached as <logical name>`
The specified device has already been attached by the EIOS; **attachdevice** does not re-attach it.

`<physical_name>, device does not exist`
The physical device name you specified does not correspond to a name the BIOS recognizes. The current configuration does not specify the indicated physical name as the name of a device-unit. **Attachdevice** does not attach the device.

`<logical_name>, logical name already exists`
The specified logical name is already cataloged in the root job's object directory. **Attachdevice** does not attach the device.

`<logical_name>, logical name is already attached to physical device <physical_name>`
The specified logical name refers to an EIOS attached device that is already cataloged in the root job’s object directory. **Attachdevice** does not attach the device.

`0085 : E_LIST, too many device names`
You tried to attach more than one physical device with a single **attachdevice** command. **Attachdevice** cannot attach more than one device per invocation.

`<logical_name>, device was not shut down properly`

The named volume device you attached was not previously shut down with a **shutdown** or **detachdevice** command.

`<logical_name>, volume is not a named volume`

Attachdevice attempted to attach a device as a `named` device and discovered that a physical volume (for example, an unformatted diskette) was mounted. However, **attachdevice** does attach the device. You can use the device after formatting the volume as a `named` volume or after inserting a `named` format diskette in the device.

`<logical_name>, volume not formatted`
`<logical_name>, <condition code:mnemonic>`

Attachdevice attempted to attach a device as a named device and encountered an I/O error while searching for the volume's root directory. This usually indicates that the volume is not formatted. However, **attachdevice** does attach the device.

`<logical_name>, volume not mounted`

The specified device does not contain a volume. However, **attachdevice** does attach the device.

`<condition code:mnemonic>, while collecting device name`

Attachdevice encountered this condition code while parsing the device name from the command line. **Attachdevice** does not attach the device.

`<condition code:mnemonic>, while collecting logical name`

Attachdevice encountered this condition code while parsing the logical name from the command line.

attachfile

Associates a logical name with an existing file or directory; one use is to change your current working directory. After making this association, you may use the logical name to refer to the file, instead of the entire pathname.

Syntax

af|attachfile [*pathname* [as :*logical_name*: [system]]]

Parameters

pathname

The file or directory with which the HI associates a logical name.

logical_name

The 1- to 12-character name (excluding colons) to be associated with the file. Colons surrounding the logical name are optional, but if used must be in pairs (:*logical_name*:). If you omit this parameter, the default logical name is :*$*:.

s(ystem)

Creates the logical name and catalogs it in the root job as a system logical name. System logical names can be used by all users; they are permanent until they are detached with the **detachfile** command. If the system logical name already exists, it is deleted and replaced by a connection to the new pathname. This option can only be executed by the Super user and is only valid with a logical name. The system option can be used in either the *r?init* or the *loadinfo* system initialization file to attach system logical names. Without the `system` option, **attachfile** catalogs the logical name in your global object directory.

Additional Information

The uses for this command are to:

- Change your working directory. **Attachfile** does this by associating the default logical name :*$*: with the directory. The syntax is either of these:

```
af directory_path
af directory_path as $
```

- Restore your working directory to your home (logon) directory. **Attachfile** does this by associating the logical name :*$*: with the logical name *:home:*. The syntax is either of these:

```
af
af :home: as :$:
```

- Create a short logical name that refers to a commonly-used directory or file. If you use the system option, this logical name is available to all users and valid until detached with the **detachfile** command.
- Change the *:home:* logical name. Each user has a *:home:* logical name that points to the user's home directory. This logical name can be changed with the **attachfile** command as shown below:

  ```
  attachfile /user/world as home
  :HOME:, overwrite existing logical name?
  ```

  If you answer yes, the current path for *:home:* will be overwritten with the new one. This option can be used to restore your home directory for any reason; for example, the home directory is accidentally deleted or the connection is deleted as a result of a diskverify operation.
- Recover from using the Disk Verification Utility on the system device (*:sd:*). The system option can be used to restore system logical names that were deleted when using the Disk Verification Utility on *:sd:*. You can accomplish this by creating a submit file that attaches all of the system logical names.

  Example submit file, *lognames.csd*:

  ```
  :sd:sys386/attachfile :sd:util286 as util286 system

  :sd:sys386/attachfile :sd:intel/include as include system

  :sd:sys386/attachfile :sd:lang286 as lang system

  :sd:sys386/attachfile :sd:work as work system

  :sd:sys386/attachfile :sd:util386 as utils system

  :sd:sys386/attachfile :sd:sys386 as system system

  :sd:sys386/attachfile :sd:rmx386 as rmx system

  :sd:sys386/attachfile :rmx:config as config system

  :sd:sys386/attachfile :rmx:icu as icu system
  ```

  After running the Disk Verification Utility, submit the file using a full pathname to the file:

  ```
  submit :sd:user/super/lognames.csd
  ```

Normally (without the system option) **attachfile** associates a file with a logical name by cataloging a connection to the file in your global object directory (this is usually the object directory of your interactive job). It catalogs the connection under the logical name. If another connection is cataloged in the object directory under the same name, **attachfile** uncatalogs and deletes the previous connection before cataloging the new one. If an object other than a connection is cataloged under the logical name, **attachfile** leaves the previous object as is, does not catalog the new connection, and displays an error message.

Because the file connection is cataloged in your object directory, the logical name has effect only within your interactive job. Therefore, several users can specify the same logical name without affecting the others. Background jobs can also attach files without affecting tasks being run in the foreground, since the background and foreground environments are independent.

See also: Logical names, Chapter 1

Logical names created with **attachfile** remain valid until one of these situations occurs:

- A **detachfile** command removes the association between file and logical name.
- The interactive session that specified the **attachfile** command terminates processing, either because you log off or as a result of the **jobdelete** command.
- A background job exits or is killed. In this case, only logical names attached in the background environment are removed.
- A task deletes the file connection with a BIOS or EIOS system call. In this case, the logical name remains cataloged in the global directory, but the connection to which it refers does not exist.
- A user forcibly detaches the volume containing the file, using the **detachdevice** command.
- A user removes the (diskette) volume from the drive. In this case, the logical name remains cataloged in the global directory, but the connection to which it refers does not exist.

Logical names created with **attachfile** using the system option remain valid until one of these situations occurs:

- A **detachfile** command removes the association between file and logical name.
- A task deletes the file connection with a BIOS or EIOS system call. In this case, the logical name remains cataloged in the global directory, but the connection to which it refers does not exist.
- A user forcibly detaches the volume containing the file, using the **detachdevice** command.
- A user removes the (diskette) volume from the drive. In this case, the logical name remains cataloged in the global directory, but the connection to which it refers does not exist.

You cannot use **attachfile** to change the meaning of *:term:*, *:ci:*, and *:co:* (default console input and output).

Error Messages

`<logical_name>, list of logical names not allowed`
: You entered more than one logical name as input to **attachfile**.

`<pathname>, list of pathnames not allowed`
: You entered more than one pathname as input to **attachfile**.

`<logical_name>, logical name not allowed`
: You attempted to attach a file using one of the logical names *:term:*, *:ci:*, or *:co:*. You cannot change the meaning of these logical names.

`<logical_name>, not a file connection`
: The logical name you specified is already cataloged in the object directory of the session and does not represent a connection object.

`<pathname>, not allowed as default prefix`
: You attempted to attach a physical or stream file as your working directory (:*$*:). Only named files (including DOS files) are valid.

`<logical_name>, too many logical names`
: Your global object directory is full; therefore **attachfile** cannot catalog the logical name. Delete some logical names you are no longer using.

`Must be SUPER user to execute the SYSTEM option`
: Only the Super user can use the system option.

background

Executes the specified command line as a background job, enabling you to continue entering commands while the job executes.

Syntax

```
background [([pool_min], pool_max)] command_line [> pathname]
```

Parameters

pool_min

A decimal number of Kbytes specifying the minimum memory pool size to be allocated for the background job. If specified, this value overrides the default minimum value (either 6 Kbytes or as defined with the **set** command).

pool_max

A decimal number of Kbytes specifying the maximum memory pool size to be allocated for the background job. This value overrides the default maximum value (as defined with the **set** command or the smaller of 384 Kbytes and `user_pool_max` - 200 Kbytes). If you specify *pool_max* less than 384 Kbytes, the CLI sets it to 0.

command_line

A user command to be executed in the background.

> *pathname*

A file where command output is written. If you do not specify this parameter, you are prompted for the name of a file; output from a background job cannot be written to the screen.

Additional Information

⚠ **CAUTION**

Do not put a **background** command in the *r?logon* file.

Background jobs are executed as they are submitted and are not queued. Each background job is assigned a four-digit hexadecimal job ID that you can display by entering the **jobs** command. You can cancel background jobs by entering the **kill** command.

When you invoke **background**, the active foreground environment is copied to the background job and becomes its initial environment. This means that the same logical names and aliases used in the foreground are also available to the background job. However, after the background job begins, changes made to logical names and aliases in the background environment do not affect the foreground, and vice-versa.

You can control the amount of memory allocated for the background job by entering the `pool-min` and `pool-max` parameters. These modifiers are recommended for large programs such as compilers, ensuring the minimum memory pool to get acceptable performance for the application, but leaving enough memory for foreground jobs to also perform at an acceptable level.

Before the background job begins, the CLI checks that the minimum memory pool size is less than the maximum; if not, the CLI issues this warning:

```
WARNING:    maxbackpool < minbackpool,
            use set command to set background memory pools
```

If `pool-max` is less than 384 Kbytes, the CLI assigns a value of 0 and issues this message:

```
maxbackpool attribute <384K, was set to 0
please set your maxbackpool attribute
```

Then the background job terminates.

If you don't specify the `>` *`pathname`* parameter, the **background** command prompts for a log file to replace the terminal:

```
the log file is ?
```

If you enter *:co:* as the log file, the CLI displays the message:

```
:co:, not a valid log file
the log file is ?
```

A background job that tries to send a message to the *:co:* device causes this message to appear on your screen:

```
***8085:  E_ERROR_OUTPUT
```

However, if you have a system with multiple terminals, you can redirect *:ci:* and *:co:* to another terminal that acts as a background terminal.

When the background job begins running, the CLI displays this message:

```
Background job <job_id> "command" has been started
```

When the background job is complete, the CLI displays:

```
Background job <job_id> "command" completed
```

The command given in the above messages is always enclosed in quotation marks ("). Only the first 15 characters of the command are displayed.

Examples

1. This example illustrates using the **background** command and the I/O redirection feature to create a background job and send the output to a file named *out*.

   ```
   background copy X.ASM to Y >OUT  <CR>
   Background job <0168> "copy x.asm to y" has
   been started
   ```

   When the background job is complete, this message is displayed:

   Background job <0168> "copy x.asm to y" completed

   The *out* output file contains all the output messages, such as:

   x.asm copied to y

2. This example shows how the CLI prompts for an output file if you do not redirect the output:

   ```
   background copy X.ASM to Y  <CR>
   the log file is ? OUT  <CR>
   Background job <0E78> "copy x.asm to y" has been started
   ```

3. This example changes the default pool sizes of a background job by entering the `pool-min` and `pool-max` parameters:

   ```
   background (300,500) submit PLM >OUT  <CR>
   ***CLI : background job <0C68> "submit plm" has been
   started
   ```

Error Messages

`Background job <job_id> "<command>" failed`

`<error message>`
The **background** command failed for the reason given in the error message.

`background, parameter required`
You entered the command without parameters.

backup

Archives named files by copying them to a physical volume serving as a backup storage device. The source volume may be a named, remote, or DOS volume. In addition to each file's name and contents, **backup** saves the file access list and owner, extension data, and file granularity.

Note
Do not use this command in an esubmit file or an **rq_c_send_command** system call, because queries for user input will not be received.

Syntax

```
backup [pathname] to|over|after :logical_device:
      [date=mm/dd/yy] [time=hh:mm:ss] [name=name] [f] [q]
```

CAUTION
While **backup** is executing, no other activity should be occurring on the volume you are backing up. If other users access the volume during a backup operation, the volume's data could become corrupted, possibly requiring the volume to be reformatted.

Parameters

`pathname`

Pathname of a file or directory on the source volume (either a local or remote device). If you specify a file, only that file is saved. If you specify a directory, **backup** saves all the files starting from that point on the file tree. If you don't specify this parameter, **backup** saves all files in the current volume, beginning with the root directory.

⚠ **CAUTION**

Backup fails if you use it on a file named $ or a directory containing a file named $; for a directory, remove the file before using the **backup** command.

`to` Output is sent to a new volume. If possible, **backup** reads the volume label on each newly mounted volume to determine the volume type. This ensures that the volume is compatible with any previously mounted volumes in a backup set. If backup data exists on the volume you are prompted to overwrite files of the same name as those being backed up.

`over` Any previous files or directories on the backup volume are overwritten; **backup** begins writing on each fresh volume without checking the label for compatibility.

`after` **Backup** searches the mounted volume for the end of a previous backup operation; the current backup begins at that spot. There must be at least enough space left on this volume to write header information. If more volumes are needed to complete the backup operation, **backup** behaves as if the `to` preposition had been specified for subsequent volumes. If you specify `format`, **backup** formats any new volumes required to finish the backup operation.

:*`logical_device`*:

The logical name of the device to which **backup** copies the files. The device must be local, not remote.

`date=` Saves only files created or modified on or after the specified date.

`mm/dd/yy`

Numeric designation for the month, day, and year. Specify only as many digits as needed; for example, 1/1/91 indicates January 1, 1991. The year may be entered in two or four digits, as follows:

Entry	**Specifies year**
00 through 77	2000 through 2077
78 through 99	1978 through 1999
1978 through 2099	1978 through 2099

`time=` When used with the `date` parameter, saves only files created or modified on or after the specified time and date. When used without the `date` parameter, the date is the current system date. If `time` is omitted, the default is 00:00:00. If both `date` and `time` are omitted, the date and time default to 1/1/78 and 00:00:00.

`hh``:`*`mm`*`:`*`ss`*

Numeric designation for the hour, minute, and second. Specify only as many digits as needed: hours in the range 0-23, and minutes and seconds in the range 0-59.

`name=`*`name`*

Specifies a 1- to 9-character name that **backup** applies to the backup set of data. If you store multiple data sets on a single backup volume by specifying `after`, you must specify a name to be able to restore an individual data set.

`f(ormat)`

Formats each volume before writing to it. The interleave is set to one on diskette media. Use this parameter for new, unformatted media or to overwrite media formatted for a different OS. On a tape device, `format` also retensions the tape, ensuring the best conditions for archiving.

`q(uery)` Prompts for permission to save each file:

```
<pathname>, backup Data File?     or
<pathname>, backup Directory?
```

Respond as follows:

Y	Save the file
E	Exit from **backup**
R	Save remaining files without further query
N	If a file, don't save it; if a directory, don't save the directory or any files under it in the tree. Query for the next file.
other	Error message and reprompt.

Additional Information

Files can be backed up from a remote device, but not to a remote device. For **backup** to save files from either a local or remote named volume, you must have read access to the files and to the directories that contain them.

Backup can save a large volume (a hard disk, for example) onto a number of volumes such as diskettes or tape cartridges. You do not have to separately format the backup volumes; use **backup**'s `format` parameter.

Depending on the amount of data being backed up, a named data set may be a portion of a single backup volume or may span multiple volumes. If you store multiple data sets on a single backup volume, it is important to name each data set. Only by naming the data sets can you restore them individually with the **restore** command.

To restore a logical volume from a backup volume containing multiple data sets, you must supply the name of the data sets in the **restore** command. There is no way to get a listing of these names from the volume itself. Label the backup volume with the names of data sets on the volume.

After using the **backup** command to archive files, you should immediately invoke the **restore** command with the `verify` option to make sure the data has been recorded correctly. When you use `verify`, **restore** only verifies that **backup** produced a restorable backup volume; no files are actually restored. Enter:

```
restore backup-volume to :bb: verify
```

When you invoke **backup**, the command displays this sign-on message, where `V`*`x.y`* is the version number of the utility:

```
iRMX Backup Utility, Vx.y
Copyright <year> Intel Corporation
All Rights Reserved
```

Once the command line has been scanned, one of these messages is displayed, depending on whether you specified the date and time:

```
All Files Modified After <date>, <time>  Will Be Saved
```
or
```
All Files Will Be Saved
```

Backup then prompts you to mount the backup volume. Whenever **backup** requires a new backup volume, the command displays this message:

```
<device>, Mount Backup Volume (name) #<nn>, Enter Y to
Continue:
```

Where:

`<device>`	The logical name of the backup device
`(name)`	The name of the physical volume set
`<nn>`	The identifying number of the requested volume.

When you see this message, place a volume in the backup device and respond with `Y` or `R` to continue the backup process or `E` to exit the **backup** command. If you continue the backup process, **backup** displays this buffer summary message:

```
I/O Buffer Summary
Buffer Size <number>
Number of Buffers <number>
```

Backup continues prompting for a backup volume until you supply one that it can access.

Backup displays an error message if you insert a volume with one of these problems:

- The volume cannot be read
- The volume is a named volume and data would be overwritten
- The volume is a backup volume and data would be overwritten
- The volume is a physical volume containing data

If the situation is appropriate, the command may prompt you with a request to format or overwrite the mounted volume. Respond to this prompt as described for responses to the `query` parameter:

```
<device>, Enter Y to Overwrite/Format:
```

When **backup** fills a backup volume, it prints this message and prompts for additional volumes if it needs them:

```
Physical Volume (<name>), #<nn>, Complete
```

After **backup** finishes, it displays the number of data files and directories saved:

```
Summary For Logical Volume (<name>)
<nn> Data File[s] Saved
<nn> Director[y] [ies] Saved

Backup Complete
```

In some circumstances, when backed-up files are restored the original ownership rights are not preserved, and restored files are owned by the user who performed the **restore**.

See also: **restore** command, in this chapter

Error Messages

If you encounter an error message that requires a response, enter `Y` or `R` to continue the backup process or `E` to exit the **backup** command.

`<backup device>, backup not complete`

You specified an `E` to exit **backup**. This message reminds you the backup operation is not complete. The last file on the last backup volume may be incomplete.

`<backup device>, Backup Volume (<name>), #<nn>, <date>, <time>,`

`Mounted <backup device>, Enter Y to Overwrite:`

The backup volume you supplied already contains backup information. **Backup** lists the logical name of the backup device, the volume number, and the date on which the original backup occurred. It overwrites this volume if you enter `Y` or `R`.

`<backup device>, Cannot Attach Volume`

`<backup device>, <condition code:mnemonic>`

`<backup device>, Mount Backup Volume #<nn>, Enter Y to Continue:`

Backup cannot access the backup volume. This could be because there is no volume in the backup device or because of a hardware problem with the device. The second line of the message indicates the condition code encountered. **Backup** continues to issue this message until you supply a volume that can be accessed.

`<pathname>, <condition code:mnemonic>, Cannot Back up File`

Backup could not copy this file from the source volume, possibly because you do not have read access to the file or because there is a faulty area on the volume. The message lists the condition code encountered. **Backup** copies as much of the file as possible and continues with the next file.

`<backup device>, Device in Use`

`<backup device>, <condition code:mnemonic>`

The device you specified for the backup device is being used by another job. Continuing would result in damage to existing files on the output volume.

`<backup device>, Error Writing Volume Label`

`<backup device>, <condition code:mnemonic>`

`<backup device>, Mount Backup Volume #<nn>, Enter Y to Continue:`

When **backup** attempted to write a label on the backup volume, it encountered the indicated error condition, possibly because of a faulty area on the volume, or because the volume is write-protected. **Backup** reprompts for a different backup volume.

`<backup device>, Input and Output are on Same Device`

The device you specified for the backup device is the same device that contains your input pathname. Continuing would result in damage to the files on the input volume.

`<backup device>, Invalid Input Specification`

The logical name you specified for the backup device was not a logical name for a device. Example invalid names are *:ci:*, :*co*:, and :*home*:.

`<condition code:mnemonic>, Invalid Date or Time`

You entered a date or time parameter that is out of range (such as 31/02/86 or 26:03:62). The message lists the condition code encountered as a result of this entry.

`Invalid Output Specification`

You did not supply the logical name of the backup device when you entered the **backup** command.

`<backup device>, Named Volume <volume name>, Enter Y to Overwrite:`

The backup volume you supplied is a named volume. **Backup** lists the logical device name and the volume name; it overwrites this volume if you enter `Y` or `R`.

`<backup device>, Not Correctly Formatted, Enter Y to Format:`

The backup volume was not correctly formatted.

`Requested Date/Time Later Than System Date/Time`

Either the date and time you specified in the **backup** command are in error or you did not set the system date and time.

`<pathname>, invalid wildcard specification`

You entered a list of pathnames or used a wildcard in the input pathname. You can enter only one input pathname per invocation of **backup**.

`<pathname>, invalid output specification`

You entered a list of logical names for the backup device. You can enter only one output logical name per invocation of **backup**.

`<pathname>, Unable to Complete Directory`

Backup encountered an error when accessing a file in the indicated directory. It skips the rest of the files in the directory and goes on to the next directory. This error could occur if you do not have list access to the directory.

`<backup device>, Unrecognized Volume, Enter Y to Overwrite:`

The backup volume you supplied is a formatted volume, but it has a label that is not readable. **Backup** will overwrite this volume if you enter `Y` or `R`.

`<backup device>, Volume Not Formatted`

`<backup device>, Mount Backup Volume #<nn>, Enter Y to Continue:`

The backup volume you supplied was not formatted. **Backup** continues to issue this message until you supply a formatted backup volume.

`<backup device>, Write Error On Backup Volume`

`<backup device>, <condition code:mnemonic>`

Backup encountered an error condition when writing information to the backup volume. The second line of the message lists the condition code encountered. This error is probably the result of a faulty area on the volume.

`Name Required If After Is Selected`

You must use the `name` parameter when using the `after` preposition.

`cannot attach VOLUME`

The destination device of the backup is a remote server.

`No Room for Append on Mounted Volume`

You specified the `after` parameter, but there is not enough room left on this volume to write the header information to begin appending this data set. Use a new volume.

bcl

Converts an ASCII file into a special binary file understood by the Remote Boot Server program.

Syntax

```
bcl input_file output_file
```

Parameters

input_file

The pathname of an ASCII file containing language input statements, as specified in the Boot Definition Language section below.

output_file

The pathname of the resulting *ccinfo* file to be created.

Additional Information

The **bcl** command is the Boot Configuration Language utility, which produces a special binary file called the Class Code Information File, or *ccinfo* file. The Remote Boot Server uses the *ccinfo* file to determine which bootable file(s) to send over the network during a remote boot request. The remote boot request sends a class code to the Boot Server. Entries in the *ccinfo* file map the class codes to bootable files. A bootable file is the kind of file produced by the **xlate** command.

See also:	Remote Booting and *ccinfo* file, *Network User's Guide and Reference*
	xlate command, in this chapter

The Boot Definition Language

Each statement in the language has this form:

```
   cc[,cc...] is fn[,fn...] [for na[,na..]];
```

Where:

cc	One or more hexadecimal values of class codes, in the range 0 to 0FFFFH.
fn	One or more pathnames of files to be remotely loaded. The first directory in the pathname must be a public directory on the Boot Server system. The string is not case-sensitive.

na	One or more Ethernet addresses of Boot Clients.
;	Ends each statement.

Each **bcl** statement defines one or more mappings between class codes and an ordered list of filenames. When more than one class code is given in a statement, they act as synonyms to each other; any of the class codes result in exactly the same image being sent.

The filenames within a single statement can be thought of as being concatenated in the order given, to form the image that will be sent. **Bcl** itself makes no restrictions on the characters used in the filenames, except that they cannot contain space characters, commas, semicolons or end-of-line characters.

Statements that do not have an Ethernet address specified (no `for` clause) form the default mapping for all Boot Consumers not specifically mentioned in any other statement in the *ccinfo* file. The default mapping does not apply to Boot Consumers whose Ethernet address appears in any statement. Ethernet addresses within a statement qualify the statement as pertaining to only those Boot Consumers. When a particular Ethernet address appears in a **bcl** statement, that Ethernet address must appear with every class code that is to service that Boot Consumer.

The standard command prepositions `to`, `over`, and `after` are not allowed. If used, incorrect results can be expected.

Examples

1. This command instructs the **bcl** utility to read the input statements in the file *ccinfo.bdf*. If there are no errors, **bcl** creates the file *ccinfo*.

```
bcl ccinfo.bdf ccinfo
```

2. These statements are examples of lines that might be in the *ccinfo.bdf* file. Together, these statements program the Remote Boot Server to send the */net/ina961.rem* file when class code 1 is received, and the */rboot32/38612NET.386* file when class code 2 is received.

```
1 is /NET/INA961.32R;
2 is /RBOOT32/38612NET.386;
```

3. These lines state that class code 3BF maps to two files, but only for the two Ethernet addresses given. Unless specified by other statements, all other addresses are ignored. When more than one file is specified, as above, they are sent in the order specified.

```
3BF is /RBOOT32/rem3rd,/RBOOT32/boot2 for 00aa00010203,
00aa00020304;
```

4. These are examples of other statements that might occur in an input file:

```
1,7 is /rboot86/boot1 for 00aa00030405, 00aa00020608;

99 is /sd/net/exec.rem for 00aa00030405, 00aa00020608;
abcd is /sd/tx/default;
```

bootdos

Activates the primary DOS partition and resets the systems.

Syntax

```
bootdos
```

Additional Information

The **bootdos** command is used primarily with the iRMX for PCs OS. It resets the system to boot DOS from the primary DOS partition rather than the iRMX OS from an iRMX partition.

See also: **bootrmx** command

bootrmx

Activates the primary iRMX partition and resets the systems.

Syntax

```
bootrmx
```

Additional Information

The **bootrmx** command is used primarily with the iRMX for PCs OS. It resets the system to boot the iRMX OS from an iRMX partition rather than DOS from a DOS partition.

See also: **bootdos** command

case

Converts the name of the specified file from upper- to lower-case.

Syntax

```
case pathname
```

Parameters

pathname

The pathname of a file or directory whose name is to be converted to lower-case. The pathname may contain a wildcard (*) character.

Additional Information

This command is useful when working in a network environment, where some OSs maintain case-sensitive filenames. The **case** command lets you convert the case of iRMX filenames and access them from Unix or Xenix.

Note

The **case** command works only on local files managed by the iRMX named file driver. Do not use this command with DOS files or remote files.

Examples

To convert the case of all files in a directory to lower-case, enter:

```
case directory_name/*
```

To convert a single filename to lower-case, enter either a full pathname or the pathname relative to your current working directory. For example:

```
case :config:terminals
```

changeid

Changes the system manager's current user ID to any value from 0 to 65535. You can only use this command after invoking the **super** command, regardless of whether you logged on as the Super user.

Syntax

```
changeid [id|world]
```

Parameters

`id`	A decimal value to which you want to change your user ID, in the range 0 to 65535.
`world`	Changes you to the World user, with ID 65535.

Additional Information

If you omit an ID parameter, you are assigned ID 0, the system manager. If you change your user ID to any value other than 0, the system prompt changes to this, indicating the current ID value:

```
    super(id)-
```

The new user ID is not a verified user; you cannot access files available on the iRMX-NET network. You are not a verified user until you return to user ID 0.

Error Messages

`0084;  E_INVALID_NUMERIC`
The user ID you specified contained invalid characters or was not in the range 0 to 65535.

`changeid, allowed only in super mode`
You invoked this command without previously invoking the **super** command.

`<parameter>, unexpected parameter`
You entered too many parameters.

`<condition code:mnemonic>, while executing changeid`
An internal system problem occurred which prevented the CLI from setting the default user.

cli

Invokes a loadable version of the Command Line Interpreter.

Syntax

```
cli
```

Additional Information

In a system that uses a different command interface than the CLI, you may invoke the CLI to take advantage of its interface. The CLI may also be started from a submit file.

connect

Associates a locked terminal device with a logical name. The terminal can then be used as a physical device, in the same manner as any other terminal attached with the **attachdevice** command. The logical name is cataloged in the root job's object directory.

Syntax

```
connect physical_name as :logical_name:
```

Parameters

physical_name
Physical device name of the locked terminal device to be connected. This name must be in the *:config:terminals* file, and must be defined as a BIOS DUIB, either in the system configuration or through a loadable device driver. You can obtain the terminal device names by invoking the **initstatus** command.

`as` Preposition required for the command.

logical_name
The 1- to 12-character name (excluding colons) to be associated with the device. Colons surrounding the logical name are optional, but if used must be in pairs (:*logical_name*:).

Additional Information

When you connect a locked terminal device, the associated serial port can be used as a physical port, without an HI logon process. You may send data to or receive data from any physical device that uses a serial stream of data. The **connect** command cannot be used for virtual terminals.

After connecting the device and cataloging its logical name in the root job's object directory, the **connect** command displays this message:

```
<physical_name> connected as <logical_name>
```

If you change the terminal attributes while the terminal is connected, the changes remain in force after the terminal is disconnected. Note your terminal's attributes before connecting; you must restore them before the HI can use the terminal.

Error Messages

`<logical_name>, logical name already in use`
: The logical name already exists in the root job's object directory.

`<physical_name>, device name not found`
: The physical name is not a terminal device that was defined at system configuration time.

`<physical_name>, has not been locked`
: The specified terminal device must be locked using the **lock** command before it can be connected.

`not multi-access system`
: The **connect** command does not function if the HI is configured as a single-user system.

`<logical_name>, invalid logical name`
: The logical name is too long.

`<physical_name>, not connected`
: The device could not be cataloged.

`<condition code:mnemonic>, too many device names`
: The parameters contain too many device names.

`<physical_name>, already connected`
: The specified device has already been connected.

`*, invalid wildcard specification`
: Wildcards are not supported.

`no logical name given`
: You did not specify a logical name.

console

Dynamically changes the SDM (System Debug Monitor) console device to redirect the I/O streams on DOSRMX systems.

Syntax

`console` *`device_name`*

Parameters

`device_name`

The name of the device (`CON`, `COM1`, or `COM2`) to which you want to redirect the SDM I/O. `CON` is the normal screen and keyboard; `COM1` and `COM2` are the first two serial ports. If this parameter is omitted, a usage message is displayed.

Additional Information

Use this command on DOSRMX systems, as a tool for debugging your OS and software. SDM normally defaults to the console device (`CON`). The **console** command redirects the SDM output stream, input stream, and error message stream to the specified device. If used, **console** should be set prior to entering SDM. From the user's perspective, the redirection does not take effect until SDM starts.

Examples

This command redirects the streams to the COM1 console controller device:

```
console COM1
```

Error Messages

`<device_name>, device does not exist`

The current configuration of the OS does not include the indicated device name.

copy

Displays or makes a copy of the specified file(s) and synchronizes the time stamps.

Note
You can use this command in an esubmit file or **rq_c_send_command** system call if the form of the command does not require user input. If the command requires user input in an **rq_c_send_command** system call, it will fail. However, you can use a form of the command that requires user input in an esubmit file if you use the `eoresponse` and `coresponse` subcommands.

See also: **esubmit** command, in this chapter

Syntax

```
copy inpath_list [to|over|after outpath_list] [q] [ns]
```

Parameters

`inpath_list`
One or more pathnames of files to be copied. Multiple pathnames must be separated by commas. Wildcards are permitted.

`to|over|after outpath_list`
If you omit this parameter, the input files are displayed on the screen (*:co:*). If you specify this parameter, the input files are written to the specified output, such as a printer (*:lp:*) or to new filenames. To copy files on a one-for-one basis, specify the same number of output files as input files. If you specify multiple input files and a single output file, **copy** appends the remaining input files to the end of the output file. If you specify a single output directory, the input files are copied to that directory under their current filenames.

`q(uery)`
Prompts for permission to copy each file. Respond to the prompt with:

Y	Copy the file
E	Exit the command
R	Copy remaining files without further query
N or other	Do not copy this file; go to the next file in the inpath-list

`ns (nosynchronize)`
Disables synchronization of the files' time stamps.

Additional Information

When **copy** copies files, it updates the new file's time stamp to match the original file (if this is supported on the target file driver). **Copy** can be aliased so that `nosynchronize` is automatically specified.

See also: **alias** command

When **copy** creates new files, it sets the access rights and list of accessors as follows:

- The file has *all* access (delete, read, append, and change).
- The owner is the only accessor to the file.

The user ID of the person who invokes the **copy** command is considered the owner of new files created by **copy**. The user owns and has full access to remote files created by **copy**. Only the owner or the system manager can change the access rights associated with the file.

See also: **permit** command, in this chapter
file access, Chapter 1

If you specify multiple output files, and there are more or fewer input files than output files, **copy** returns an error message.

If you specify a wildcard character in an output pathname, you must specify the same wildcard character in the corresponding input pathname. Other combinations result in error conditions.

See also: Using wildcards in file names, Chapter 1

A file listed under one directory can be copied to another directory. For example:

```
copy samp/test/A to :f1:alpha/beta
```

This would copy data file *A* to a different volume and directory. If *beta* is a filename, that is the new name of the copied file. If *beta* is a directory name, the copied file retains the name *A* in the *beta* directory.

You cannot successfully use **copy** to copy a directory to a data file or to another directory. The directory attributes are lost and the copy can no longer be used as a directory. Use the **copydir** command instead.

The **copy** command cannot be used with tape cartridges.

To transfer files between low-density and high-density 5.25" diskettes in Multibus I or II systems, attach the devices with the uniform granularity device name `wdf0`, rather than the standard granularity device `wmf0`.

Error Messages

```
<pathname>, output file same as input file
```

You attempted to copy a file to itself.

copydir

Copies all files and subdirectories from one or more directory trees.

Note
You can use this command in an esubmit file or **rq_c_send_command** system call if the form of the command does not require user input. If the command requires user input in an **rq_c_send_command** system call, it will fail. However, you can use a form of the command that requires user input in an esubmit file if you use the `eoresponse` and `coresponse` subcommands.

See also: **esubmit** command, in this chapter

Syntax

```
copydir inpath_list [to|over outpath_list ] [q]
      [accessors|noaccessors] [world|noworld] [nodelete]
```

Parameters

`inpath_list`
The pathnames of one or more directories to be copied. Use commas to separate multiple directories.

`to|over` *`outpath_list`*
Either one directory where the input directories are all copied, or the same number of directories as specified in *`inpath_list`*. If you specify `to`, **copydir** prompts for permission to overwrite existing files; a `Y` response overwrites the file and any other response skips that file. If you specify `over`, existing files are overwritten.

`q(uery)`

Prompts for permission to enter each directory and to copy each file in it. Respond to the prompt with:

Y	Enter the directory or copy the file.
E	Exit from the **copydir** command.
R	Continue copying without further query.
S	Skip to the end of this (sub)directory and continue prompting for directories at this level or higher.
A	Copy all remaining files and subdirectories in the current directory without further query, then begin querying before entering the next (sub)directory.
N or other	Do not enter this directory or copy this file.

`accessors`

Copies access information with the files; this is the default.

`noaccessors`

Does not copy access information.

`world` Assigns World read access to all files copied; this is the default.

`noworld`

Does not assign World read access.

`nodelete`

Do not overwrite existing files.

Additional Information

If you specify multiple input directories and a single output directory, the output directory has the combined structure of the input directory trees. For example, this command copies the directory structures of both *dir1* and *dir2* into *dir3*:

```
copydir dir1, dir2 to dir3
```

If you specify multiple input and output directories (the number must be same), each input directory tree is copied to the corresponding output directory, in order. For example, this command copies *dir1* to *dir3*, and *dir2* to *dir4*:

```
copydir dir1, dir2 to dir3, dir4
```

Copydir can also copy individual files. **Copydir** handles access rights better than the **copy** command when copying remote files. From the local system, a remote file appears to have its delete bit set to off, regardless of how the bit is set on the remote system. When copying access rights from a remote file to a local file, **copydir** sets the delete bit to on if the file has write access. The same is true of the change bit for directories.

Examples

These examples illustrate how **copydir** works when copying an entire directory tree.

1. The directory *test1* that has this structure:

   ```
   test1/dir1
   test1/dir1/file1
   test1/dir2
   test1/dir2/file2
   test1/file3
   ```

   Test1 has this directory listing:

   ```
   04 APR 89 20:14:52
   directory OF $ ON VOLUME rmxll
   test1
   ```

   Enter:

   ```
   copydir test1 to newdir
   ```

   In response, this information is written to the screen:

   ```
   test1/dir1/file1, copied
   test1/dir1, directory copied
   test1/dir2/file2, copied
   test1/dir2, directory copied
   test1/file3, copied
   test1, directory copied
   ```

   It creates an identical directory structure as *test1* with the name *newdir*, as follows:

   ```
   newdir/dir1
   newdir/dir1/file1
   newdir/dir2
   newdir/dir2/file2
   newdir/file3
   ```

   This is the new directory listing:

   ```
   04 APR 89 20:14:52
   directory OF $ ON VOLUME rmxll
   test1  newdir
   ```

2. Given the same *test1* directory structure as in example 1, enter:

   ```
   copydir test1
   ```

   It writes this information to the screen:

```
test1/dir1/file1, copied
test1/dir1, directory copied
test1/dir2/file2, copied
test1/dir2, directory copied
test1/file3, copied
test1, directory copied
```

It creates directories in your current directory with this structure:

```
dir1
dir1/file1
dir2
dir2/file2
```

The subdirectories and files of *test1* are created and placed at the same directory level as *test1*. This is the new directory listing:

```
04 APR 89  20:17:59
directory OF $ ON VOLUME rmxll
test1  dir1   dir2   file3
```

Error Messages

`<pathname>, output file same as input file`

You attempted to copy a file to itself.

createdir

Creates one or more directories with all access rights available to you as the owner. You may delete, list, add, and change the contents of the new directory.

Syntax

```
crdir|createdir path_list [FILES=file_count]
```

Parameters

`path_list`

One or more pathnames of directories to be created. Multiple pathnames must be separated by commas.

`FILES=file_count`

Reserves space for the specified number of files in the new directory. If this option is not specified, the default is zero files. This parameter can be used to help control fragmentation of large directories by allocating space when the directory is created. Some file systems (e.g., DOS) may always allocate some directory space when a directory is created.

⇒ **Note**
On some file systems, reserving space for a large number of files may take a long time.

Additional Information

You can create new directories that are subordinate to other directories. For example, if the subdirectory *ab/dc/ef* exists in your current working directory, this command creates the directory *gh* under it:

```
createdir ab/dc/ef/gh
```

You own and have full access to any new remote directories that you create (list and add-entry access permissions constitute full access for remote directories). No other users except the system manager have access to the directory unless you use the **permit** command to change the access rights and list of accessors.

In a DOS file system, the directory is owned by the World user.

See also: **permit** command, in this chapter
creating a new directory, Chapter 1

Error Messages

`<directory_name>, file already exists`

The specified directory already exists.

`<file_name>, file does not exist`

One of the directories specified in the pathname does not exist.

`<directory_name>, invalid file type`

One of the directories specified in the pathname is not a valid directory.

`<pathname>, 26H:  E_FACCESS`

The pathname is a remote directory and you do not have add-entry access to the parent directory of the directory to be created.

date

Displays the current date and time, or sets the local (OS) or global (battery-backed) time-of-day clock. **Date** optionally synchronizes the date of the local clock with the global system clock.

➾ **Note**
You can use this command in an esubmit file or **rq_c_send_command** system call if the form of the command does not require user input. If the command requires user input in an **rq_c_send_command** system call, it will fail. However, you can use a form of the command that requires user input in an esubmit file if you use the `eoresponse` and `coresponse` subcommands.

See also: **esubmit** command, in this chapter

Syntax

```
date [date|q] [local|global]
date synchronize
```

Parameters

`date` You may specify the day (month and year remain unchanged), the day and month (year remains unchanged), or the day, month, and year. Use one of these formats:

mm/dd/yyyy	all numerals
dd month yyyy	spell *month* using enough letters to distinguish it

Specify only the number of digits needed. For example, `12/1/91`, `01 DE 91`, and `1 December 1991` are equivalent. The year may be entered in two or four digits, as follows:

Entry	**Specifies year**
00 through 77	2000 through 2077
78 through 99	1978 through 1999
1978 through 2099	1978 through 2099

`q(uery)`
Displays the current date, time and clock type, and prompts for a new date. In response, enter the date as shown above, or `E` to exit.

`local` Displays or sets the date portion of the local time-of-day clock maintained by the OS. This is the default if `local` or `global` is not specified. Any user may set the date.

`global` Applies only to systems with hardware clock/calendar components, typically backed up by battery power. Specifying `global` displays or sets the date portion of this clock. Any user may display the date, but only the Super user can set it. If you set the global clock, the local clock automatically takes on the same value.

`synchronize`
For systems with a global clock/calendar, this sets the date portion of the local clock to the current date of the global clock. If you set the global clock, this parameter is unnecessary.

Additional Information

The **date** command displays an error message if you specify `global` or `synchronize` and your system does not have a global clock/calendar.

If you set only one or two date parameters, the omitted parameters are replaced by their defaults. If you enter only one parameter, it is assumed to be the day. Two parameters (in either format) represent the day and month. For example, assume the current date in the system is 9 Sept 91. If you enter:

```
date 18 <CR>
```

date displays:

```
18 Sep 91, <current time>
```

If you omit the date parameters, **date** displays the current date and time as follows, showing only the first three characters of the month and the last two digits of the year:

```
dd month yyyy, hh:mm:ss <local or global clock type>
```

If you have a system without a global clock/calendar (such as a System 310), whenever you start up or reset the OS, the date is automatically set to the date you last accessed the :*system*: directory. You can reset the date to any acceptable value.

If your system has a global clock/calendar and the OS is configured to recognize it, the local clock is automatically set to the date maintained in the global clock whenever you turn on or reset your system.

Error Messages

`<date>, invalid date`
You entered an invalid date. This error could result from specifying a day that is invalid for the month (such as 31 FEB 90), entering characters for the year that do not fall into a legitimate range, entering a month parameter that does not uniquely identify the month, or using an invalid format.

`<parameter>, invalid syntax`
: You specified an illegal combination of parameters. For example, you may have entered a date and also specified the `query` option.

`only the system manager may set the global clock`
: You specified the `global` parameter, but you are not the system manager.

`<condition code:mnemonic>, getting system time`
: You specified the `global` or `synchronize` parameter, but there is no global clock in the system.

`E_SHARE, global clock busy`
: You attempted to access the global clock while another job was accessing it. Try the command again.

`E_INVALID_DATE, global date read was invalid`
: The date returned from the global clock was invalid. This condition usually occurs when the global clock has never been initialized or when power to the clock has been interrupted. The BIOS system call **get_global_time** sets the date to 1 Jan 1978, which the **date** command then displays.

`E_INVALID_TIME, global time read was invalid`
: The time returned from the global clock was invalid. This condition usually occurs when the global clock has never been initialized or when power to the clock has been interrupted. The BIOS system call **get_global_time** sets the time to a valid time, which the **date** command then displays.

`E_SUPPORT, attempted to access non-existent global clock`
: There is no global clock in the system.

dealias

Deletes one or more aliases defined with the **alias** command.

Syntax

```
dealias abbreviation [q]
```

Parameters

`abbreviation`

The alias to be deleted. You may delete all aliases with the * wildcard, or delete a group of aliases by using * as the last character of the abbreviation.

`q(uery)`

Prompts for permission before deleting an alias. Respond to the prompt with `Y` to delete the alias, or any other character to keep it.

Additional Information

If you specify a wildcard in the aliases to be deleted, you may use the `query` option to choose which aliases to delete. Assume you have defined the two aliases `s = submit` and `su = super`, and want to delete only the `su` alias. Enter:

```
dealias S* Q  <CR>
```

At these prompts, respond as shown:

```
s = submit delete ? (y or [n]) <CR>
su = super delete ? (y or [n])  Y <CR>
```

Error Messages

`<parameter>, alias not found`

You tried to delete an alias that was not defined in the alias table.

`<parameter>, wildcard is allowed only in the last character`

You tried to delete a number of aliases with a wildcard, but the wildcard was not the last character.

debug

Loads an application program into memory, prints debug information to the screen or to an output file, and transfers control to the System Debug Monitor (SDM). The **debug** command cannot be used to debug CLI-level commands; only HI commands and application programs.

Syntax

`debug [to|over|after` *`outpath`*`]` *`pathname`* `[`*`parameter_string`*`]`

Parameters

`to|over|after` *`outpath`*
: A pathname for the output file where debug information is to be written, rather than to the screen.

`pathname`
: The file containing the application program to be debugged.

`parameter_string`
: A string of required and/or optional parameters passed to the application program being debugged.

Additional Information

When you invoke the **debug** command with no output file, it displays this message, including the pathname of the application to be debugged:

```
    debug file, <pathname>
```

Then it displays a segment map for the loaded program and breaks to the monitor.

If you specify an output file, **debug** loads the application job and writes the segment map to the output file. Then it displays a prompt and waits until you indicate that you're ready to enter SDM by pressing <CR>. This allows you to access the debug file from a remote system (using iRMX-NET) to aid in the debug process. The system breaks to SDM immediately after you press <CR>.

Use SDM to single-step, display registers, and set breakpoints within the program. When **debug** executes, SDM disables interrupts. This causes the time-keeping function to stop when code is not executing. This slowing of the timing function has two consequences:

- It affects the ability of the Nucleus to execute time-out tasks that have provided time limits to system calls, such as **receive_units** and **receive_message**.
- It affects the ability of the BIOS to keep track of the time-of-day and write its data structures to secondary storage.

This example shows the debug information that is displayed or written to a file. The first line lists the token for the job that is created. The remaining lines list the selector portions of all segments (under the heading `BASE`) assigned by the bind application when the code was bound. The `LDT(n)` values are the same as those that appear on the bind map. You can match the selector values shown in this display with the offset values shown in the bind map to determine the exact location of a symbol listed in the bind map.

```
             SEGMENT MAP FOR job:  2250

 NAME    BASE    NAME    BASE    NAME    BASE    NAME    BASE

LDT(2)   2E40    LDT(3)  2E30    LDT(4)  2C08    LDT(5)  2CE0
LDT(7)   2220    LDT(8)  2158

Break at xxxx:yyyy
..
```

See also: Binder, map files, *Intel386™ Family Utilities User's Guide*

The **debug** command loads the application program into its own dynamic memory. As a result, the application program obtains dynamic memory from the memory pool of **debug**, not from the memory pool of the user session. Because **debug** uses a different set of default values than the CLI, it is possible that the program may behave differently than when it is run independently.

See also: *System Debugger Reference* for more details and for commands you enter at the SDM prompt

If you use an SBX 279(A) graphics subsystem for a terminal, the monitor session occurs on a different window than the HI window from which you invoke the **debug** command. Using two windows allows you to see more debugging context than with a single window. To return to the HI window, you may use either the mouse or a previously mapped ALT/Function key.

The command to exit SDM and return to the CLI prompt is `g <CR>`.

Error Message

```
<condition code:mnemonic> command aborted by EH
```

This condition code was encountered and the **debug** command was aborted by the exception handler.

delete

Deletes one or more files and/or empty directories, or marks them for deletion if a user is currently accessing them.

➨ **Note**
You can use this command in an esubmit file or **rq_c_send_command** system call if the form of the command does not require user input. If the command requires user input in an **rq_c_send_command** system call, it will fail. However, you can use a form of the command that requires user input in an esubmit file if you use the `eoresponse` and `coresponse` subcommands.

See also: **esubmit** command, in this chapter

Syntax

`delete` *`pathname_list`* `[q]`

Parameters

`pathname_list`

One or more pathnames of files or empty directories to be deleted. Multiple pathnames must be separated by commas. Wildcards are permitted.

`q`(`uery`)

Prompts for permission to delete each file in the list. Respond to the prompt with:

Y	Delete the file
E	Exit the command
R	Delete remaining files without further query
N or other	Do not delete this file; query for the next

Additional Information

You don't need to be the owner of a file to delete it, but you must have delete access. If a user or program is accessing the file (has a connection to it) when you invoke **delete**, the file is marked for deletion, and deleted when all connections to the file are gone.

Directories must be empty to be deleted with this command.

See also: **deletedir** command, in this chapter

To delete a directory with **delete**, first delete all files and subdirectories contained in it. For example, to delete a directory named *alpha* whose entire contents consist of a directory *beta* containing a data file *samp*, you could enter:

```
delete alpha/beta/samp, alpha/beta, alpha
```

Delete displays this message as it deletes each file or marks the file for deletion:

```
<pathname>, deleted
```

⚠ **CAUTION**

Use wildcards carefully with the **delete** command. For example, entering `delete *,a` (with a comma) instead of `delete *.a` erases all files in your current directory, instead of just those files ending in *.a*.

The DOS file system does not support the delete access bit. DOS files are owned by the World user and are either read-only (cannot be deleted) or read/write (can be deleted by any user). DOS directories cannot be made read-only.

The delete access bit is not supported by iRMX-NET. Normally, append and update access allow you to delete a remote file if you have add-entry access to the parent directory; and add-entry access allows you to delete an empty remote directory. However, if a user on the remote system has removed delete access to a file or directory, you cannot delete it, regardless of other access permissions.

See also:	**permit** command, in this chapter
	deleting files, *Installation and Startup*
	deleting directories, Chapter 1

Error Messages

`<pathname>, delete access required`

You do not have delete access to the file. If this is a remote file, a user at the remote system has removed delete access. You cannot change the delete access locally; a user at the remote system must grant delete access before this command succeeds.

`<pathname>, 026H:  add access required`

The pathname to be deleted is a remote file and you do not have add-entry access to the parent directory.

deletedir

Deletes one or more directories, including subsidiary files and subdirectories.

➯ **Note**
You can use this command in an esubmit file or **rq_c_send_command** system call if the form of the command does not require user input. If the command requires user input in an **rq_c_send_command** system call, it will fail. However, you can use a form of the command that requires user input in an esubmit file if you use the `eoresponse` and `coresponse` subcommands.

See also: **esubmit** command, in this chapter

Syntax

```
deletedir pathname_list [q]
```

Parameters

`pathname_list`

Names of directories or files to be deleted. Multiple pathnames must be separated by commas. Wildcards are permitted.

`q(uery)`

Prompts for permission to enter each directory and to delete each file in it. Respond to the prompt with:

Y	Enter the directory or delete the file.
E	Exit from the **deletedir** command.
R	Delete remaining directories without further query.
S	Skip to the end of this (sub)directory and continue prompting for directories at this level or higher.
A	Delete all remaining files and subdirectories in the current directory without further query, then begin querying before entering the next (sub)directory.
N or other	Do not enter this directory or delete this file. If given in response to the original directory prompt, **deletedir** exits.

Additional Information

The **deletedir** command deletes an entire directory tree or trees. These are examples of commands:

```
deletedir dirA
deletedir dirB, dirC
```

If you specify the `query` parameter, **deletedir** displays one of these prompts:

```
<pathname>, enter directory?
<pathname>, delete?
```

Deletedir can only delete empty directories; all files and subdirectories must be deleted first. Thus, if you enter `S` to skip a queried file or directory, **deletedir** cannot delete that directory or those above it on the same branch. For each of these directories, this prompt is displayed:

```
<pathname> delete directory?
```

Any response other than `N` causes an exception code to be returned.

Error Messages

`<pathname>, delete access required`

You do not have delete access to the file. If this is a remote file, a user at the remote system has removed delete access. You cannot change the delete access locally; a user at the remote system must grant delete access before this command succeeds.

`<pathname>, 026H:  add access required`

The pathname is a remote file and you do not have add-entry access to the parent directory.

deletename

Removes specified server names and addresses from the local network Name Server object table.

Syntax

```
deletename object_name_list
```

Parameter

`object_name_list`

Specifies one or more server names (or other object names) to be deleted. Multiple names must be separated with commas.

Additional Information

A typical Name Server object is the name and transport address of a server system on the network. Delete the object by specifying the server name. The **deletename** command deletes objects from the table on the local system, but not from remote systems. If the object table contains more than one entry with the same name but different property types, all entries of that name are deleted by this command.

See also: Format of names and addresses, **setname** and **loadname** commands, in this chapter

Error Messages

`<object_name>, name does not exist locally`

The specified object name is not located in the local object table. However, the name may exist on the network in the object table of another system.

`illegal name`

The specified object name is more than 16 characters long. Verify the name of the object being deleted, and invoke the command again.

detachdevice

Detaches the specified devices and deletes their logical names from the root job's object directory.

Syntax

```
dd|detachdevice logical_name_list [f]
```

Parameters

`logical_name_list`
: One or more logical names of physical devices to be detached. Colons surrounding the logical names are optional, but if used must be in pairs (:`logical_name`:). Multiple names must be separated by commas.

`f(orce)` The device is to be detached even if connections to files on the device currently exist; the connections are deleted.

Additional Information

After a device is detached, no volume mounted on that device is accessible for system use until the device is reattached.

The Super user may detach any device. Other users can detach only these devices:

- Devices configured with your user ID as the owner ID
- Devices you originally attached using the **attachdevice** command
- Devices originally attached using the `world` parameter of **attachdevice**
- Devices originally attached by the World user

Detachdevice returns an error message if you attempt to detach devices originally attached by other users. This prevents non-Super users from detaching devices belonging to other users and from accidentally detaching system volumes.

If other users are currently accessing a device, there are connections to it and you can only detach it by specifying the `force` parameter.

CAUTION
If you detach the device containing HI commands, you cannot use the commands until the system is restarted.

Error Messages

`<logical_name>, can't detach device`

`<logical_name>, <condition code:mnemonic>`
: The listed condition code shows an error condition that prevented **detachdevice** from detaching the device.

`<logical_name>, device does not belong to you`
: The device was originally attached by a user other than you or World; you cannot detach the device.

`<logical_name>, device has outstanding file connections`
: There are existing connections to files on the device. You did not specify the `force` parameter and **detachdevice** does not detach the device.

`<logical_name>, device is in use`
: Another user or program is accessing the device (has a connection to a file). You must specify the `force` parameter in order to detach the device.

`<logical_name>, outstanding connections to device have been deleted`
: There were outstanding connections to files on the volume. You specified the `force` parameter and **detachdevice** deleted the connections. This is a warning message only; it does not prevent the device from being detached.

`device is not a device connection`
: You attempted to detach a remote server device. Remote devices attached by the BIOS, such as the system containing the Master UDF, cannot be detached by the EIOS through the **detachdevice** command.

detachfile

Terminates the association between one or more files and their logical names established with **attachfile**.

Syntax

```
df|detachfile logical_name_list [system]
```

Parameter

`logical_name_list`
: One or more logical names that represent the files to be detached. Colons surrounding the logical names are optional, but if used must be in pairs (:*logical_name*:). Multiple names must be separated by commas.

`s(ystem)`
: This option indicates that the logical names in the list are system logical names. System logical names are cataloged in the root directory and are, therefore, available to all users. The system option can only be executed by the Super user.

Additional Information

Detachfile also uncatalogs the detached files' logical names from your interactive job's global object directory.

You cannot use **detachfile** to detach logical names that represent devices rather than files. **Detachfile** returns an error message if you make such an attempt.

You cannot use **detachfile** to detach logical names originally created by other users.

If you do not specify the system option, **detachfile** searches for logical names only in the global object directory of your interactive job. However, if you specify the system option, it searches only in the root job's object directory.

Error Messages

`<condition code:mnemonic> invalid global job`
: The HI encountered an internal system problem when it attempted to remove the logical name from the global job's object directory. The message lists the resulting condition code.

`<logical_name>, logical name not allowed`
: You specified one of the logical names *:$:*, *:term:*, *:ci:*, or *:co:*. You cannot detach the files associated with these logical names.

`<logical_name>, not a file connection`

The logical name you specified is cataloged in the global object directory of your interactive job, but it is not the logical name of a file.

`Must be SUPER user to execute the SYSTEM option`

Only the Super user can use the system option.

deviceinfo

Displays information about the size and available space on the specified volume(s).

Syntax

```
deviceinfo [logical_name_list] [to|over|after outpath]
```

Parameters

logical_name_list

One or more logical names of volume devices for which information is displayed. The names must be surrounded by colons (:*logical_name*:), and multiple names must be separated by commas. If no logical name is specified, *:$:* is the default.

to|over|after *outpath*

Writes the output to the specified file rather than to the screen.

Additional Information

Note
You cannot use this command with a device that you access through NFS.

This command supports resident file drivers and dynamic loadable file drivers. This example shows the type of information produced by **deviceinfo** for a named file driver:

```
deviceinfo :A: <CR>
:A:, volume (RMX) on device (AMH), NAMED file driver
  block size   =     512  bytes
  total blocks =   2,880  (1.406 Mbytes)
  free blocks  =   2,832  (1.382 Mbytes)
  free files   =     200
  total files  =     207
```

This example shows the type of information produced by **deviceinfo** for an EDOS file driver:

```
deviceinfo :sd: <CR>
:SD:, volume (MS-DOS) on device (C_DOS), EDOS file driver
  block size   =   2,048  bytes
  total blocks =  40,877  (79.83 Mbytes)
  free blocks  =  18,967  (37.04 Mbytes)
  free files   =  unlimited
```

The `total files` field includes the internal system files. The number listed may be up to seven higher than the number of user files that can be created. If information is not available, the command does not display any information.

dir

Lists the names (and optionally, attributes) of files and directories contained in a given directory.

Note
You can use this command in an esubmit file or **rq_c_send_command** system call if the form of the command does not require user input. If the command requires user input in an **rq_c_send_command** system call, it will fail. However, you can use a form of the command that requires user input in an esubmit file if you use the `eoresponse` and `coresponse` subcommands.

See also: **esubmit** command, in this chapter

Syntax

```
dir [inpath_list] [to|over|after outpath_list]
      [f[ o]|s[ o]|l|e] [fr]
      [so] [i] [p] [q] [for path_list]
```

Parameters

`inpath_list`
: One or more pathnames of the directories to be listed. Multiple pathnames must be separated by commas. If no parameters are specified, your current working directory (*:$:*) is listed. Wildcards are not permitted.

`to|over|after` *`outpath_list`*
: Writes the output to the specified file (or device) rather than to the screen. Multiple pathnames must be separated by commas and match the number specified in *`inpath_list`*.

`f(ast) [one]`
: Lists only filenames and directory names. This is the default listing format. The output is in five columns unless you specify `one`, for a single column.

`s(hort) [one]`
: Lists names, file attributes, your access rights to the files, and sizes. The output is in two columns unless you specify `one`.

`l(ong)` In addition to the information listed for short, lists the volume and file granularity, the owner, and the date last modified.

`e(xtended)`
: In addition to the information listed for `long`, lists the date and time of creation, last access, and last modification; also lists the users who have access to the file and their access rights.

`fr(ee)` Lists the amount of free space available on the volume containing the given directory, including the number of free files, free volume blocks, and free bytes. This information is automatically displayed for short, long, and extended listings.

`so(rt)` Sorts the list in alphanumeric order (except on DOS devices).

`i(nvisible)`
Additionally lists invisible files: those beginning with the characters *R?* or *r?*. If you omit this parameter, invisible files are not listed.

`p(arent)`
Displays an entry for the directory specified in *`inpath_list`*, in addition to the files contained in the directory. In a list of directories you may specify a file if you include the `parent` parameter.

`q(uery)` Prompts for permission to list a directory. Respond with:

Y	List the directory
E	Exit the command
R	List remaining directories without further query
N or other	Do not list the directory; query for the next

`for` *`path_list`*
In the directories specified by *`inpath_list`*, lists only those files that match a name in *`path_list`*. Wildcards are permitted.

Additional Information

You do not need to be the owner of a directory to list its contents with **dir**; however, you must have list access to the directory. In DOSRMX and iRMX for PCs, you can list any directory in the DOS file system.

See also: Accessors and access rights, **permit** command, in this chapter

To list your current working directory in `fast` format, enter `dir` without parameters. However, to use a listing format other than `fast`, you must specify the directory name explicitly. The short, long, and extended listings display the amount of space used by the listed files and the amount of free space on the volume.

The iRMX **dir** command does not work exactly like the DOS **dir** command. In the iRMX OS, if you just type **dir**, it displays all files in the current directory (*:$:*), as in DOS. If, however, you include command line parameters, you must type `$` to specify the current directory.

For example, to display just the file *myfile* in the current directory, you cannot enter `dir myfile`. You must enter `dir $ myfile`. The **dir** command always interprets the first command line parameter as a directory, so when you type `dir myfile`, it attempts to display the contents of a subdirectory named *myfile* under the current directory. Similarly, if you want to display all invisible files in the current directory, you cannot enter `dir i` (the "invisible" switch), you must enter `dir $ i`.

Another use of the **dir** command is to display the names of the HI system commands, utilities, or development tools available on your system, with the commands shown below:

```
dir :system:
dir :utils:
dir :lang:
```

Examples

The examples are followed by explanations of the fields in the listings, and the field differences for DOS and remote file listings.

This command displays a long listing for the current directory:

```
dir $ l
```

```
03 JAN 91   21:55:24
directory OF mydir1 ON VOLUME myvol
                                            GRAN
   NAME      AT     ACC  BLKS   LENGTH    VOL FIL   OWNER     LAST
MOD
ed                  -R--   11    1,057  1,024   1   # 47     02 MAR
90
programs     DR     DL--   30   30,185  1,024   1   # 47     03 JAN
91
fmat                DRAU    1       39  1,024   1   WORLD    08 NOV
90
OBJfile             ---U    3    2,895  1,024   1   # 47     18 DEC
89
alpha1.P28          DLAC    2    1,304  1,024   1   # 50     22 OCT
90
alpha1.MP1          DLAC    6    5,397  1,024   1   # 50     22 OCT
90
manuals      DR     -L--    1      304  1,024   1   # 47     02 JUL
90

      7 files     54 BLKS         41,181 BYTES

     33 files  3,000 BLKS      3,072,000 BYTES FREE
```

This command displays an extended listing for the current directory:

```
        dir $ e
```

```
03 JAN 91  21:50:24
directory OF mydir ON VOLUME myvol
                                          GRAN
    NAME   AT   ACC   BLKS     LENGTH    VOL  FIL OWNER
LAST MOD
 programs  DR   DL--   30      30,185    1,024  1  # 47       03 JAN
91
                     CREATION: 01 JAN 91  04:05:44     ACCESSORS
ACC
                     LAST ACC: 03 JAN 91  05:52:33     # 47
DL--
                     LAST MOD: 03 JAN 91  05:52:33     # 50        -
LA-
                                                       # 82        -
L--
 ed             -R--   11       1,057    1,024  1  # 47
02 MAR 90
                     CREATION: 11 NOV 85  12:24:05     ACCESSORS
  ACC
                     LAST ACC: 02 MAR 90  14:22:16     # 47        -
R--
                     LAST MOD: 02 MAR 90  14:22:16
 fmat           DRAU    1          39    1,024  1  WORLD
08 NOV 90
                     CREATION: 01 NOV 87  08:54:39     ACCESSORS
  ACC
                     LAST ACC: 03 JAN 91  14:56:59     WORLD
  DRAU
                     LAST MOD: 08 NOV 90  20:44:01

       3 files        42 BLKS          31,281 BYTES

       33 files     3,000 BLKS      3,072,000 BYTES FREE
```

This is the meaning of fields shown in the listings.

Heading	**Meaning**
NAME	Up to 14-character filename (8.3 characters in DOS)

AT	File attribute, where:
	DR = Directory
	MP = Bit map file
	blank = Data file

ACC	File access rights of the user who entered the **dir** command For Directories: DLAC For Data Files: DRAU D = Delete D = Delete

	L = List	R = Read
	A = Add	A = Append
	C = Change	U = Update
BLKS	9-digit number (5 digits on short listing, unless the number is too long) giving the volume-granularity units allocated to the file	
LENGTH	10-digit number (7 digits on short listing, unless the number is too long) giving the length of the file in bytes	
VOL	5-digit number giving the volume granularity in bytes	
FIL	3-digit number giving the granularity of the file in multiples of volume granularity	
OWNER	User ID of the file owner	
LAST MOD	Date of last file modification	
CREATION LAST ACC LAST MOD	Dates and times of file creation, last file access, and last file modification	
ACCESSORS	User IDs of users who have access to the file, followed by the access rights of the corresponding user. The format is identical to ACC, above.	

DOS Files

The size of DOS directories is listed as 0. All files are owned by the World user. The `CREATION`, `LAST ACC`, and `LAST MOD` times are all equal to the DOS `last modified` time.

NFS Files

Access rights and user IDs map differently between iRMX and other OSs when you use NFS.

See also: **permit** command for information on NFS mapping

Remote iRMX-NET Files

You own and have full access to any new remote output files created by the **dir** command. The listing format is identical to that for local directories. However, some fields of iRMX-NET remote directory listings have different interpretations:

- The `ACC` field supports the `R` (read), `A` (append), and `U` (update) access controls for data files, and the `L` (list) and `A` (add entry) access controls for directory files. The `D` (delete) and `C` (change entry) values are omitted from the `ACC` field.

- Remote directory listings display the number of files, blocks, and bytes used by the remote directory. The listings omit this information for the entire volume.

- The user IDs in the `OWNER` and `ACCESSORS` fields may not be the same as a listing on the remote system. Your (client) system receives a user name from the server for these fields. Your system obtains the user ID that corresponds to that user name from its own User Definition File (UDF). If your system and the remote system are in different Administrative Units (subnetworks), and if both systems contain a user by the same name, the user IDs are likely to be different.
- If the user name received from the server does not exist in the client UDF, the user ID is displayed as 65534.
- The `VOL` granularity field is estimated by the Remote File Driver, using the value returned by a BIOS **rq_get_file_status** call.
- The `BLKS` field is calculated by dividing the `LENGTH` field by the estimated value of the `VOL` granularity field.
- The `FIL` granularity is assigned a value of 1.

Error Messages

`no directory files found`
: None of the files you specified were directories.

`<pathname>, READ access required`
: You do not have read (list) access to the directory.

disconnect

Removes a terminal connection established with the **connect** command; cannot be used for virtual terminals.

Syntax

`disconnect :`*`logical_name`*`:`

Parameter

:*`logical_name`*:
The logical name for the physical terminal device that is to be disconnected.

Additional Information

The specified logical name is deleted from the root job's object directory and the terminal returns to locked status, under HI control.

The Super user may disconnect any connected terminal. Other users can disconnect only those terminals connected by themselves or by the World user. **Disconnect** returns an error message if you attempt to disconnect a terminal originally connected by another user.

If you change the terminal attributes while the terminal is connected, the changes remain in force after the terminal is disconnected. Note your terminals attributes before connecting; you must restore them before the HI can use the terminal.

Error Messages

`<logical_name>, is not a terminal connection`
The specified name does not represent a terminal connection.

`<logical_name>, has not been connected`
The specified name has not been connected using the **connect** command.

`<logical_name>, not found`
The terminal connected as `<logical name>` cannot be found in the terminal table.

`<logical_name>, device does not belong to you`
The device was originally connected by a user other than you or World; you cannot disconnect the device.

`*, invalid wildcard specification`
Wildcards are not supported.

diskverify

Invokes the Disk Verification Utility, which inspects, verifies, and corrects the data structures of iRMX physical and named volumes. Operates as a single command (described here) or in interactive mode.

See also: Using **diskverify** in interactive mode, Appendix B

Note
You can use this command in an esubmit file or **rq_c_send_command** system call if the form of the command does not require user input. If the command requires user input in an **rq_c_send_command** system call, it will fail. However, you can use a form of the command that requires user input in an esubmit file if you use the `eoresponse` and `coresponse` subcommands.

See also: **esubmit** command, in this chapter

Syntax

```
diskverify :logical_name: [to|over|after outpath]
      [disk|gb|v[ options]|fix[ options]]
```

The options for the `verify` and `fix` parameters are shown in the diagram on the next page.

Parameters

`logical_name`

Logical name of the secondary storage device containing the volume to be verified. The colons are not required.

`to|over|after` *`outpath`*

Pathname of the file to receive the output from **diskverify**. If you omit this parameter, and/or no preposition is specified, the output goes to the console screen (*:co:*). You cannot direct the output to a file on the volume being verified; if you do, the utility returns an error message.

`disk` Displays attributes of the volume, such as the type of volume, device granularity, block size, number of blocks, interleave factor, extension size, volume size, the root fnode number, and number of fnodes.

`gb` (or `getbadtrackinfo`)

Reads and displays the bad track information from the volume. Output redirected to a file may be used as input to the **format** command by removing the header information.

`v(erify)`

Verifies the volume according to the specified option. If you omit the option, the utility performs `named` verification.

`fix` Verifies and fixes the volume according to the specified option. After performing the `verify` functions, the utility tries to fix several types of inconsistencies on the volume. Using the `fix` parameter may prove dangerous, since it changes data on the disk. For example, during `N1` verification, `fix` corrects the checksums on fnodes with bad checksums. However, an fnode with a bad checksum may indicate another fnode problem which needs attention.

It is best to use `fix` in this manner:

1. Use **diskverify** with the `verify` option.
2. Examine the output and the problems on the volume to determine the type of fix needed.
3. If the problems can be fixed using **diskverify**, invoke **diskverify** with the `fix` option to correct the problem.

`n(amed)` Performs both the `N1` and `N2` options described below. If you omit an option to `verify` or `fix`, `named` is the default.

`n1` (or `named1`)

For named volumes only, checks the fnodes of the volume to ensure that they match the directories in terms of file type and file hierarchy. This option also checks the information in each fnode to ensure that it is consistent and displays a list of files in error, with information about each file. When used with `fix`, the `N1` option corrects bad checksums and attaches orphan fnodes to their parents.

See also: Fnodes, **format** command, in this chapter

`all` For named volumes, this option performs the `N1`, `N2`, and `physical` functions. For physical volumes, only the `physical` option is done.

`list` A control you may use with any option that activates `N1` verification (`named`, `N1`, or `all`). When you use this control, the same file information generated by `verify` or `fix` is displayed for every file on the volume, even if the file contains no errors.

`n2` (or `named2`)

For named volumes only, checks the allocation of fnodes on the volume, checks the allocation of space on the volume, and verifies that the fnodes point to the correct locations on the volume. When used with `fix`, the `N2` option saves on the volume the correct bit maps constructed during verification. It also removes fnodes with multiple references from illegal parent directories.

`physical`

Applies to both named and physical volumes. This option reads all blocks on the volume and checks for I/O errors. It displays block numbers where errors are found.

Additional Information

Diskverify is most useful after such occurrences as power irregularities or accidental reset. **Diskverify** can be used on only named and physical volumes; it cannot be used on remote, NFS, EDOS, or DOS volumes. In DOSRMX and iRMX for PCs, use this command only for an iRMX partition, not for a DOS drive or a partition containing the DOS file system.

Diskverify can be used in two ways:

- As a single command that verifies the structures of a volume and returns control to the Human Interface; this mode is covered here.
- In interactive mode, which you enter if you don't specify any parameters after *`outpath`*; interactive mode is covered later in this manual. Using diskverify in interactive mode requires a more thorough understanding of iRMX volume structures to avoid damaging the volumes.

See also: **diskverify** in interactive mode, Appendix B
iRMX volume structures, Appendix C

When you invoke the **diskverify** command, the utility responds by displaying this message, where `V`*`x.y`* is the version number of the utility:

```
iRMX Disk Verify Utility, Vx.y
Copyright <year> Intel Corporation
All Rights Reserved
```

In single-command mode, the results of your diskverify command follow immediately after the sign-on message. If you enter the interactive mode in error, the sign-on message is followed by a prompt (*). To exit **diskverify** at the * prompt, enter `quit`.

Unless you are the Super user, you may only invoke **diskverify** for devices attached by you or the World user. The **diskverify** utility reattaches the device as a physical device before verifying it. When the utility finishes, it reattaches the device as it was before you invoked the utility.

If you verify the system device (*:sd:*), the OS deletes all connections to the device; thus you must reboot the system before entering more commands.

See also:	Named and physical volumes, **format** command, in this chapter

Examples

1. This example uses the `verify` option:

```
-diskverify :f1: verify named2 <CR>
iRMX Disk Verify Utility,  Vx.y
Copyright <year> Intel Corporation
All Rights Reserved
DEVICE NAME = F1 : DEVICE SIZE = 0003E900 : BLOCK SIZE= 0080
'NAMED2'  VERIFICATION
   BIT MAPS O.K.
```

The `DEVICE SIZE` is a hexadecimal number of bytes. The `BLOCK SIZE` is the volume granularity in hexadecimal; this is the size of a block on this volume.

If there were errors found, they would be reported as shown below. This display also applies to the `n1` option and the `fix` parameter. If you use the `list` control, this type of information is reported for all files, without an error message for files not in error:

```
FILE=(<filename>, <fnodenum>):  LEVEL=<lev>:  PARENT=<parnt>:  TYPE=<typ>
       <error messages>
```

`<fnodenum>`	Hexadecimal number of the file's fnode.
`<lev>`	Hexadecimal level of the file in the file hierarchy. The volume's root directory is the only level 0 file. Files in the root directory are level 1 files. Files in level 1 directories are level 2 files, etc.
`<parnt>`	Hexadecimal fnode number of the directory that contains this file.
`<typ>`	File type, either `DATA` (data files), `DIR` (directory files), `SMAP` (volume free space map), `FMAP` (free fnodes map), `BMAP` (bad blocks map), or `VLAB` (volume label file). If **diskverify** cannot ascertain that the file is a directory or data file, it displays the characters `****` in this field.

2. This example uses the `fix` option to perform both `named` and `physical` verification of a named volume and correct the problems on the volume. Notice the prompt to save the bad block map from the `physical` verification.

```
-diskverify :f1: fix ALL <CR>
iRMX Disk Verify Utility, Vx.y
Copyright <year> Intel Corporation
All Rights Reserved
DEVICE NAME = F1 : DEVICE SIZE = 0003E900 : BLOCK SIZE= 0080
'NAMED1' VERIFICATION
'NAMED2' VERIFICATION
   BIT MAPS O.K.
'PHYSICAL' VERIFICATION
   NO ERRORS
   free fnode map saved
   free space map saved
save bad block map? <y>
   bad block map saved
```

3. This example uses the `disk` option. This is for a named device; many of these fields are not displayed for a physical device.

```
-diskverify :f2: disk <CR>
iRMX Disk Verify Utility, Vx.y
Copyright <year> Intel Corporation
All Rights Reserved
              Device name = WF0
  named disk, volume name = UTILS
       device granularity = 0080
               block size = 0080
         number of blocks = 0000072D
    number of free blocks = 00000408
              volume size = 0003E900
               interleave = 0005
           extension size = 03
         number of fnodes = 0038
    number of free fnodes = 0022
               root fnode = 0006
       save area reserved = no
MSA second stage included = no
```

4. This example uses the `getbadtrackinfo` option. This option may be useful on a Multibus I system when migrating from a 215G controller to a 214 or 221 controller.

   ```
   -diskverify :sd: to :f1:WORK/BT GB <CR>
   ```

   This information is written to the *:f1:work/bt* file:

   ```
   Bad track information
   cyl   head  sector
   0034  03    00
   0043  02    00
   0316  00    00
   ```

Error Messages

In addition to the errors listed below, the `verify` and `fix` options produce error messages.

See also: **diskverify** error messages, Appendix B

`argument error`
The option you specified is not valid.

`command syntax error`
You made a syntax error when entering the command.

`device size inconsistent size in volume label = <value1> : computed size = <value2>`
When **diskverify** computed the size of the volume based on the physical name used for attachment, the size it computed did not match the information recorded in the volume label. It is likely that the volume label contains invalid or corrupted information. This is not a fatal error, but it indicates that further errors may occur during verification. You may have to reformat the volume or use the **diskverify** utility to modify or restore the volume label.

`not a named disk`
You tried to perform a `named`, `named1`, or `named2` verification on a physical volume.

`Can't attach device`
Diskverify's **attachdevice** system call failed or you specified the logical name of a remote server.

domain

Sets the search domain of all subnets the iRMX-NET Name Server can access. Use this command when you have set up a network with any subnet IDs except 1, using routable iNA 960 jobs.

Syntax

```
domain [-a ID[-range]] [-d ID[-range]]
```

Parameters

`-a`	Adds a single ID or a range of IDs to the search list.
`-d`	Deletes a single ID or a range of IDs from the search list.

Additional Information

Without any parameters, **domain** displays the current search domain. With either parameter, **domain** displays the current search domain after the addition or deletion.

When adding or deleting IDs, specify either a single subnet ID or a range of IDs separated with a dash (-) and no spaces. The ID must be a four-digit hexadecimal number followed by an H. For example, to add subnet 4 to the current search domain, enter:

```
domain -a 0004H
```

To enable searching of all subnets from 1 to 1AH, enter:

```
domain -a 0001H-001AH
```

The maximum number of subnets to be searched is 80. You can specify subnet IDs not currently in use. However, adding more subnet IDs to the search domain slows down Name Server operations.

You can add the **domain** command to the *loadinfo* file following the **sysload** command that loads the iRMX-NET job.

See also: Multibus II Subnet and Multiple Subnets, *Network User's Guide and Reference*

dump

Displays one or more files in hexadecimal format.

Syntax

```
dump inpath_list [to|over|after outpath_list] [b|w] [q] [p=num]
```

Parameters

`inpath_list`

One or more filenames separated with commas. Wildcards are permitted.

`to|over|after` *`outpath_list`*

Writes the output to the specified file(s) rather than to the screen. If you specify multiple input files and one output file, the output is appended.

`b(yte)` Displays the input files as 2-digit hexadecimal numbers, with the ASCII printable characters on the right. This is the default format.

`w(ord)` Displays the input files as 4-digit hexadecimal numbers.

`q(uery)` Prompts for permission to process each file. Respond to the prompt with:

Y	Display the file
R	Display remaining files without further query
E	Exit the command
N or other	Don't display the file; query for the next

`p(agewidth)=`*`num`*

Specifies the width of the output display in number of characters. By default the number is decimal, but you can specify octal or hexadecimal by appending an O or H. If this parameter is not entered, the default width for byte displays is 80 characters, and for word displays is 55 characters.

Additional Information

All input files are considered one logical file. Therefore the offsets at the beginning of each line are not reset to 0 between each file. The default output is in columns of eight bytes for byte format and columns of four words for word format.

enetinfo

Displays the Ethernet addresses of the local system.

Syntax

```
enetinfo
```

Additional Information

The output of the **enetinfo** command is similar to:

```
Subsystem ID  Ethernet Hardware Address
    0x20      00:aa:00:02:fd:3a
    0x2f         a2:a4:a6:a8:aa:00
```

The Subsystem ID indicates the subsystem being used by iNA 960 network software. The Ethernet address is encoded on the network controller board. In a Multibus II system you may have as many as three active network controller boards by using MIX 560 boards. In this case the **enetinfo** command displays the subsystem ID and Ethernet address for each board. iNA 960 assigns subsystem IDs according to the Data Link subsystem on each board:

Subsystem ID	**Board**
20H	first MIX 560
21H	SBX 586 board, EWENET module, or EtherExpress 16
22H	second MIX 560
23H	third MIX 560
24H	82595TX component, EtherExpress PRO/10, SBC P5090 and P5120 PC-compatible boards, all versions
2FH	Multibus II subnet

When configuring TCP/IP, you assign a particular stream to one of the boards in the *inetinit.cf* file.

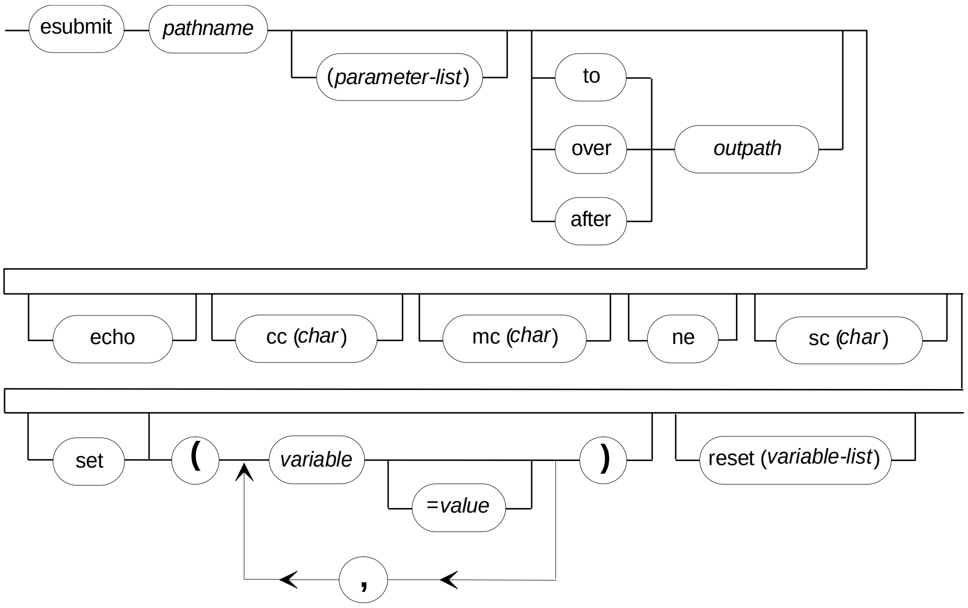
See also: */dev/edlina2x* and *inetinit.cf*, *TCP/IP and NFS for the iRMX Operating System*
Subsystem field in request blocks, *Network User's Guide and Reference*

esubmit

Reads and executes a set of commands from a file called an esubmit file. The **esubmit** command allows more replaceable parameters than **submit**, and the esubmit file may contain programming statements and user-defined variables.

Syntax

```
esubmit pathname [(param_list)] [to|over|after outpath] [e]
       [cc (char)] [mc (char)] [noexecute (ne,e)] [sc (char)]
       [set (variable [=value][, variable [=value]...] )]
       [reset (variable_list)]
```



W-3469

Parameters

pathname

Name of the file from which **esubmit** executes commands. This file may contain nested **esubmit** commands. Typically the filename has the extension *.csd*, which you do not include in the pathname. If no such file is found, the filename is assumed to be exactly as entered here.

`param_list`
: As many as 36 actual parameters, separated by commas, that are to replace formal parameters in the esubmit file. You must surround this parameter list with parentheses. To omit a parameter in the middle of the list, reserve its position by entering a comma. If a parameter contains a comma, space, or parenthesis, enclose the parameter in single or double quotes. The sum of all characters in the parameter list must not exceed 1024 characters.

`to|over|after` *`outpath`*
: Writes the output from each command in the esubmit file to the specified file rather than to the screen. Commands in the esubmit file may redirect their own output; that output is not written to this file.

`e(cho)` Data written to an output file is also echoed to the screen. Nested **esubmit** commands do not have their contents echoed to the screen unless they are also invoked with the `echo` parameter.

`cc` (or `contchar` or `continuationchar`)
: Specifies a character in parentheses to be used as a line continuation character in **esubmit** subcommands. By default, the continuation character is **&**.

`mc` (or `metachar`)
: Specifies a character in parentheses to be used by **esubmit** as a metacharacter. By default, the metacharacter is **$**. The metacharacter at the beginning of a line in the esubmit file indicates the line contains an **esubmit** subcommand, rather than an OS command.

`ne` (or `noexecute`)
: Displays the commands without actually sending them to the iRMX Human Interface.

`sc` (or `subchar` or `substitutionchar`)
: Specifies a character in parentheses to be used by **esubmit** as a substitution character. By default, the substitution character is **%**. The substitution character is used to indicate substitution of formal parameters and esubmit variables.

`set` *`variable`* `[=`*`value`*`]`
: Sets one or more user-defined variable names to the specified numeric value. If the value is not specified, the default is one. The variable list must be within parentheses and the variables must be separated with commas. The requirements for variable names and values are described in a later section.

`reset` *`variable_list`*
: Sets one or more user-defined variable names to zero. The variable list must be within parentheses and the variables must be separated with commas.

See also: Example 6 for this command

Additional Information

Note

Do not include the following commands in an esubmit file:

backup	restore
pause	telnet

If you use a form of the following commands that requires user input in an esubmit file, you must use the `eoresponse` and `coresponse` subcommands with **esubmit** to access the user repsonse. Without access to the required user input the commands will fail.

accounting	format
addloc	ftp
copy	help
copydir	locdata
date	permit
delete	remini
deletedir	rename
dir	time
diskverify	

The **esubmit** command has these characteristics in common with the **submit** command:

- Any program that reads its commands from the console input (*:ci:*) can be executed from within an esubmit file. With certain restrictions described at the end of this section, a submit file may be used with the **esubmit** command.
- The **esubmit** command can be nested in an esubmit file to any level, within the limits of memory.
- If **esubmit** is operating in the foreground, you may enter a <Ctrl-C> to abort **esubmit** processing and return control to the command line.
- You own and have full access to any new files created by the **esubmit** command, including files created by the `to`, `over`, or `after` parameters.

To use the **esubmit** command, you must first create a text file that defines the command sequence. **Esubmit** supports aliases similar to the way in which the iRMX CLI does for iRMX commands (note that this does not include alias support for **esubmit** commands). The **alias** and **dealias** commands, and alias expansion are supported. The difference between the alias support in **esubmit** and in the iRMX CLI is that **esubmit** treats the "?" (question mark) character as a single character wild card. The iRMX CLI treats the "?" character as a supported ASCII character for the alias abbreviation and the alias expansion.

Other CLI commands, such as **background**, cannot be used in the file. Before submitting commands in the file to the OS, **esubmit** processes these elements in the file:

- formal parameters
- esubmit variables
- esubmit subcommands

In most cases, an error within an esubmit subcommand causes **esubmit** to terminate. When all commands in the esubmit file have been executed, **esubmit** displays:

```
END esubmit <pathname>
```

Formal Parameters

Formal parameters in the esubmit file are specified by the characters %*n*, where % is the substitution character and *n* ranges from 0 through 9 and A through Z, in that order. Letters used as formal parameters are not case-sensitive. When **esubmit** executes the file, it replaces the formal parameters with the actual parameter list in the **esubmit** command. The first actual parameter replaces all instances of %0, the second parameter replaces all instances of %1, and so forth. If the actual parameter is surrounded by quotes (to avoid command-line interpretation of a comma, space, or parenthesis in the parameter), **esubmit** removes the quotes before performing the substitution. If there is no actual parameter that corresponds to a formal parameter, **esubmit** replaces the formal parameter with a null string.

Within each line of the esubmit file, substitution of formal parameters occurs before processing of esubmit subcommands. Therefore, the metacharacter, a subcommand, or an expression within a subcommand may be passed as an input parameter.

See also: Example 1 for this command

Variables

Variables are names defined by the user and set to a numeric or string value on the command line or in an esubmit file. Numerical and string variable names can be 1 to 32 characters and are not case-sensitive. String variables follow the same syntactic rules as numerical variables, except that all string variables start with an underscore (_) followed by either A through Z or a through z. The maximum length of the value of each string variable is 128 bytes.

There are five new read-only esubmit variables.

- `date` is a numeric variable that contains the value *yymmdd* in decimal where *yy* is the last two digits of the year, *mm* is the month, and *dd* is the day of the current date.
- `time` is a numeric variable that contains the value *hhmmss* in decimal where *hh* is the hour, *mm* is the minute, and *ss* is the second of the current time.
- `_date` is a string variable that contains the value *mm/dd/yy* where *yy* is the last two digits of the year, *mm* is the month, and *dd* is the day of the current date.
- `_time` is a string variable that contains the value *hh:mm:ss* where *hh* is the hour, *mm* is the minute, and *ss* is the second of the current time.
- `_hostid` is a string variable that contains the interconnect board id for the current board.

Two variable names are reserved:

- `Commandexcep` always contains the condition code of the last command executed. This read-only variable cannot be changed with the **set** or **reset** subcommands.
- `Inputparameters` is a read-only variable that contains the value of the number of input parameters (within parentheses) that were passed by the CLI to the command sequence definition file.

Variables can be set to any whole number value in the range 0-0FFFFFFFFH. When you set a value, the default base is decimal, but you may specify the base by appending one of these letters to the value: B for binary, O or Q for octal, D or T for decimal, H or X for hexadecimal, or E for enumerated. Enumerated numbers range from 0 through 9 and A through Z, with equivalent decimal values of 0 through 9 and 10 through 35. To distinguish between variable names and values, values must begin with a numeral 0 through 9.

See also: Example 2 for this command

String variable values are assigned using the **set** and **for** subcommands. **Set** supports concatenation using the plus (+) character. **For** supports sets inside braces ({ and }) delimited by commas. All values that are not other string variables must be enclosed within quotation marks. Both single and double quotation marks are supported, but they must match within a single assignment statement. An example of a **set** command with a string variable is:

```
$SET _stringvar = "my string's value"
```

This assigns the value enclosed by the double quotes, including the single quote, to the string variable `_stringvar`. An example of a **set** command with concatenation is:

```
$SET _stringvar = _stringvar + ' delimiter ' + _stringvar
```

An example of a **for** command with sets is:

```
$FOR _stringvar = {"one",'two',_stringvar+"three's",'four'}
```

String variables are maintained in an internal table separate from the one for numerical variables, and, therefore, do not count against the limit of numerical variables. The default maximum number of string variables is 32. This is configurable with the commands **allocatestring**, **clearstring**, and **initstring**, which are equivalent to the **allocate**, **clear**, and **init** subcommands for numeric variables, respectively. The maximum allowable number of string variables is 128. Each entry in the table takes 162 bytes (1 byte for the variable name length, 32 bytes for the variable name, 1 byte for the string value length, and 128 bytes for the string value).

Generally, a variable name within **esubmit** subcommands may be used to represent the value to which it is set. However, when writing information to a file or issuing an OS command, you need the actual value as an ASCII string rather than the variable name that represents the value. To accomplish this, format the variable name in the esubmit file as a variable substitution string. The **esubmit** command replaces the substitution string with an ASCII string corresponding to the current numeric value. This process is similar to replacing formal parameters.

The **esubmit** command substitutes the value string for variables preceded by the substitution character and metacharacter, and followed by the metacharacter. You may format the way the value string is displayed when substitution takes place by embedding optional control characters before the variable name. The syntax for variable substitution is shown below; the characters cannot be separated with spaces. The closing metacharacter may be replaced with an end-of-line or end-of-file.

```
    subchar metachar [base digits zerosupp] variable metachar
```

`Base`, *`digits`*, and *`zerosupp`* are format control characters that may occur in any order, but each may only be specified once for a given variable. Each control character is preceded with a backslash (\). Control characters are not case-sensitive. If no variable name is provided, the value 0 is substituted in the specified format.

`base`	By default, the value is substituted in decimal. You may specify the base with a two-character code: \B for binary, \O or \Q for octal, \D or \T for decimal, \H or \X for hexadecimal, or \E for enumerated.
`digits`	This is a two-character code specifying the number of digits to use: \0 through \9. If the specified number is smaller than the number of significant digits, this code is ignored (the string `%$\2var$` with

`var=1234` becomes `1234`). If the specified number is greater than the number of significant digits, the display is padded with leading zeros (the string `%$\4var$` with `var=3` becomes `0003`).

`zerosupp` If the value is 0, it is substituted in the number of digits indicated (one by default), unless you specify 0 suppression with a \S or \Z. Zero suppression takes precedence over the number of digits (the string `%$\Z\2var$` with `var=0` displays nothing). Zero suppression does not suppress leading 0s in a non-zero value.

Examples of the string substituted for the variable `myvar = 165` are shown below:

Variable String	**Substituted String**
%$myvar$	165
%$\Hmyvar$	A5
%$\z\5myvar$	00165

Part of a variable name may be formed by embedding a formal parameter or another variable substitution string. The form is `%$`*`variableX`*`$` where *`variable`* is at least one character and *`X`* is a formal parameter (%0 through %Z) or a second variable string. For example, assume the variable *`myvar2`* has the value 7, the first input parameter (%0) is 2, and the variable *`index2`* has the value 2. During substitution, the strings `%$myvar%0$`, `%$myvar%$index2$$`, and `%$myvar%$index%0$$` become instances of `%$myvar2$`. Each is replaced with 7.

When an **esubmit** command is nested in an esubmit file, the nested **esubmit** shares no variables with the parent **esubmit**. Each invocation of **esubmit** starts with a buffer large enough for 80 variables. Refer to the `allocate`, `clear`, and `init` subcommands for information about manipulating the buffer size.

Using Esubmit Subcommands

Esubmit subcommands are commands in the esubmit file to control processing. You indicate a subcommand with a metacharacter ($ by default) at the beginning of the line in the esubmit file. The metacharacter must be in the first column; if you indent subcommands, do not indent the metacharacter. Subcommands are not case-sensitive. A subcommand may be continued on subsequent lines with the continuation character (& by default). Any text following the continuation character on the same line is ignored. Subsequent continuation lines may optionally include a metacharacter in the first column.

Within a subcommand, the semicolon (;) is a comment character. Any text following a semicolon on a subcommand line is ignored. However, variable substitution and input parameter substitution occur in a comment.

Some subcommands define programming expression blocks that conditionally execute OS commands within the block. The subcommands to terminate a block (`endif`, `endwhile`, `enduntil`, `endcase`, `end`, and `next`) are matched with the most recent corresponding subcommand (`if`, `ifexist`, `ifnotexist, dowhile`, `dountil`, `case`, `do`, and `for`). Programming expression blocks may be nested up to 14 deep, in any order. Subcommands may contain mathematical or logical expressions as arguments. Elements in expressions are not case-sensitive.

Mathematical and Logical Expressions

Mathematical expressions are expressions evaluated to a whole number in the range 0-0FFFFFFFFH. Mathematical expressions have the form:

```
operand [operator operand]...
```

An operand may be a numeric constant (optionally followed by a character indicating the base), a variable, or another mathematical expression enclosed in parentheses.

Operators are the characters % (modulus), * (multiplication), / (division), + (addition), and - (subtraction). When the substitution character is %, a space or tab must follow the % modulus operator on a subcommand line. Otherwise, the substitution character takes precedence over the modulus operator. This is the order of precedence for operators:

()	
%	Evaluated left to right
* and /	Evaluated left to right
+ and -	Evaluated left to right

This is an example of a mathematical expression:

```
(36H / (17 + subtotal)) % 32
```

Logical expressions are expressions evaluated to TRUE or FALSE. TRUE is defined as the least significant bit on (all other bits are ignored) and FALSE is defined as the least significant bit off (all other bits are ignored). Logical expressions have the form:

[not] *variable* [*relation expression*] [*logical* [not] *variable* ...]

`Relation` is one of <, <=, =, <>, >=, or >. `Expression` is a mathematical expression enclosed in parentheses, a variable, or a numeric constant (optionally followed by a character indicating the base). `Logical` is one of the logical operators AND, OR, or XOR. This is the order of precedence for elements in a logical expression:

()	
NOT	
AND, OR, and XOR	Evaluated left to right. (The current order of evaluation does not follow commonly accepted practice, which is AND evaluated left to right, then OR and XOR evaluated left to right.)

This is an example of a logical expression:

```
myvar = 32T OR NOT myvar = 10H
```

Subcommand Descriptions

`allocate`
`clear`
`init`

The `allocate`, `clear`, and `init` subcommands adjust the size of the variable table buffer. This is a buffer that stores the variable names and values; when **esubmit** is invoked the buffer has room for 80 variables. `Init` and `clear` are equivalent, and reinitialize the buffer so no variables are currently stored in it. `Allocate` reinitializes the buffer without losing the current contents, unless you specify a new buffer size smaller than the existing number of variables. These subcommands can be used to dynamically tune the **esubmit** memory requirements and resource availability. It takes 37 bytes to store each variable in the table: 1 byte for the variable name length, 32 bytes for the name, and 4 bytes for the value. The form of the subcommand is

$*keyword* [*mathematical expression*]

where *keyword* is `allocate`, `clear`, or `init`, and *mathematical expression* is the number of variables to be supported by the new table. The maximum number of variables is 600H; if more than 600H are requested, the number is reduced to 600H. If you specify 0, or if no mathematical expression is provided, the default number is 80. If you use `allocate` to make the buffer smaller than the current number of variables, only the specified number of variables is preserved. The most recently declared variables are lost.

See also: Example 3 for this command

If an error is encountered trying to change the buffer using one of these subcommands, **esubmit** continues and the previous variable buffer is maintained.

`break`

The `break` subcommand executes an Interrupt 3 to break to the debug monitor. When this subcommand is executed, all processing in the system is halted. To allow pending I/O to complete before the INT 3, it is prudent to execute a `delay` subcommand immediately before the `break`. The subcommand has the form:

```
$BREAK
```

See also: Example 4 for this command

`case...`
`value...`
`default...`
`endcase`

These subcommands conditionally execute lines of text between them, where the text may be other subcommands and/or OS commands. `Case` begins the conditional block and `endcase` terminates it. `Value` and, optionally, `default` define blocks of text between the `case` and `endcase`.

Only one block of text is executed: the block following the first `value` expression equivalent to the value in the `case` subcommand. If no `value` expression is equivalent to the `case` expression, the block of text following the `default` subcommand is executed. (Including `value` subcommands after the `default` subcommand is pointless, since the `default` or a previous `value` expression will have already forced execution of a text block.)

The `case...endcase` block has the form:

```
$CASE mathematical expression
$VALUE mathematical expression
text
[$VALUE mathematical expression]
[text]
[$DEFAULT mathematical expression]
[text]
$ENDCASE
```

This is an example of a `case...endcase` block:

```
$CASE 5 - 200 % (myvar * 3)
$VALUE newvar - 1
text
$VALUE (newvar * 2) - 3
text
$DEFAULT
text
$ENDCASE
```

`clear`

See the `allocate`, `clear`, `init` description.

`coresponse`
`eoresponse`

These commands execute the **c_send_co_response** and **c_send_eo_response** Human Interface calls. They use a *`prompt_string`* as the message parameter, which is sent to :CO: (for `coresponse`) or to the operator's terminal (for `eoresponse`). Execution will be halted until input is received. An `eoresponse` input must come from the operator's terminal. A `coresponse` input will come from whatever is attached as :CO: (possibly another **esubmit** file that is executing this one). The syntax is:

```
$CORESPONSE variable [prompt_string]
```

```
$EORESPONSE variable [prompt_string]
```

where *`variable`* is a numeric or string variable and the optional parameter *`prompt_string`* is a string constant enclosed in quotes or a string variable expression.

Examples:

```
$CORESPONSE _input_string "Enter a string value: "

$CORESPONSE _opt “Enter dir opt: “
dir $ %$_opt$

$EORESPONSE input_var "Please enter a numeric value:
"

$EORESPONSE _opt “Enter dir opt: “
dir $ %$_opt$
```

`continuationchar`
`contchar`

These subcommands are equivalent. `Contchar` changes the continuation character from the point where this subcommand occurs. The continuation character (& by default) specifies that a subcommand continues on this line. For example, to make @ the continuation character, use the subcommand:

```
$CONTCHAR @
```

`copydependency`

The `copydependency` subcommand copies one file over another under certain conditions. It has this syntax:

```
$COPYDEPENDENCY target | dependency [access]
```

where *`target`* is a single filename, *`dependency`* is a single filename, and *`access`* is an optional parameter listing the World access rights to be granted to the target file if a copy is performed. (In the syntax above, you must enter the pipe symbol (|) as part of the command. It means that the dependency file follows, as in the **make** command. In this case, the pipe symbol does not mean enter either *`target`* or *`dependency`* as part of the command.) If the target file does not exist, or if the dependency file has been modified later than the target file, then the dependency file is copied over the target file. Choices for *`access`* include any permutation of "DRAU" access. If you do not specify *`access`*, the current user will have DRAU access, and all other non-Super users will have ---- access.

`createdirdependency`
`mkdirdependency`

These subcommands are equivalent. They create a directory unless the specified directory already exists. The syntax is:

```
$CREATEDIRDEPENDENCY target
```

```
$MKDIRDEPENDENCY target
```

where *`target`* is a single directory name. If the target directory does not exist it is created, with World DLAC access rights.

`delay`
`pause`
`sleep`
`wait`

These subcommands are equivalent. They delay execution of the **esubmit** file for a specified amount of time. The form of the subcommand is

```
$keyword delaytime
```

where *`keyword`* is one of `delay`, `pause`, `sleep`, or `wait`, and *`delaytime`* is a number, variable, or mathematical expression that indicates the amount of time to delay, in hundredths of seconds. This list shows the amount of delay time for various commands:

Subcommand	**Seconds Delayed**
$DELAY 100	1
$PAUSE 200	2
$SLEEP 5 * 100	5
$WAIT myvar	10, when myvar = 1000

`dependency...` `enddependency`	The `dependency` subcommand conditionally executes any commands until the `enddependency` subcommand, depending on certain conditions. It has this syntax: `$DEPENDENCY` *`target`* `\|` *`dependency_list`* <**esubmit** and iRMX commands> `$ENDDEPENDENCY` where *`target`* is a single filename and *`dependency_list`* is a list of filenames delimited by spaces or tabs. (In the syntax above, you must enter the pipe symbol (|) as part of the command. It means that the dependency file follows, as in the **make** command. In this case, the pipe symbol does not mean enter either *`target`* or *`dependency`* as part of the command.) If the target file does not exist, or if no dependency files are specified, or if any of the dependency files have been modified later than the target file, the commands inside the dependency/enddependency loop are executed. Otherwise, they will not be executed.
`do...end`	See the `for...next` description.

`dowhile...` `endwhile,` `dountil...` `enduntil`	These subcommands conditionally execute the intermediate block of text in a loop, based on logical expressions involving variables. `Dowhile...endwhile` executes the text as long as the conditional expression evaluates to TRUE. `Dountil...enduntil` executes the text as long as the conditional expression evaluates to FALSE. The subcommands have the form:
	
	`$DOWHILE` *`logical expression`*
	`text`
	`$ENDWHILE`
	`$DOUNTIL` *`logical expression`*
	`text`
	`$ENDUNTIL`
	
	These are examples of subcommands that cause infinite loops:
	
	`$DOWHILE 1`
	`text`
	`$ENDWHILE`
	
	`$DOUNTIL 0`
	`text`
	`$ENDUNTIL`

`eoresponse`	See the `coresponse`, `eoresponse` description.

`exit`
`quit`

The `exit` and `quit` subcommands end the current **esubmit** processing. If the current esubmit file was invoked with an `include` command from another esubmit file, then processing of that parent file is also ended. If the current esubmit file was invoked from an **esubmit** command in another esubmit file, then processing of that parent file resumes. The subcommands are equivalent and have the following syntax:

`$EXIT` *`exit_value`*

`$QUIT` *`exit_value`*

where *`exit_value`* is a mathematical expression whose value is passed to the Human Interface as the command exception when **esubmit** exits using the **rq_exit_io_job** system call.

`for...next`, `do...end`

These subcommands execute a block of text a specified number of iterations. `Do...end` is equivalent to `for...next`. The subcommands typically have the form:

```
$FOR variable = startvalue TO stopvalue [STEP
stepvalue]
text
$NEXT
```

```
$DO variable = startvalue TO stopvalue [BY
stepvalue]
text
$END
```

`Startvalue`, *`stopvalue`*, and *`stepvalue`* may be numeric constants, variables, or mathematical expressions enclosed in parentheses. *`Startvalue`* must be less than or equal to *`stopvalue`* to enter the loop. *`Stepvalue`* is always interpreted to be greater than or equal to 0. Text following the `next` subcommand on the same line is ignored. Therefore, `next` always ends the loop begun by the last `for` subcommand. In nested loops, specifying `$NEXT` *`variable_name`* does not necessarily end the loop begun with a `$FOR` *`variable_name`* `= ....` subcommand.

See also: Example 5 for this command

If the value of the loop variable is modified within the loop (using the `set` subcommand), the next iteration increments the modified value of the variable instead of the previous iterative value. The same variable should not be used as a loop counter within nested loops.

The `for` and `next` and the `do` and `end` subcommands must occur as pairs. You can not have a `for...end` or a `do...next` block. However, the `step` and `by` keywords are interchangeable.

An alternate form of these subcommands is to iteratively assign the variable to a set of values in a list. The loop executes once for each value in the list, independently of whether the variable is modified within the loop. This form of the command is:

```
$FOR variable = {list}
text
$NEXT
```

`List` is a series of numeric constants, variables, or mathematical expressions enclosed in parentheses. Surround the list with braces ({ }) and separate each item in the list with commas.

This example would execute five times, once for each value in the list:

```
$DO loopvar = & {10,(4*9),myvar,(myvar*2),%$myvar$}
text
$END
```

`gethostid`

Sets an environment variable to the value of the Multibus II slot ID of the host CPU board. If an error is encountered, such as not having the Nucleus Communication System configured, the environment variable is set to 0FFH. This is the syntax:

```
$GETHOSTID variable
```

`if/ifexist...`
`ifnexist...`
`ifnotexist...`
`else...`
`elseif...`
`elseifexist...`
`elseifnexist...`
`elseifnotexist...`
`endif`

These subcommands conditionally execute blocks of text, based on logical expressions. `If`, `ifexist`, `ifnexist` or `ifnotexist` begin the conditional block and `endif` terminates it. `Else`, `elseif`, `elseifexist`, `elseifnexist` and `elseifnotexist` may be used between the `if/ifexist` and the `endif`; only one block of text defined by the subcommands is executed. `Ifexist`, `elseifexist`, `ifnexist`, `ifnotexist`, `elseifnexist` and `elseifnotexist` are similar to `if` and `elseif`, except that the conditional expression is a pathname. The positive conditionals evaluate to TRUE if the file exists (even if it's an empty file) or FALSE if it doesn't exist. The negative conditionals evaluate to TRUE if the specified file does not exist, or FALSE if it does exist.

The subcommand block has the form:

```
$IF logical expression
text
[$ELSEIF logical expression]
[text]
[$ELSEIFEXIST filename]
[text]
[$ELSEIFNEXIST filename]
[text]
[$ELSEIF logical expression]
[text]
[$ELSE]
[text]
$ENDIF
```

The block shown above could begin with the statement `$IFEXIST` *`filename`*. This is an example of using these subcommands:

```
$RESET EOK
$IF r_32 AND NOT (COMMANDEXCEP = EOK)
text to handle error condition
$ELSEIFEXIST a.inc
$INCLUDE a.inc
$ELSE
text to handle default case
$ENDIF
```

`include`

This subcommand executes the contents of another file as if the text existed in the current esubmit file. The scope of variables and input parameters for the included file is the same as for the including esubmit file. The nesting limit for `include` is 6.

The subcommand has the form:

```
$INCLUDE filename
```

where *`filename`* is either the full pathname of the file or the pathname relative to the current working directory. `Include` does not append any extension to the specified filename. For example, to include the file *test.inc* in the *csd* subdirectory under your current working directory, the subcommand is:

```
$INCLUDE csd/test.inc.
```

`init`

See the `allocate`, `clear`, `init` description.

`log`

The `log` subcommand appends a log message to a file. The subcommand has the form:

```
$LOG filename [list]
```

where *`filename`* is any valid pathname and *`list`* is an optional list of arguments to be written to the file. Arguments in the list must be separated with spaces. Arguments can include text strings (quotes are not required) and variables in substitution format. If the Universal Development Interface (UDI) is part of the current iRMX system, the date and time are the first two arguments in the line written to the file. The arguments in *`list`* are appended to the line in order, separated in the log file by two spaces. Arguments longer than 12 characters are truncated; arguments shorter than 12 characters are padded in the log file with trailing spaces.

If the file exists, the line is appended to the end of the file. If the file does not exist, it is created. If an error is encountered while trying to attach or create the file, an error message is displayed and the `log` subcommand is aborted, but **esubmit** continues executing. Examples of the `log` subcommand are:

```
$LOG
$LOG file.log
$LOG file.log Command_%$\3myvar$ Error_=
     %$commandexcep$
```

If no parameters are provided in the `log` subcommand, as in the first line above, **esubmit** writes the date and time to *:co:*. For the `$LOG file.log` command, **esubmit** writes the date and time to the log file. For the third example above, **esubmit** writes the date, time, and "command_002=00" to the log file.

`metachar`

Use this subcommand to change the metacharacter from within the **esubmit** file. For example, if the metacharacter has not been changed on the command line, the subcommand to make # the metacharacter is:

```
$METACHAR #
```

`min`
`max`

The `min` and `max` subcommands assign to a variable the minimum or maximum value from a list of values. The subcommand has the form:

```
$keyword variable {list}
```

where *`keyword`* is either `min` or `max` and *`list`* is a series of operands separated by commas. The operands may be mathematical expressions enclosed in parentheses. For example:

```
$MIN minvalue {10,30,99,%$myvar$,42}
$MAX maxvalue {10,30,99,(myvar% 20),42}
```

`pause`

See the `delay` description.

`random`

The `random` subcommand returns a pseudo-random value. It has this syntax:

```
$RANDOM variable maximum_value
```

where *`variable`* is an **esubmit** numeric variable and *`maximum_value`* is a mathematical expression as defined in the "Mathematical and Logical Expressions" section under this command description. `Random` executes a call to **get_time** and returns the value (time MOD *`maximum_value`*). This is not a true random number function because the variation of the value returned by consecutive `random` functions is dependent on the time elapsed between the calls.

`set,`
`reset`

`Set` sets a variable to a specified value. If no value is specified, the default is one. `Reset` sets a variable to 0. These subcommands have the form:

```
$SET variable [= mathematical expression]
$RESET variable
```

Examples are:

```
$SET r_32
$SET iteration = iteration + 1
$SET execution_cnt = (iteration * loop ) / 10H
$RESET a
```

`sleep`

See the `delay` description.

`substitutionchar`
`subchar`

These subcommands are equivalent. `Subchar` changes the substitution character (% by default) from the point in the **esubmit** file where this subcommand occurs. For example, this is the subcommand to make @ the substitution character:

```
$SUBCHAR @
```

`wait`	See the `delay` description.

Compatibility with Submit Files

A file that works with the **submit** command may be used as an esubmit file, with these restrictions:

- A line that begins with $ is assumed to be an **esubmit** subcommand. If this occurs in the submit file, change the metacharacter on the command line to a character that does not occur at the beginning of the line.
- If the two characters %$ occur in sequence, where % is the substitution character and $ is the metacharacter, the text that follows until a closing metacharacter is assumed to be an **esubmit** variable. If this occurs in the submit file, change the substitution character and/or the metacharacter on the command line. If you change the substitution character, you must also change the character used in the submit file for substitution of formal parameters.
- If the two characters %X occur in sequence, where % is the substitution character and X is any character from A to Z, upper- or lower-case, the characters are assumed to be a formal parameter. If this occurs in the submit file, change the substitution character on the command line. You must also change the character used in the submit file for substitution of formal parameters.
- The file must use full command names rather than CLI-supported aliases. For example, use **attachdevice** instead of **ad**. CLI commands such as **alias**, **dealias**, and **background** may not be used in an esubmit file.

Examples

1. This is an **esubmit** invocation that calls the file *test.csd* and uses the `set` subcommand:

```
esubmit test (:sd:testdir/test1, :sd: testdir/test2) &
set (decision=1)
```

This code is the file *test.csd*; it uses the `if`, `else`, and `endif` subcommands:

```
$if decision = 1
      %0
$else
      %1
$endif
```

The esubmit invocation will be interpreted as:

```
$if decision = 1
      :sd:testdir/test1
$else
      :sd:testdir/test2
$endif
```

2. This examples use the `set` subcommand:

```
$set num = 255
$set bin_num = 11111111b
$set oct_num = 377Q
$set hex_num = 0FFh
```

3. These examples use the allocate, clear, and init subcommands:

```
$clear       ;clears variable buffer of all variables
$init        ;same as clear
$allocate 100;creates variable buffer capable &
                   of having 99 variables
$allocate %0       ;creates a variable buffer the &
                   size  of the first parameter-1
```

4. This command sets a delay of 2 seconds before the break:

```
$delay 200
$break
```

5. This example references all of your input parameters sequentially using the `for` and `next` subcommands:

```
$for loopvar = 0 to (inputparameters-1)
%%$\Eloopvar$
$next
```

`Loopvar` would take on the values 0,1,...,9,A,...Z depending on how many parameters you passed in. The substitution `%%$\Eloopvar$` would give you %0, %1,...%9,%A... which in turn would give you your parameters.

6. These are **esubmit** invocations of the file *test.csd*:

```
esubmit :sd:testdir/test (:amh:,1)

esubmit test (:amh:,1) over log/test.log echo

esubmit test (:amh:,1) cc(\) mc(@) sc(#)&
set (dos_lvl=330,file_driver=1)

esubmit test (:amh:,1) reset (dos_lvl,file_driver)
```

Error Messages

The error messages listed under the **submit** command may be returned, as well as:

`error creating variable buffer`
: An error was encountered creating the variable table buffer segment. If this error is caused by invoking **esubmit** while trying to create the original variable table buffer, it is fatal and causes **esubmit** to exit. If the error is returned because of an `allocate`, `clear`, or `init` subcommand, it is not fatal. The original variable buffer is maintained.

`illegal ASCII base`
: The code used to indicate a numeric base is not a valid value.

`illegal subcommand`
: The esubmit file contains a line with the metacharacter in the first column, but it is not followed by a supported subcommand.

`illegal invocation parameter`
: The **esubmit** invocation line contains an illegal parameter.

`illegal operand`
: The subcommand did not find a valid operand (%, *, /, +, or -).

`illegal relation`
: The subcommand did not find a valid relation (<, <=, =, <>, >=, or >)

`illegal variable name`
: The esubmit file contains a reference to an illegal variable name.

`insufficient input`
: The subcommand did not contain sufficient input to complete its function.

`misplaced logical`
: The subcommand found a logical keyword (NOT, AND, OR, or XOR) where one is not allowed.

`misplaced parenthesis`
: The subcommand found a parenthesis where one is not allowed.

`missing environment command`
: The esubmit file contains the metacharacter in the first column of a line, with either nothing or only a comment character following (regardless of spaces and tabs).

`missing logical`
: The subcommand did not find a valid logical keyword (NOT, AND, OR, or XOR) where one was expected.

`missing operand`
: The subcommand did not find a valid operand (%, *, /, +, or -) where one was expected.

`nesting limit exceeded`
: The `include` nesting limit of six has been exceeded.

`unmatched (`
: An unmatched open-parenthesis was encountered.

`unmatched )`
: An unmatched close-parenthesis was encountered.

`unmatched command`
: A subcommand was encountered that required a previous subcommand for it to be valid. This could be caused by:

- An `elseif`, `else`, `elseifexist`, or `endif` without a preceding `if` or `ifexist`
- A `value`, `default`, or `endcase` without a preceding `case`
- An `endwhile` or `enduntil` without a preceding `dowhile` or `dountil`, respectively
- A `next` or `end` without a preceding `for` or `do`, respectively.

`variable limit exceeded`
: More variables have been declared than can be supported in the current table. Refer to the `allocate`, `clear`, and `init` subcommands.

exit

Exits the system manager mode that was entered with a previous **super** command.

Syntax

```
exit
```

Additional Information

When you enter this command, the CLI changes your user ID back to the ID you had before entering the last **super** command. It also changes the system prompt back to the prompt in effect before the **super** command.

Error Messages

`exit, allowed only in super mode`
You invoked this command without previously invoking the **super** command.

`<parameter>, unexpected parameter`
You entered a parameter; the **exit** command does not take any parameters.

`<condition code:mnemonic>, during exit execution`
An internal system problem occurred which prevented the CLI from setting the default user.

find

Searches a directory tree for files with names that match a given pattern. For each matching filename, the full pathname is displayed.

Syntax

```
find pattern [directory [to|over|after outpath]]
```

Parameters

pattern
A pattern filename that may contain wildcards.

directory
The pathname of the directory to search for matching filenames. All subdirectories are also searched.

`to|over|after` *outpath*
Writes the output to the specified file rather than to the screen.

Additional Information

The **find** command recursively descends a directory hierarchy comparing the pattern with each data or directory file in the tree. If you do not specify a directory, **find** searches the current working directory. However, you must specify a search directory if you direct the output to a file using the `to`, `over`, or `after` parameter.

This command finds all files under the current directory that begin with *term*. It writes their pathnames to the *findlog* file in this directory:

```
find term* $ over findlog
```

This command displays the pathnames of all files on this volume that end in *doc*:

```
find *doc /
```

findname

Finds the spokesman system on the network that has cataloged a specified object name in its Name Server table.

Syntax

```
findname object_name [P=property] [R=retries] [L]
```

Parameters

object_name
: The name of the object to locate. This may be the name of a file server or virtual terminal server, or any other object in the Name Server object tables.

property
: The property type of the object to be located; assumed to be a hexadecimal value. You need not specify an H after the value unless it contains the letters A-F. Any letters in the hexadecimal value must be entered in upper-case (but the H need not be). If a property type is not specified, 5H is the default.

retries
: A decimal number of times the Name Server should try to find the spokesman using a different slot ID (necessary only for Multibus II spokesman systems). The maximum is 21. The default is 8.

`L` Additionally display the Ethernet address of the spokesman system.

Additional Information

Table 2-4 shows some of the property types defined by Intel. Types with values 8000H and higher are available for user definition.

Table 2-4. Property Types Used in Name Server Entries

Type Value	Kind of Entry
0000H	File server TSAP ID
0001H	File client TSAP ID
0002H	Name of client
0003H	File server transport address
0004H	Configuration objects
0005H	Host unique ID
0000H-7FFFH	Reserved by Intel
8000H-0FFFFH	Available for user applications

The **findname** command provides information about the system whose Name Server has cataloged the specified object. The **findname** command returns the name of the system where the given object is entered. If an object by the same name is cataloged on multiple systems, only the first system found is listed. You may specify an object by its name or by name and property type.

The **findname** command tries up to eight times to find the name of the system where the given object is entered. This is necessary because in Multibus II systems, the host can be located in any one of the slots, and the slot ID is used as part of the unique ID for the object. If the Multibus II system contains more than eight slots, specify the `retries` option to increase the number of trials. Repeated trials are indicated by this message, where *n* stands for the number of trials:

```
finding iRMX System name - Trial n
```

In Multibus I and PC systems, the **findname** command finds the name of the host in the first trial.

See also: Format of names and addresses, **setname** and **loadname** commands, in this chapter

Error Messages

`<object_name>, illegal name`

The name given in the command line is longer than 16 characters. Execute the **findname** command again with a valid object name.

`<object_name>, illegal property`

The property type of the object specified in the command line is longer than four characters. Execute the **findname** command again using a valid property type.

`<object_name>, illegal option`

The switch specified in the command line is not correct. Execute the command again giving the correct switch.

`Spokesman name for object not found`

The name of the host with the property type 0005H is not entered in the object table of the spokesman. The **findname** command could not find the name of the spokesman; it displays the Ethernet address of the spokesman system.

`<name>, name does not exist`

The given object does not exist in the network.

format

Formats an iRMX or DOS volume on an attached device, such as a diskette or hard disk. The **format** command cannot format a device across a network.

Note

You can use this command in an esubmit file or **rq_c_send_command** system call if the form of the command does not require user input. If the command requires user input in an **rq_c_send_command** system call, it will fail. However, you can use a form of the command that requires user input in an esubmit file if you use the `eoresponse` and `coresponse` subcommands.

See also: **esubmit** command, in this chapter

Syntax

```
format :logical_name:[volume_name] [named|DOS|physical
      [options]]

format :logical_name: getbadtracks [> pathname]

format :logical_name: bootstrap [msaboot|pcboot]
```

Use one of the three forms of the command shown above. The main optional parameters for formatting `named`, DOS, and `physical` devices are shown below. The options for `physical` and DOS are a subset of the options for `named`.

Options for Formatting Named Devices

Options for Formatting DOS Devices

Options for Formatting Physical Devices

Parameters

:*`logical_name`*:
: Logical name of the physical device-unit to be formatted. You must surround the name with colons.

`volume_name`
: An optional alphanumeric ASCII name, of up to 6 characters without embedded spaces, to be assigned to a named volume. You must not leave spaces between the logical name and the volume name.

`na`(`med`) The volume can store only named files; that is, it can hold many files that can be accessed by individual pathnames. Diskettes and hard disks are typically formatted for named files.

`DOS` The volume can store only DOS files.

`p`(`hysical`) (or `pi`)
: The volume can be used only as a single, physical file (the `files`, `extensionsize`, `granularity`, `mapstart`, and `reserve` parameters are not meaningful). If neither `named` nor `physical` is specified, the volume is formatted for the file type specified when the device was attached.

`quick`
: An option for `named` and `DOS` devices that bypasses the normal low-level format and simply writes the file system to the device.

`fi(les) =` *`num`*

A decimal number, 1-65528, defining the maximum number of user files that can be created on a named volume. (The maximum may be limited by different combinations of `granularity` and `extensionsize`.) The default number is 200. The `reserve` and `msaboot` parameters each require one of the files allocated.

`force` Forcibly deletes any existing connections to files on the volume before formatting the volume. If connections exist and you do not specify `force`, you cannot format the volume.

`e(xtensionsize)` (or `es`) `=` *`num`*

A decimal number, 3-255, specifying the number of bytes in the extension data portion of each file. If not specified, the default extension size is 3 bytes.

`g(ranularity)` (or `gu`) `=` *`num`*

A decimal number, 1-65535, specifying the volume granularity. This is the minimum number of bytes to be allocated for each increment of file size on a named volume. The value you specify is rounded up to the next multiple of the device granularity, and becomes the default file granularity for every file created on the volume. If not specified, the default granularity is the device granularity.

See also: Device tables, Appendix E

`m(apstart)` (or `ms`) `=` *`num`*

The block number on the volume where the fnodes file, bit map files, and root directory should start. The size of the block is set by the `granularity` parameter. If no number is given, the OS puts the fnodes file in the center of the volume. If the number is too low, the OS places the map files at the lowest available space on the volume.

`i(nterleave)` (or `il`) `=` *`num`*

A decimal number, 1-255, specifying the interleave factor for a named or physical volume. If not specified, the default value is 5. Track 0 is not affected by this value.

`bt` (or `btfile` or `badtrackfile`)

Names a file containing bad track/sector information to be written to the volume. Unless you specify `overwrite`, the information from the file is merged with any bad track/sector information existing on the disk, and is written to the disk before the volume is formatted.

`btonly` Identical to `badtrackfile`, except that the rest of the volume is not formatted after the bad track/sector information is written.

`s(etbadtracks)` (or `sbt`)

Invokes a user interface that allows you to enter bad track/sector information from the keyboard.

`o(verwrite)` (or `ow`)
: Bad track/sector information existing on the disk is overwritten by information you provide. This parameter is only meaningful when used with the `badtrackfile`, `btonly`, or `setbadtracks` options. If you do not specify `overwrite` with one of these options, the default is to merge the bad track/sector data you supply with the bad track/sector information already on the device.

`r(eserve)`
: Creates the special file *r?save* at the end of a volume after formatting. The volume label file and the fnode file are copied to *r?save*. This file may be used in conjunction with the **diskverify** utility to back up the fnodes file on the volume. The *r?save* file is not updated when files are altered; you update the file by using **diskverify** or by specifying `backup` in the **shutdown** command.

`q(uery)` Issues this prompt for permission to format the volume:

```
        <volume name>, format?
```

Enter `Y` or `R` to format the volume. Any other response is considered to be a `no`.

`world` Makes the World user the owner of the formatted disk's root fnode, regardless of what user issues the **format** command.

`msa(boot)`
: Writes the Multibus II System Architecture (MSA) second stage bootloader in a file named *r?secondstage* and initializes the Bootloader Location Table (BOLT) in the volume label to point to it. When this parameter is used with `bootstrap`, the *r?secondstage* file is written without formatting the rest of the volume.

`pcboot`
: Writes the second stage bootloader for PC platforms to track 0 of the volume. When this parameter is used with `bootstrap`, the second stage is written without formatting the rest of the volume.

`gbt` (or `getbadtracks`)
: Existing bad track/sector information is read from the disk and displayed. This option may be used only on a hard disk that is not the system device (*:sd:*). If this option is specified, all other options are ignored. However, you can redirect the output to a file (> *pathname*), and use the file when reformatting the disk.

`bs` (or `bootstrap`)
: Writes the second stage of the Bootstrap Loader onto track 0 without formatting the volume. When this parameter is specified, the only options that apply are `msaboot` or `pcboot`.

Additional Information

➠ **Note**
You cannot use this command with a device that you access through NFS or through iRMX-NET.

Hard disks, diskettes, and RAM disks must be formatted as named or DOS volumes before you use them to store and access files. For example, you must format all previously unused diskettes before storing files on them. Formatting a volume as `named` or `DOS` also includes a `physical` format, or low-level format.

If you do not specify `named`, `DOS`, or `physical`, the volume is formatted as appropriate for the file driver attached to the connection specified when the device was attached. For example:

```
format :c_rmx3:  /*formats a named disk*/
format :c_dos:   /*formats a DOS disk*/
```

Although you could use the **format** command to format a tape, the proper header information is not created on the tape for use with the **backup** and **restore** commands. Instead, use the `format` option of the **backup** command.

Before formatting a volume, you must attach it with the **attachdevice** command. When formatting a diskette, you must attach it by its physical name. The physical name you specify determines the device characteristics used when you invoke **format**.

See also: **attachdevice**, in this manual

Low-Level Format for Partitioning

A `named` or `DOS` format of a complete (non-partitioned) volume includes a low-level format, unless you also specify the `quick` option. On a hard disk where you want to create partitions, you must first do a low-level format, then partition the volume, and finally format each partition. To do the low-level format, specify `named` or `DOS`, without the `quick` option. (Do not specify a `physical` low-level format as preparation for partitioning.) Then partition the disk with the **rdisk** command.

After partitioning, format each partition as a `named` or `DOS` volume. The format command performs only a high-level (file system) format when you format a partition. You can specify the `quick` option, but it is not necessary to prevent a low-level format after partitioning.

Volume Name

Specifying a volume name makes a convenient volume reference (for example, it identifies a diskette with a lost or destroyed label). The volume name is displayed when you list any directory of the volume. Once the volume is formatted, you don't need to specify the volume name in commands; you only specify the logical name for the device.

DOS Format Option

This option forces a DOS file system to be installed on the device. It overrides the file driver that is attached to the logical device. A DOS file system can also be installed by attaching to the device using the DOS file driver.

These examples illustrate the DOS format option:

```
attachdevice d_dos as d_dos DOS
format :d_dos:
```

or

```
format :d_dos: DOS
```

This is the output message for DOS volumes:

```
volume (<volume name>) will be formatted as a DOS volume
      device gran     = 512   interleave         =  5
      root dir size   = 512   volume size        =  30,719 K
      volume gran     = 2,048 available bytes    =  30,656 K
      fat type        = 16    number of clusters =  15,328
      number of fats  = 2     sectors/cluster    =  4
      sectors/fat     = 60
```

Where:

`device gran`	The low-level sector granularity of the device.
`interleave`	The sector interleave factor.
`root dir size`	The number of file slots available in the root directory.
`volume size`	The total volume size.
`volume gran`	The allocation granularity (size of a cluster).
`available bytes`	The free space on the device (total space - file system overhead).
`fat type`	Either a 12-bit or 16-bit FAT (file allocation table).
`number of clusters`	Total number of allocation units in the file system.
`number of fats`	Is always 2.
`sectors/cluster`	The number of disk sectors per each allocation cluster.

`sectors/fat`	The size of each fat, in sectors.

Quick Format Option (Named and DOS Only)

This option causes the **format** command to bypass the low-level format and simply write the file system to the device. It is useful for formatting devices that have been previously formatted, either by the manufacturer, or by a previous use of either the DOS or iRMX **format** command. A file system can be quickly changed from one supported file system to another by using this option. All data on the device is lost, just as in a full format. The `quick` option is ignored if you specify a `physical` format.

This is an example quick format command:

```
format :a_dos: QUICK
```

When performing a quick format, **format** displays this message:

```
volume (xyz) will be quick-formatted as a [DOS|NAMED] volume
```

Files and Fnodes (Named Only)

The number of fnodes on a volume defines the number of files that can exist on the volume. Each fnode is a data structure that contains information about a file. Each time you create a file on the volume, the OS records information about the file in an unused fnode. Later, it uses the fnode to determine the location of the file on the volume. You can enter the `mapstart` option to locate fnodes anywhere on a volume. If this option is not entered, the OS puts the fnodes in the center of the volume.

The number of fnodes created during formatting is the number you specify with the `files` parameter, plus 7. Six of the additional fnodes are for internal system files and one is for the root directory. If you specify the `reserve` or `msaboot` parameters, one fnode is used for each parameter. For example, if you use the default `files` value of 200, 207 fnodes are established and you may create 200 files on the volume. If you specify `reserve` and `msaboot`, you may create 198 files.

Two of the internal system files created during formatting are not listed in a directory. The other four files (five if you specify `reserve`) are listed in the root directory as hidden files. The OS grants World read access to these files.

The files are listed below; the volume label file is a special file occupying the first 3328 bytes of the volume:

File	Description
r?spacemap	Volume free space map
r?fnodemap	Free fnodes map
r?badblockmap	Bad blocks map
r?volumelabel	Volume label
r?save	Save area for fnodes and volume label (created by the reserve parameter)

See also: Disk Verification, Appendix B

Owner of the Root Directory (Named Only)

The fnode for the root directory lists the user who formats the volume as the owner, giving that user all access rights. No other user has access to the root directory until the owner explicitly grants access. The owner can grant other users access to the volume with the **permit** command. However, because the owner has all access rights to the root directory, the owner can obtain exclusive access to the volume, and can obtain delete access to any file created on the volume, even files created by other users.

Extension Data (Named Only)

Each fnode contains a field that stores extension data for its associated file. An OS extension can access and modify this extension data by invoking the **a_get_extension_data** and **a_set_extension_data** system calls. You can use the `extensionsize` parameter to set the size of the extension data field in each fnode. Although you may specify any size from 0 to 255 bytes, the HI requires all fnodes to have at least 3 bytes of extension data.

See also: **a_get_extension_data** and **a_set_extension_data** system calls, *System Call Reference*

Volume Granularity (Named Only)

The volume granularity is the minimum block assigned for files created on the volume. For example, if the volume granularity is 128 bytes, the I/O System automatically allocates permanent storage to each new file created on the volume in multiples of 128 bytes, regardless of whether the file requires the full amount. The default volume granularity is always the granularity of the physical device. When you specify the granularity, the value is rounded to the next multiple of device granularity. That number is written in the header of the volume, where it becomes the default file granularity when a file is created on the volume.

Using a volume granularity larger than 1024 might cause users to exceed their memory limits when executing programs that reside on the volume. This error can occur because the OS uses the volume granularity as a minimum buffer size when reading and writing files.

Relationship Between Files, Extension Size, and Granularity (Named Only)

Although the `files`, `extensionsize`, and `granularity` parameters have the maximum values listed in the parameter descriptions, the combination of these parameters must also satisfy this formula:

```
(87 + extensionsize) * (files + 7) / granularity < 65535
```

The **format** command displays an error message if the combination of values you specify for these parameters exceeds this limit.

Map Files (Named Only)

If you have specified a map-files location (either implied or explicit) in an area which has a bad track or for which an alternate track was assigned, **format** allocates these files to the nearest available area, and then asks for permission to move the files in one of these ways:

```
Map files located on a track assigned an alternate
```

```
Map files located on a bad track
```

A response of `Y` causes the files to be relocated and this message to be displayed:

```
map start relocated to <hex-location>
```

This means you do not have to compute the location of the maps.

Interleave Factor (Named and DOS Only)

The interleave factor applies to volumes formatted either for named or physical files. The interleave factor specifies the logical sector sequence. If the consecutively-accessed sectors of a disk are staggered (not physically consecutive), disk access time can decrease considerably. The reason for this decrease is that although a controller cannot read a sector and issue another **read** command in the time it takes for the next sector to be positioned under the head, the controller can perform this operation in less time than it takes for the disk to revolve once. Therefore, if consecutively-accessed sectors are correctly interleaved, the next sector accessed will be positioned under the read head just as the controller becomes ready to read it. An interleave factor of two means that as the disk rotates, the controller consecutively accesses every second sector. An interleave factor of five means that the controller consecutively accesses every fifth sector.

The interleave factor also implies the number of disk rotations necessary to access all the sectors on a given track in order. For example, with an interleave factor of two the controller might access sectors 0, 2, and 4 on the first rotation and sectors 1, 3, and 5 on the second.

How to Select an Interleave Factor (Named and DOS Only)

The interleave factor is important when large transfers of consecutive data take place at speeds that approach the maximum transfer rate of the disk. For hard disks, the revolution speed is high enough that the type of application does not affect the choice of interleave factor. Format hard disks with an interleave factor optimized for the turn-around speed of the disk controller. Recommended values for hard disks are shown below.

System	Controller	Interleave	Controller	Interleave
DOSRMX	SCSI	1	non-SCSI	2
Multibus II	any	1		
Multibus I	SBC 221	1	SBC 215G, 5 1/4"	5

For diskettes with a slower revolution speed, the default value 5 is typically used. The ideal interleave factor depends on the turn-around time of software that controls I/O operations. The turn-around time is the time between reading a sector and becoming ready to read the next sector.

In the cases listed below, the turn-around time between sector accesses is different, indicating a different interleave factor:

- When you bootstrap load the OS, the Bootstrap Loader instructs the disk controller to read one sector at a time. The turn-around time depends on the execution overhead of the Bootstrap Loader and is comparatively long. A large interleave factor is optimum for diskettes used with the Bootstrap Loader.
- When you load an application program, the Application Loader reads several sectors at a time into its internal buffer, taking a relatively long time to process the data. The ideal interleave factor for diskettes is somewhat smaller than for the Bootstrap Loader.
- When you invoke programs that transfer large amounts of consecutive data (such as the **copy** command), data transfers can involve many sequential sectors. The controller accesses sectors on a given track as fast as possible. Optimize the interleave factor for the turn-around speed of the disk controller.

If you do not know the optimum interleave factor, it is better to specify too large a value rather than too small. An interleave factor slightly larger than optimum causes the disk to move only an extra sector or two before reaching the correct sector.

However, an interleave factor smaller than optimum causes the disk to make nearly a complete revolution before reaching the sector.

Getting Bad Track Information (Named Only)

When you use the `getbadtracks` parameter, the bad track information is displayed (or written to a file) in this form:

```
cyl    head   sector
xxx    xxx    xxx
```

If you use I/O redirection (> *pathname*) to write this information to a file, you may edit the file to remove the header information and add your own data. Then re-invoke **format** and specify this file with the `badtrackfile` or `btonly` parameter.

Writing Bad Track Information (Named Only)

The `badtrackfile`, `btonly`, and `setbadtracks` parameters allow you to enter the manufacturer's bad track information before actually formatting the disk. With the `badtrackfile` and `btonly` parameters, bad track information in the file must be in this format, which constitutes a triplet:

```
cylinder_number  head_number  sector_number <CR><LF>
```

Where:

`cylinder_number`
: The cylinder number of the bad track or sector

`head_number`
: Head number of the bad track or sector

`sector_number`
: The number of the bad sector on the track indicated by the cylinder and head numbers. On devices that only support bad track information, this value must be set to 0.

The triplets may be separated by spaces, commas, carriage returns, or line feeds. Each triplet is terminated with a carriage return-line feed combination.

If you use the `setbadtracks` parameter to enter bad track information, this message is displayed:

```
Enter bad track information in <cylinder_number>, <head_number>,
<sector_number> triplets, one triplet per line.  Numbers can
be in decimal or hexadecimal form.  Entry of <sector_number>
is optional.  An empty line terminates the entry process.

   <cylinder>, <head>, <sector> =
```

The last line is the prompt line for the utility. Enter the cylinder, head, and sector number in that order on one line and then enter a <CR>. The prompt is again displayed; enter either more bad track information or <CR>. A <CR> with no entries indicates that all the bad track information has been entered. The system then displays the entries you made, in this form:

```
n bad track triplets entered.

Entered bad track information:

    entry  cyl    head   sector
      1    nnnn   nnnn   nnnn
      2    nnnn   nnnn   nnnn            and so on
```

If you want to change or add to your previous input, type the entry, cylinder, and head numbers (sector number is optional) of the new or existing information and press <CR>. Repeat this process until all changes have been made. When you finish entering information, press <CR> on a line by itself. A summary of the bad track information is again displayed. If the bad track information is correct, press <CR> again to begin formatting the disk.

Bad track information you enter (in a file or interactively) is not checked for validity. Only the first 255 triplets are used when writing bad track information to a non-ESDI drive configuration.

When writing to an ESDI drive on an SBC 221 controller board, the first 202 bad track entries per head are used. If you have greater than 2048 defect entries, you must invoke the **format** command with the `btonly` parameter and either the `badtrackfile` or `setbadtracks` parameter. Do this multiple times in 2048 defect blocks, until all the bad track information is written to the disk. When writing multiple defect blocks, use the `overwrite` parameter the first time you invoke the **format** command. This overwrites any old bad track information. Omit this parameter in subsequent executions of the **format** command.

Bootstrap Loader and the Format Command (Named Only)

The Bootstrap Loader operates in three stages on a Multibus I system, in two stages on a Multibus II system, and in three stages on a PC system. On all three buses, the first stage of the Bootstrap Loader resides in the system firmware and a real mode second stage resides in a reserved area on Track 0 of the disk. On a Multibus II system, an additional MSA second stage resides as a named file somewhere on the hard disk. This MSA second stage is pointed to by an entry in the Bootloader Location Table (BOLT) located in a reserved area on Track 0 of the disk. The third stages on Multibus I and PC systems are named files located on the disk.

To avoid forcing you to reformat entire disks when the second stage of the Bootstrap Loader changes, you can specify the `bootstrap` parameter to write the second stage of the Bootstrap Loader onto track 0 without reformatting the rest of the volume.

⚠ **CAUTION**
If you fail to specify the `bootstrap` parameter, **format** will format the entire volume.

You can also add the MSA second stage to an existing iRMX disk by using the `msaboot` parameter with the `bootstrap` parameter. In this case, both second stages, (real mode and MSA) are added to the disk. The real mode second stage overwrites the existing one on track 0, and the MSA second stage replaces any existing MSA second stage, in the */r?secondstage* file.

You can replace the second stage for PC platforms on an existing iRMX disk by using the `pcboot` parameter with the `bootstrap` parameter.

Any of these commands copy the second stage of the Bootstrap Loader onto track 0 of a device that was attached using *:f:* as the logical name:

```
-format :f: BS <CR>
-format :f: bootstrap <CR>
-format :f: files= 300 granularity=200 force bootstrap <CR>
-format :f: BS MSA
```

The remainder of the files on the volume are unaffected. (In the third example, the `file`, `granularity`, and `force` switches are ignored because the `bootstrap` parameter has precedence over any other format parameter.)

Output Display

The **format** command displays one of these messages while formatting. This is the message for physical volumes:

```
volume (<volume name>) will be formatted as a physical volume
      device gran  = <number>
      interleave   = <number>
      volume size  = <k/m_number>

TTTTTTTTTTTTTTTTTTT...

volume formatted
```

This is the message for named volumes:

```
volume (<volume name>) will be formatted as a named volume
      granularity  = <number>   map start = <block_number>
      interleave   = <number>   sides     = <sides>
      files        = <number>   density   = <density>
      extensionsize  = <number>  disk size = <d-size>
      save area reserved = <yes/no>
      bad track/sector information written = <yes/no>
      MSA bootstrap information written    = <yes/no>
      PC Bus bootstrap loader chosen   = <yes/no>
      volume size  = <k/m_number> K (or M)

TTTTTTTTTTTTTTTTTTT...

      volume formatted
```

See also: DOS format option for the DOS output message

Where:

`<volume name>`
Volume name specified in the **format** command

`<number>` Decimal number specified in the command (or the default)

`<block_number>`
Volume block number where the fnodes file, bit map files, and the root directory start

`<k/m_number>`
Volume size in kilobytes (K) or megabytes (M) (the display is in K-bytes unless the size is greater than 25 MB)

`<sides>` For diskettes: `1` or `2` indicates the side being formatted (if **format** can recognize this characteristic)

`<density>` For diskettes: `single` or `double` indicates the diskette density (if **format** can recognize this characteristic)

`<d-size>` For diskettes: `3.5` or `5.25` indicates the size (if **format** can recognize this characteristic)

`T` One T is displayed for every 100 tracks formatted. These are not displayed when formatting a SCSI device; SCSI controllers do not allow individual tracks to be formatted.

If you format a SCSI hard disk using the PCI driver, the volume size information is automatically obtained by querying the SCSI device. If the capacity of the device changes as a result of the format, one of these messages is displayed. The first message is for a physical format; the second for a named format:

```
    formatted capacity = <size>
```

    formatted capacity = <size>   mapstart = <block_number>

If you specify the `bootstrap` or `btonly` parameter, one of these messages is displayed (instead of `volume formatted`):

```
    Bootstrap Loader written

    Bad Track/Sector Block written
```

If the error code `E_IO_ALT_ASSIGNED` is returned by a driver when formatting a track, the track number is entered into a table and displayed when formatting is complete. There should be an entry in this table for every BTI track specified, except those that reside in the alternate track area. The cylinder and head numbers are in hexadecimal.

```
The following tracks were assigned an alternate:
cyl hd  cyl    hd     cyl    hd     cyl    hd     cyl    hd
#   #   #      #      #      #      #      #      #      #
```

If the `E_IO_NO_SPARES` error code is returned by a driver when formatting a track, the number of reserved alternate tracks is exhausted. The sectors of that track are marked in the Bad Block Map File and entered in the Volume Space Map File as they were assigned. The track is entered into a table and displayed as follows when formatting is complete:

```
The following tracks were marked as bad:
cyl hd  cyl    hd     cyl    hd     cyl    hd     cyl    hd
#   #   #      #      #      #      #      #      #      #
```

Formatting Uniform Versus Standard Granularity Diskettes

Previously, iRMX OSs supported iNDX-based development. This required a special diskette format to allow the various systems to read the same diskettes. Standard granularity diskettes were attached using the `wmf0` DUIB and formatted as follows:

```
    format :f:disk extensionsize = 41 mapstart = 0
```

These switches provide an iNDX compatible, standard granularity format, which can be read by SCSI controllers.

You should use uniform granularity format diskettes with newer Intel products such as the System 520, and with newer boards. The SCSI interface in the newer Intel boards reads uniform granularity diskettes using the `wdf0` and `wqf0` DUIBs. With these DUIBs, track 0 of a standard granularity diskette is unreadable.

Although the PCI device driver can read standard format diskettes if they were formatted with the iNDX-compatibility switches, these are not the default values for the **format** command. If it is necessary to transfer files to the System 520 from a system which does not have a high density drive, use the `wdf0` DUIB to ensure creating a uniform format diskette, readable on all iRMX systems.

Error Messages

`<logical_name>, can't attach device`

`<logical_name>, <condition code:mnemonic>`
: **Format** cannot attach the device for formatting, or it cannot reattach the device (that is, restore it to its original condition) after formatting takes place.

`<logical_name>, can't detach device`

`<logical_name>, <condition code:mnemonic>`
: **Format** cannot detach the device for formatting, which means that the volume does not exist, the volume is busy, or the device on which the volume is mounted is not currently attached to the system.

`<logical_name>, device is in use`
: You cannot format the volume because there are outstanding connections to files on the volume and you did not specify the `force` parameter.

`<vol_name>, fnode file size exceeds 65535 volume blocks`
: The combination of values specified for `files`, `granularity`, and `extensionsize` is too great. See the formula described earlier.

`<number>, invalid number`
: You specified an out-of-range number for any of the `files`, `granularity`, `extensionsize`, or `interleave` parameters.

`<logical_name>, map files do not fit`
: The volume is too small for the map files or the map start block is too high to allow room for the map files.

`map files do not fit with save area`
: Either the volume is too small for both the map files and the save area, or the map start block is too high in disk storage memory to allow for the map files and the save area.

`<logical_name>, outstanding connections to device have been deleted`
: There were outstanding connections to files on the volume. However, because you specified the `force` parameter, **format** deleted those connections. This is a warning message that does not prevent formatting the volume.

`0023 : E_SUPPORT PCBOOT not supported for standard diskettes`
An attempt was made to write the second stage of the bootstrap loader to a standard format diskette.

`0085 : E_LIST, too many values`
You entered multiple logical_name/volume_name combinations separated by commas; **format** can format only one volume per invocation.

`<logical_name>: <condition code:mnemonic>`

`unit status <unit status code> while writing block number`
An I/O error occurred while writing the label, map files, or save area to a named file.

`<logical_name>: <condition code:mnemonic>`

`unit status <unit status code> while formatting track`
An I/O error occurred while physically formatting the volume. If an E_IO_ALT_ASSIGNED error code is returned, you can consider this message a warning.

`<volume_name>, volume name is too long`
The volume name must not be longer than six characters.

`Track zero bad, cannot write`
The volume label track (track 0) is marked in the Bad Block Map.

`cannot relocate`
This is a warning message displayed when the map files are located on one or more sectors which have been assigned an alternate, and a suitable location cannot be found on the disk.

`cannot relocate...aborting`
The map files are located on a sector or sectors which have been marked in the Bad Block Map and an alternate location cannot be found.

`Save file located on a bad track, cannot write`
The save area is located on a sector or sectors which have been marked in the Bad Block Map.

`<filename>, cannot open bad track/sector information file`

`<filename>, <condition code:mnemonic>`
The file containing the bad track/sector information cannot be opened for reading.

`too many bad track/sector information entries`
The file containing the bad track/sector information has too many entries, or the combination of file entries and information on the volume cannot be merged.

`<filename>, illegal bad track/sector information`
The file containing the bad track/sector information has the wrong format.

```
badtrackfile option missing, cannot replace Bad Track/Sector

Information Block
```

You entered the `overwrite` option without the `badtrackfile` parameter.

ftp

The user interface to the File Transfer Protocol (FTP), which allows you to transfer files to and from a remote network site.

Note

You can use this command in an esubmit file if the form of the command does not require user input. If the command requires user input, you must use the esubmit `eoresponse` and `coresponse` subcommands to get the user input. In either case, errors from FTP will not percolate to the esubmit variable `commandexcep`.

Do not use this command in an **rq_c_send_command** system call.

See also: **esubmit** command, in this chapter

Syntax

```
ftp [-d] [-g] [-i] [-n] [-t] [-v] [host [port]]
```

Parameters

`-d`	Enables debugging (see **debug**).
`-g`	Disables filename globbing (see **glob**).
`-i`	Turns off interactive prompting during multiple file transfers (see **prompt**).
`-n`	Disables autologin upon initial connection.
`-t`	Enables packet tracing (see **trace**).
`-v`	Enables verbose mode (see **verbose**).
`host`	A host name or Internet address.
`port`	A port number or a port name defined in the */etc/services* file.

Most options correspond to an **ftp** command and are discussed in more detail in the description of the referenced command.

Additional Information

The **ftp** client includes a command interpreter which interactively executes file transfer commands. The command interpreter prompt is `ftp>`.

If no `host` is specified on the command line, **ftp** enters its command interpreter and awaits further instructions from the user. If a `host` is specified, **ftp** immediately attempts to establish a connection to an FTP server on that host. If the `host` is followed by a `port`, **ftp** attempts to contact an FTP server at that port; otherwise it uses the default FTP port number.

If autologin is enabled (the default), **ftp** checks the *netrc* file in the user's home directory for an entry describing a login on the remote host. If such an entry exists, **ftp** automatically logs in to that account. If no entry is found, **ftp** uses the local user name as the login on the remote host and prompts for a password (and account, if appropriate) to complete the login. If autologin is disabled, **ftp** establishes the initial connection to the remote host and returns to the command interpreter. The **user** command must then be invoked to log in to that host.

Filenames specified as arguments to **ftp** commands are processed according to these rules.

1. If the filename is `-`, *stdin* is used for reading and *stdout* is used for writing.
2. If the first character of the filename is a pipe symbol (|), the remainder of the argument is interpreted as a shell command. **Ftp** will fork a shell with the supplied argument, and pipe the output of the **ftp** command to the shell. If the shell command includes spaces, the entire argument must be enclosed in quotation marks (for example, `"|ls -lt"`). There can be no space between the pipe symbol and the shell command.
3. If globbing is enabled, local filenames are expanded according to shell metacharacters (see the **glob** command).
4. The transformations defined by **case**, **ntrans**, and **nmap** are applied whenever a destination filename is derived from a source filename. When you use **mget** or **get** with an unspecified local filename, **case**, **ntrans**, and **nmap** are applied. When you use **mput** or **put** with an unspecified remote filename, **ntrans** and **nmap** are applied. These transformations are of particular interest when connecting to a remote host with different file naming conventions or practices.
5. If **runique** or **sunique** is on, a unique local or remote destination filename is created by appending a unique numeric extension to the filename.

An FTP command works only if the remote FTP server supports it. Use **rhelp** to see which requests the remote server recognizes. Commands may be abbreviated, so long as they remain unique. **Ftp** will prompt for required arguments omitted from a command. Command arguments that have embedded spaces should be enclosed in double quotation marks.

⚠ **CAUTION**

Use the **mget** and **mdelete** commands with caution. You may overwrite or remove files you did not intend to.

Specifying a directory where a plain filename is expected could produce unexpected results. For example, the **ftp** command `ls -l` *`file`* will put a long directory listing of the current working directory into *`file`* instead of returning a long listing of that file.

Commands

These commands are recognized by the **ftp** command interpreter.

account *passed*
: Specify the supplemental password or account name required by some systems for access to system resources. This command has no meaning on the iRMX and Unix OSs; they do not implement account information.

allbinary Toggle the use of binary type for non-file transfer operations. Normally, these operations are done in ASCII mode regardless of the file transfer type. If **allbinary** is on and the file transfer type is binary, non-file transfer operations will also be done in binary mode.

append *local-file* [*remote-file*]
: Append *local-file* to a file on the remote host. If *remote-file* is not specified, the remote file will be named *local-file*. **Ftp** uses the current settings for file type, format, transmission mode, and structure.

ascii Set the data representation type to ASCII. This is the default type.

bell Toggle sounding of a bell after each file transfer command is completed. By default, the bell is turned off.

binary Set the data representation type to binary.

bye Terminate the FTP session with the remote server and exit the **ftp** program.

case Toggle case-mapping of remote filenames during a **get** or **mget** command. When case-mapping is enabled, uppercase letters in the remote filename are changed to lowercase letters in the local filename. By default, case-mapping is turned off.

cd *remote-directory*
: Change the working directory on the remote host to *remote-directory*.

cdup Change the working directory on the remote host to the parent of the current working directory.

chmod *mode remote-file*
Change the permission mode on the remote file or directory to *mode* (interpreted by the remote server). An iRMX FTP server accepts only a 3-digit octal value; for example, `777` grants all permissions.

See also: **chmod( )** function, *C Library Reference*

close Terminate the FTP session with the remote server and return to the client FTP command interpreter.

cr Toggle stripping of carriage returns during ASCII file retrieval. When enabled, the carriage return is stripped from each carriage return/linefeed pair encountered in the file, leaving the linefeed record delimiter recognized by Unix. By default, carriage return stripping is off.

debug Toggle debug mode. When debug mode is on, each **ftp** protocol command sent to the remote server is displayed, preceded by the string `-->`. By default, debug mode is off.

delete *remote-file*
Delete the file *remote-file* on the remote host.

dir [*remote-file* [*local-file*]

dir [*options* [*local-file*]]
List the current remote directory or a specified file or directory on a remote host. Specified *options* are supplied to the remote list command (for example, Unix **ls** or VMS **dir**). If a local file is specified, the list is written to that file. Note that if the first argument is *options*, the second argument is assumed to be *local-file*.

disconnect A synonym for **close**.

form *format* Set the vertical format control for ASCII and EBCDIC file transfers to *format*. Valid formats are `carriage-control`, `non-print` (the default), and `telnet`. Only the non-print format is supported.

get *remote-file* [*local-file*]
Retrieve the specified *remote-file* and store it on the local host. If *local-file* is not specified, the local file will be named *remote-file*. **Ftp** uses the current settings for file type, format, transmission mode, and structure.

glob Toggle local filename globbing. With globbing disabled, all local files and pathnames are treated literally. With filename globbing enabled, each local file or pathname is processed for the shell metacharacters *** ?** **[ ]** and **~**. An additional pair of metacharacters, **{** and **}**, may enclose several comma-separated strings, for each of which a match is sought. Globbing is always on with reference to remote files; it is on by default with reference to local files.

hash Toggle hash mark (#) printing for each data block transferred. The size of a data block is 4096 bytes. By default, hash mark printing is off.

help [*command*]
Display a list of the **ftp** commands (no argument) or information about the specified *command*.

idle [*seconds*]
Display the current inactivity timer on the remote host or set it to *seconds*.

image Same as **binary**.

lcd [*directory*]
Change the working directory on the local host to the user's home directory (no arguments) or to the specified *directory*.

ls [*remote-file* [*local-file*]]

ls [*options* [*local-file*]]
Same as **dir**. Note that if the first argument is *options*, the second argument is assumed to be *local-file*.

macdef *mname*
Define a macro that will be invoked by using the name *mname*. Subsequent lines will be stored as the macro definition. A null line (consecutive newlines or carriage returns) ends the macro definition. Within the macro definition, a dollar sign specifies substitution of arguments from the macro invocation line. The sequence **$***n*, where *n* is a number, will be replaced by the *n* argument (for example, $1 is the first argument). The sequence **$i** will cause the macro to loop automatically, executing once with each argument. Escape the dollar sign with a backslash (\$) to prevent this special treatment. The maximum number of macros is 16. The maximum definition length is 4096 characters. A macro definition is valid only for the duration of a connection to a remote host; all macros are automatically deleted when the connection is closed.

macdel *mname*
Delete the macro *mname*.

macls [*mname*]
: List the names of defined macros or list the definition of the macro *mname*.

mdelete *remote-file* ...
: Delete the specified files on the remote host. If globbing is enabled, each filename is first expanded.

mdir *remote-file ... local-file*
: Obtain an extended directory listing of multiple files on the remote host and place the result in *local-file*. Globbing must be turned off when using this command. Note that the specification of *local-file* is mandatory.

mget *remote-file ...*
: Retrieve the specified files from the remote host and place them in the current local directory. If globbing is enabled, the specification of each remote file will first be expanded.

mkdir *directory-name*
: Make a directory on the remote host.

mls *remote-file ... local-file*
: Obtain an abbreviated listing of multiple files on the remote host and place the result in *local-file*. Globbing must be turned off when using this command. You must specify a local file.

mode [*mode-name*]
: Set the file transmission mode to *mode-name*. Valid modes are `block`, `compressed`, and `stream` (the default). Only the stream mode is supported.

modtime *remote-file*
: Display the last modification time of the remote file.

mput *local-file ...*
: Transfer multiple files from the current local working directory to the current working directory on the remote host.

newer *remote-file*
: Get the specified remote file if a local file of that name does not exist or if the remote file has a later modification date than the local file of the same name.

nlist [*remote-file* [*local-file*]]

nlist [*options* [*local-file*]]
: List name(s) of the current directory or a specified file or directory on a remote host. Specified *options* are supplied to the remote list command

(for example, Unix **ls** or VMS **dir**). If a local file is specified, the list is written to that file. Note that if the first argument is *options*, the second argument is assumed to be *local-file*.

nmap [*inpattern outpattern*]

Remove (no arguments) or set the filename mapping mechanism. Filename mapping automatically derives a destination filename from the source filename during **get**, **mget**, **put**, and **mput** commands. This is of particular interest when connecting to a non-Unix remote host with different file naming conventions or practices.

The input pattern consists of the variables **$1** through **$9** and literals. This pattern is matched against a source filename to extract the portions of interest. The input pattern cannot contain spaces.

The output pattern specifies the manner in which the variables derived by the input pattern are used to create the destination filename. The variables **$1** through **$9** are replaced by their derived values. The variable **$0** is replaced by the original source filename. The pattern **[***str1***,***str2***]** is replaced by *str1* if *str1* is not a null string or by *str2* if *str1* is a null string. All other spaces and characters are treated as literals.

For example, the command **nmap $1;$2 $1.$2** can be used to create a Unix equivalent of the VMS version number extension by replacing the semicolon with a period.

ntrans [*inchars* [*outchars*]]

Remove (no arguments) or set the filename character translation mechanism. Character translation automatically derives a destination filename from the source filename during **get**, **mget**, **put**, and **mput** commands. This is of particular interest when connecting to a remote host with different file naming conventions or practices.

If a character in the source filename matches the *n* character in *inchars*, it is replaced by the corresponding character from *outchars* to create the destination filename. If the *inchars* string is longer than the *outchars* string, the characters without a corresponding output character are ignored in the source filename.

For example, the command **ntrans ;$-% .** will translate semicolons to periods wherever they appear and ignore all dollar signs, hyphens, and percent signs.

open *host* [*port*]

Establish a connection to the FTP server on the specified remote *host*. *Port* is used to specify an alternate FTP server; it can be the actual port number or the service name. If autologin is enabled (the default), **ftp** will also attempt to automatically log the user in.

prompt Toggle interactive prompting, which is turned on by default. Interactive prompts occur during multiple file transfers, to allow the user to selectively retrieve or store files. If prompting is turned off, **mget** and **mput** transfer all specified files.

proxy *ftp-cmd*

Execute an FTP command on a secondary control connection. This command enables you to open simultaneous connections to two FTP servers and transfer files between them instead of between the local client and a server. The original FTP connection is called the primary control connection; the connection made through the **proxy** command is called the secondary control connection. The server on the secondary connection must support the FTP protocol command PASV.

The first **proxy** command should be **open**, to establish the secondary connection. The **proxy** command **?** displays the list of commands that can be used on the secondary connection. These FTP commands behave differently when executed as **proxy** commands:

Command	Difference
open	will not define new macros during autologin
close	will not erase existing macro definitions
get, mget	transfer files from the primary server to the secondary server instead of to the local host
put, mput, append	transfer files to the primary server from the secondary server instead of from the local host

put *local-file* [*remote-file*]

Copy the local file to the remote host. If *remote-file* is not specified, the remote file will be named *local-file*. **Ftp** uses the current settings for file type, format, transmission mode, and structure.

pwd Display the pathname of the current remote working directory.

quit A synonym for **bye**.

quote *arg* ... The specified arguments are sent, verbatim, to the remote FTP server. A single FTP reply code is expected in return. This command is used to avoid processing of a command by the local FTP client, and facilitates the sending of an explicit FTP protocol command to the remote server when the client does not implement the related command.

recv *remote-file* [*local-file*]
A synonym for **get**.

reget *remote-file* [*local-file*]
Similar to **get**, but if *local-file* already exists and is smaller than *remote-file*, it is assumed to be a partially transferred copy of the file. The transfer is resumed from an offset into the remote file equal to the byte count of the local file.

rename *remote-file new-name*
Rename the remote file to *new-name*.

reset Clear the reply queue to resynchronize the command/reply mechanism between the FTP client and server.

restart *marker*
Restart the file transfer immediately following **get** or **put** at the indicated *marker*, which is a byte offset into the file.

rhelp [*command*]
Request a list of the FTP protocol commands implemented by the remote server (no arguments) or an explanation of the specified protocol *command*.

rmdir *directory-name*
Delete a directory on the remote host.

rstatus [*file*] Show the status of the remote host or of the specified file on the remote host.

runique (receive unique) Toggle the creation of unique local filenames when using **get** and **mget**; receive unique is turned off by default. If **runique** is on and the destination filename already exists, a numeric extension is added to the name, incrementing the number sequentially until a unique name is created. For example, if the target local filename is *fortune* and that file already exists, the target name becomes *fortune.1*. If *fortune.1* already exists, the target name becomes *fortune.2*, and so on with extensions 1 through 99. If all versions of the file already exist, the transfer fails. If the transfer succeeds, the unique filename will be displayed.

send *local-file* [*remote-file*]
A synonym for **put**.

sendport Toggle the use of the FTP protocol PORT command when establishing a data connection. When enabled (the default), **ftp** sends a **PORT** command to inform the server which local port the client uses to listen for the data connection. The server will then connect to that port. When disabled, **ftp** listens for all data connections on the default port. This command is particularly useful when connecting to FTP implementations that do not support the **PORT** command.

site *arg ...* Send the arguments, verbatim, to the remote server as a SITE command. These **SITE** commands are supported by the iRMX FTP server; the **CHMOD**, **ULIMIT**, and **UMASK** commands operate like the corresponding Unix commands:

CHMOD *mode file*	Change the permission mode on the remote file.
HELP	List the SITE commands supported by the server.
IDLE [*secs*]	Display (no arguments) or set the current idle time limit.
ULIMIT [*blocks*]	Display (no arguments) or set the current file size limit.
UMASK [*mask*]	Display (no arguments) or set the current file-creation mode mask.

size *remote-file*
Display the size of the remote file.

status Show the current status of **ftp**.

struct [*struct-name*]
Set the structure of the file to be transferred to *struct-name*. Valid formats are `file` (the default), `page`, and `record`. Only the file structure is supported.

sunique (send unique) Toggle the creation of unique remote filenames when using **put** and **mput**; send unique is turned off by default. This operates the same as **runique.**

system Display the type of OS running on the remote host.

tenex Set the data representation type to `tenex`, which corresponds to the local logical byte size. The only byte size supported is 8 bits, making this data type virtually the same as binary.

trace Toggle packet tracing. Packet tracing is turned off by default.

type [*type-name*]
Display the data representation type of the file to be transferred (no arguments), or set it to *type-name*. Valid types are `ASCII` (default), `binary`, `EBCDIC`, `image`, and `tenex` (local byte size). The binary and image types are identical. The EBCDIC type is not supported. The `tenex` type, in which the logical byte size is 8, is virtually the same as binary.

umask [*mask*]
Display (no arguments) or set the user file-creation mode mask on the remote host.

user *login* [*password* [*account*]]
Log in to the remote FTP server as user *login*. **Ftp** will prompt for the password and account if they are required and not specified.

verbose Toggle verbose mode. When enabled, all responses from the FTP server are displayed along with statistics regarding the efficiency of each file transfer. By default, verbose mode is enabled for an interactive session and disabled for a background or batch session.

? [*command*]
A synonym for **help**.

$ *mname* [*arg* ...]
Invoke the macro *mname* with the specified arguments.

! [*command*] Invoke a shell on the local host. To return to **ftp**, exit from the shell with an EOF (in the iRMX OS, a <Ctrl-Z>). If an argument is specified, that *command* is executed and the shell exits automatically. Do not execute any iRMX command that does an `attachfile :`$:.

Diagnostics

Exit status is 0 for normal termination or a positive number for error termination.

getaddr

Returns the local system's Ethernet address.

Syntax

```
getaddr
```

Additional Information

The **getaddr** command displays the Ethernet address of the local system. The command looks up the value for the local object named *myhostid* and returns it. iRMX-NET enters the *myhostid* object with the Name Server during initialization. The address is reported as shown below:

```
Ethernet address : 00 AA 00 02 5A 70
```

getname

Returns the network name of the local system or of any iRMX-NET system specified by its Ethernet address.

Syntax

```
getname [A=net_addr] [R=retries]
```

Parameters

`A=`*`net_addr`*

A 12-digit ASCII string representing the hexadecimal Ethernet address of a system. Spaces are not allowed. If this parameter is omitted, the name of the local system is returned. This is an example address:

```
00AA00025A70
```

`R=`*`retries`*

A decimal number of times the Name Server tries to find the system, using a different Multibus II slot ID. The maximum is 21. The default is 8.

Additional Information

The **getname** command displays the name of the specified host, if the name is cataloged under property type 5H in any Name Server object table. If no object with the specified Ethernet address is found cataloged under property type 5H, **getname** displays an error message.

If an input parameter is not specified, the local host name is returned. This is the type of name cataloged with the **loadname** command from the *:sd:net/data* file (assuming it is entered as property type 5H in that file). The name could also be cataloged with a **setname** command.

In Multibus I and PC systems, the **getname** command finds the name in the first trial.

In Multibus II systems, a host can be in any one of the Multibus II slots. To identify different hosts in the system, the Name Server appends the slot ID with the Ethernet address for the host-unique ID (property type 5H). For example, if a host CPU is in slot 4 of a Multibus II system, the host-unique ID might be as follows, where `04` is appended to the Ethernet address:

Name	**Type**	**Value**
SLOT4SYS	0005H	00AA00025A7004

To obtain the names of Multibus II hosts with **getname**, you may specify the slot ID as part of the address, as follows:

```
getname A=00AA00025A7004
```

If the slot ID is not known, it need not be specified. In this case, **getname** attempts to find the host name up to 21 times (depending on the number of retries specified), each time with a different slot ID. For example, this command contains no slot ID:

```
getname A=00AA00025A70
```

The **getname** command tries five times with different appended slot numbers before it finds the name, as shown below:

```
Getting iRMX System name ... Trial 01            (slot0)
Getting iRMX System name ... Trial 02            (slot1)
Getting iRMX System name ... Trial 03            (slot2)
Getting iRMX System name ... Trial 04            (slot3)
Getting iRMX System name ... Trial 05            (slot4)

Host name is:  SLOT4SYS
```

See also: **findname** command, in this chapter

Error Messages

`<net_addr>, illegal Ethernet address`

The Ethernet address specified in the command line is invalid. Execute the **getname** command again using the correct Ethernet address.

`<net_addr>, name does not exist`

An object with the property type 0005H matching the given Ethernet address is not found in the entire network.

`<net_addr>, maximum responses received`

More than one name is found to match the given Ethernet address. This happens if the **setname** command is executed more than once and different names are used. In this case, the number of such duplicate names found by the Name Server can be too large to handle. The maximum number of responses that can be handled by the Name Server is a configurable option.

grep

Searches the specified file(s) for a string matching the given pattern. For each matching string, **grep** displays the lines and/or filenames.

Syntax

```
grep pattern pathname [to|over|after outpath] [nofile]
      [line] [exact] [unique] [plm]
```

Parameters

`pattern`
: The pattern for which a match is desired.

`pathname`
: The file to search. Wildcards are permitted.

`to|over|after outpath`
: Writes the output to the specified file instead of to the screen.

`nofile` Don't display the filename when a match is found. The default is to always display the filename.

`line` Display the line number when a match is found.

`exact` Searches for the pattern as entered with regard to upper- and lower-case. The default is to search without case-sensitivity.

`unique` When a match is found, displays only the filename, and only once for each file.

`plm` Ignores $ characters in the file when searching for a match.

Additional Information

Unless you specify the `exact` parameter, the search is caseless; all occurrences of the matching string, in any combination of case, are reported.

Examples

To find all occurrences of **rq$send$message** in all files ending with *p38*, regardless of PLM coding style, enter:

```
grep rqsendmessage *p38 plm
```

To find all occurrences of a distinctly spelled variable in the same files, enter:

```
grep SillyVar *p38 exact
```

help

Displays information about one or more commands. If no parameters are given, information about the **help** command is displayed.

➾ **Note**
You can use this command in an esubmit file or **rq_c_send_command** system call if the form of the command does not require user input. If the command requires user input in an **rq_c_send_command** system call, it will fail. However, you can use a form of the command that requires user input in an esubmit file if you use the `eoresponse` and `coresponse` subcommands.

See also: **esubmit** command, in this chapter

Syntax

help *command_list* [to|over|after *outpath_list*] [q] [p = *num*]

Parameters

command_list

One or more command names for which you want help. Separate multiple names with commas. Wildcards are permitted. Only utilities added to the OS have help screens available.

to|over|after *outpath_list*

Writes the output to the specified file(s) rather than to the screen. If you specify multiple input files and one output file, the output is appended.

q(uery) Prompts for permission to display each help file. Respond to the prompt with:

Y	Display the file
R	Display remaining files without further query
E	Exit the command
N or other	Don't display the file; query for the next

p(agelength)=*num*

The maximum number of lines in the output page; the default is 66. A formfeed (0CH) is inserted in the output every *n* lines, where *n = pagelength-3*. If the output is not directed to a file, this parameter is ignored. The default value is decimal, but you can specify octal or hexadecimal by appending an O or H.

Additional Information

If no output pathnames are given, the output is sent to the screen using the **skim** command. For help on commands used by **skim**, type H or ? at the `more?` prompt.

See also: **skim** command, in this chapter

The **help** command displays the contents of a help file with the same name as a command. Each help file has the extension *.hlp*. If the filename becomes too long the excess part of the *.hlp* extension is truncated.

Not all commands have help files. The **help** command is used primarily to give information about utilities added by users; many of these utilities are now shipped with the OS and described in this manual.

The **help** command determines the location of the help files by entries in a *help.mac* file, which is in the same directory as the **help** command. The *help.mac* file contains the names of directories to search for help files. The directories should be on separate lines or separated by commas. If you add directories, use these types of entries; note the trailing slashes on the directory pathnames:

```
:prog:
:sd:helps/system/
:sd:helps/utils/
:sd:helps/uprocs/
:sd:util286/
:$:
```

If no help file for a command is found in any of the directories listed in *help.mac*, an error message to that effect is displayed.

Indirect help files may be created by using an at sign (`@`) as the first character in the help file, followed by the indirect command name. To use this capability, there must be an actual help file referenced by the indirect command name. For example, if there is an actual *skim.hlp* file, and you want to provide help for an alias `m=skim`, create a file named *m.hlp* that contains only this line:

```
@skim
```

history

Displays the last 40 command lines in chronological order. You can use the associated number with the **!** command to recall one of the displayed command lines.

Syntax

```
history
```

Additional Information

The command lines are displayed a screenful at a time, including the **history** command, and are numbered from 1 to 999. After 999, the numbers start over at 1. When displaying the command lines, the CLI lists the first page (20 lines) of commands followed by the query:

```
display more ? ([y] or n)
```

The default is `Y`. If you enter anything other than `N`, the CLI displays the next page of command lines (assuming there are more command lines in the history buffer).

You can use the **history** command with the **!** command to recall a specific line number or command line. For example, you might enter the **history** command to see the last 20 command lines. To recall line 10 so you can modify and execute it, you would enter:

```
!10  <CR>
```

This would display line 10 as the current line. You can then edit the line; however, the original line 10 remains unchanged in the history buffer. The edited line becomes the last (newest) line in the history record.

If you have entered a command line that includes continuation lines, **history** displays it as shown for command 2 below:

```
  1 copy x to y
  2 copy z &
**  to &
**  t.asm
  3 dir
  4 history
```

Examples

Assume that you enter these commands:

```
- copy X to Y.PLM <CR>
- dir <CR>
- AEDIT Y.PLM <CR>
- history <CR>
```

The response to the **history** command would be:

```
1 copy X to Y.PLM
2 dir
3 AEDIT Y.PLM
4 history
```

To edit line 1, use the **!** command. Line 1 is displayed with the cursor at the end:

```
- !1 <CR>
- copy X to Y.PLM
```

If you edit the line to read `copy NEW.PLM to Y.PLM` and execute the command, the line is entered into the history buffer as line 5. Now if you enter the **history** command you see:

```
1 copy X to Y.PLM
2 dir
3 AEDIT Y.PLM
4 history
5 copy NEW.PLM to Y.PLM
6 history
```

Error Messages

`<parameter>, unexpected parameter`

You entered a parameter; **history** does not accept parameters. If you want to recall a specific line, enter the **!** command.

`<condition code:mnemonic>, while history displayed`

An error occurred when the CLI tried to write the history buffer to the screen.

ic

Reads or writes interconnect space to perform one of several functions on a Multibus II system. The **ic** command must be invoked separately for each subcommand function.

Syntax

```
ic -c agents [-s]
ic -c fpi [-s] arm|disarm
ic -c get [-s] slot register count
ic -c help
ic -c kill [-s] slot
ic -c myslot [-s]
ic -c nmi [-s] [-e] slot nmitype
ic -c record [-s] [-o occurrence] slot record
ic -c reset [-s] [-p monitor|bootstrap|index] slot type
ic -c set [-s] slot register value
```

Parameters

The parameters after `-c` are in alphabetical order, with hyphens ignored.

`-c` Specifies that one of the **ic** subcommands follows.

`a(gents)`
Displays the slot ID and product code for each board (agent) in the system, including add-on (extension) boards. With the `-s` switch, the slot ID is repeated for extensions.

`count` A decimal number specifying the number of registers to display.

`-e` Enables the NMI source specified by *`nmitype`*. The `-e` is unnecessary if the NMI source is already enabled.

`f(pi) arm|disarm`
Arms or disarms notification from the Front Panel Interrupt (FPI) server. This server notifies when you turn the front panel keyswitch to Interrupt. By default, all boards are disarmed when the system starts, and the interrupt switch has no effect. If you arm the server, the board where you issue the command is given a non-maskable interrupt (NMI) when you turn the keyswitch.

`g(et)` Displays the contents of one or more interconnect registers on the board in the specified slot.

`h(elp)` Displays **ic** syntax.

`k(ill)` Disables the board in the specified slot by applying a local reset. To re-enable the board it must be reset with the **ic** command or the `reset` switch.

`m(yslot)`
Displays the slot ID of the board where **ic** is executing.

`n(mi)` Issues an NMI on the board in the specified slot.

`nmitype`
The following; to specify the whole string, use underscores (_) not spaces:

```
diagnostics(_request)
debugger(_entry)
software(_nmi_source)
```

`-o` *`occurrence`*
A decimal number specifying which occurrence of the record to display, where there are multiple occurrences. The default is 1, the first record.

`-p monitor|bootstrap|`*`index`*
For a local or warm reset, specifies a program to run after the reset:

`monitor`	invokes the firmware debug monitor
`bootstrap`	invokes the firmware bootstrap loader
`index`	is a number in the range 0-7, invoking a program in the Program Table Index Register (PTIR)

`rec(ord)`
Displays the contents of an interconnect space function record on the board in the specified slot, or displays information about extension boards on it.

`record` A decimal number specifying the interconnect space record, or, to indicate extension boards, the literal `20` or `HW`.

`register`
A decimal number specifying the (beginning) interconnect register.

`res(et)` Resets the board in the specified slot.

`-s` Shortens output to the value requested, not a message, except for error messages.

`s(et)` Writes a value into an interconnect register on the board in the specified slot. The value written is verified and displayed.

`type` The type of reset: `cold`, `recovery`, `warm`, or `local`. `Local` causes a processor reset if the specified slot is where **ic** is executing.

`slot` A decimal slot number specifying which board to act upon.

`value` A one-byte hexadecimal value to write (don't specify the H).

Additional Information

Interconnect registers and the logical records that comprise a group of registers are defined differently for different boards. Refer to the hardware reference manuals for the boards you use.

See also: Records, reset, program table index register, NMI, *Multibus II Interconnect Interface Specification*

The table below shows default aliases defined for the **ic** command in Multibus II systems. These are not defined for DOSRMX installed in a Multibus II system.

Subcommand	**Aliases**
agents	agents = ic -c agents
myslot	myslot = ic -c myslot
reset	agentreset = ic -c reset #0 local

	coldreset = ic -c reset 0 cold
	sysreset = coldreset
	monitor = ic -c reset -p monitor #0 local
	reboot = ic -c reset -p bootstrap
	warmreset = ic -c reset 0 warm

nmi	nmi = ic -c nmi #0 software
	nmiforce = ic -c nmi -e #0 software

get	icread = ic -c get #0 #1 #2
set	icwrite = ic -c set #0 #1 #2
kill	offline = ic -c kill #0

Values written to a register with the `set` subcommand are hexadecimal. All other numeric values you specify in the **ic** command are decimal. Values displayed by **ic** follow the same convention. If you enter an invalid command, **ic** displays the syntax of **ic** commands.

Examples

`agents` In this example the commands are for a system that includes an SBC 386/258 board in slot 1, with a CSM/002 module attached.

```
ic -c agents <CR>                     or     agents <CR>
AGENTS COMMAND -
SLOT:00   386/258
    - CSM/002
SLOT:02   186/410
SLOT:03   386/116
SLOT:07   186/530
```

```
ic -c agents -s <CR>                  or     agents -s <CR>
00
00
02
03
07
```

`myslot` In this example the command is issued from the board in slot 1.

```
ic -c myslot <CR>                     or     myslot <CR>
MYSLOT COMMAND - SLOT:01
```

```
ic -c myslot -s <CR>                  or     myslot -s <CR>
01
```

`get` This example returns the value from the board in slot 1, interconnect register 100, with the contents of two registers returned.

```
ic -c get 1 100 2 <CR>        or     icread 1 100 2 <CR>
GET COMMAND - SLOT:01
   100 - 03H   101 - 00H
```

```
ic -c get -s 1 100 2 <CR>     or     icread -s 1 100 2 <CR>
03
00
```

`set` This example writes to the board in slot 2, interconnect register 0, value 1.

```
ic -c set 2 0 1 <CR>          or     icwrite 2 0 1 <CR>
SET COMMAND - SLOT:02, REGISTER: 0, VALUE:01H
```

```
ic -c set -s 2 0 1 <CR> or     icwrite -s 2 0 1 <CR>
01
```

`record`

This example returns information from the board in slot 1, record 1. The corresponding interconnect register numbers are shown in parentheses.

```
ic -c record 1 1 <CR>
RECORD COMMAND - SLOT:01, NAME:MEMORY, TYPE:001, LENGTH:05

2(038)-3fH   3(039)-00H   4(040)01H   5(041)-a1H
6(042)-f1H

ic -c record -s 1 1 <CR>
01
05
3f
00
01
a1
f1
```

`record`

This example returns information about the hardware extension board attached to the board in slot 0. The literals `20` or `HW`, used as a record number, specify hardware extensions. Notice the prompts to display more information between each record.

```
-ic -c rec 0 20 <CR>

RECORD COMMAND - SLOT:00, NAME:HW_EXTENSION, LENGTH:20

02(103) - 00H   03(104) - 00H   04(105) - 01H   05(106) - 00H
06(107) - 43H   07(108) - 53H   08(109) - 4dH   09(110) - 2fH
10(111) - 30H   11(112) - 30H   12(113) - 32H   13(114) - 00H
14(115) - 00H   15(116) - 00H   16(117) - 01H   17(118) - 00H
18(119) - 00H   19(120) - 00H   20(121) - 00H

-MORE ([Y]/N) ? <CR>
RECORD COMMAND - SLOT:00, NAME:CSM, TYPE:008, LENGTH:02

02(124) - 00H   03(125) - 23H

-MORE ([Y]/N) ? <CR>
RECORD COMMAND - SLOT:00, NAME:TIME_DATE, TYPE:009, LENGTH:10

02(128) - 40H   03(129) - 10H   04(130) - 27H   05(131) - 16H
06(132) - 15H   07(133) - 31H   08(134) - 01H   09(135) - 90H
10(136) - 00H   11(137) - 03H

-MORE ([Y]/N) ? <CR>
RECORD COMMAND - SLOT:00, NAME:ALARM, TYPE:032, LENGTH:07

02(140) - 00H   03(141) - 00H   04(142) - 00H   05(143) - 00H
06(144) - 00H   07(145) - 00H   08(146) - 00H
```

```
-MORE ([Y]/N) ? <CR>

RECORD COMMAND - SLOT:00, NAME:NVRAM, TYPE:033, LENGTH:28

02(149) - 00H   03(150) - 00H   04(151) - 00H   05(152) - 00H
06(153) - 00H   07(154) - 00H   08(155) - 00H   09(156) - 00H
10(157) - 00H   11(158) - 00H   12(159) - 00H   13(160) - 00H
14(161) - 00H   15(162) - 00H   16(163) - 00H   17(164) - 00H
18(165) - 00H   19(166) - 00H   20(167) - 00H   21(168) - 00H
22(169) - 00H   23(170) - 00H   24(171) - 00H   25(172) - 00H
26(173) - 00H   27(174) - 00H   28(175) - 00H   29(176) - 00H

-MORE ([Y]/N) ? <CR>
RECORD COMMAND - SLOT:00, NAME:CHASSIS_ID, TYPE:034, LENGTH:02

02(179) - 00H   03(180) - 00H
```

Error Messages

`GET COMMAND - Invalid count argument`
The count value entered is invalid.

`GET COMMAND - Invalid register argument`
The register offset is invalid.

`SET COMMAND - Interconnect write error`
The value written to interconnect space could not be read back to validate it.

`RECORD COMMAND - Invalid record type`
The record value entered is invalid.

`<slot>: Invalid slot ID argument`
The slot value is not a valid Multibus II slot.

`<slot>: Interconnect not initialized`
The specified Multibus II host had not initialized its interconnect space.

`<slot>: Invalid command argument`
The major option entered was not a valid **ic** subcommand.

`E_NOT_CONFIGURED`
The system on which the **ic** command was invoked is not a Multibus II system.

inamon

Performs several network functions chosen from a menu, including reading and setting Network Management Facility (NMF) objects, performing echo tests, and managing network routing.

Syntax

```
inamon
```

Additional Information

Inamon is a menu-driven utility that provides these functions:

- Determines and changes the iNA 960 configuration through NMF objects and monitors Remote Boot Server activity. If the NMF is configured for remote object support, you can use **inamon** to monitor NMF objects on a remote system. Except for the *ina961.31L* download file, the default NMF configuration for iNA 960 files shipped with iRMX-NET allows remote object manipulation.
- Performs echo tests of the Data Link Layer to determine if the physical link between two systems is in place and if the iNA Data Link Layers are functioning. A remote system's Ethernet address and a Data Link Layer LSAP ID of 08 are used to reach the remote Data Link Layer.
- Attaches to iNA 960 on a remote system to determine whether the iNA Transport software is functional on the two systems. You must provide the transport address for the remote system.
- Notifies the user of a local event.
- Provides routing management for both static IP and ES-IS dynamic routing.

See also: NMF objects, *Network User's Guide and Reference*

When you invoke **inamon**, this menu is displayed:

```
TYPE 0 FOR : READ/SET/CLEAR OBJECTS
TYPE 1 FOR : ECHO TESTING
TYPE 2 FOR : EVENT NOTIFICATION
TYPE 3 FOR : ROUTER MANAGEMENT
TYPE 4 FOR : ATTACH REMOTE AGENT
TYPE 5 FOR : DETACH REMOTE AGENT
Enter Option (TYPE H FOR HELP, E FOR EXIT) -->
```

At this menu, enter `H` for help information about the command. Once you enter the help screens, you must page through (using <CR>) to the end.

initstatus

Displays the initialization status of all HI-managed terminals.

Syntax

```
initstatus
```

Additional Information

This is the format of the **initstatus** display:

```
terminal     config   device  init    term   job   user    user   user
device name  excep    excep   excep   state   ID    ID     POOL   name

.T0.         0000     0000    0000    D-E     1      0     1,400K  rmx
.T1.         0000     0000    0000    SLE     2    65535   1,400K  rmx
.T3.         0000     0002            D--
.T4.         0021                     D--
```

Where

`terminal device name`	The physical name of the terminal, as defined during the configuration of the Basic I/O System and as attached by the HI. Periods surround each name.
`config excep`	Hexadecimal condition code that the HI received when it attempted to interpret the terminal definition and user definition files. A 0 value indicates a normal condition. Nonzero values indicate exceptional conditions.
`device excep`	Hexadecimal condition code that the HI received when it originally attached the terminal as a physical device.
`init excep`	Hexadecimal condition code that the HI received when it created a job for the interactive session.

`term state`	Three characters that indicate the current state of the terminal. The first character can be either: D a dynamic logon terminal S a static logon terminal The second character can be either: L the terminal is locked - the terminal is unlocked See also: **lock** and **unlock** commands, in this chapter dynamic and static terminals, *System Configuration and Administration* The third character can be either: E the HI interactive job associated with this terminal exists - the interactive job does not exist
`job ID`	A sequential number that the HI assigns to the interactive job during initialization. You specify this number as the parameter in the **jobdelete** command to delete the corresponding interactive job.
`user ID`	The user ID that the HI associates with the interactive job when the user begins a HI session.
`user POOL`	The maximum size of the memory pool associated with the interactive job.
`user name`	The logon name of the user who is accessing this terminal.

See also: Logon names and terminals, *System Configuration and Administration*

Error Message

`not a multi-user system`

The HI cannot return information about terminals because it is not configured as a multi-user system.

jobdelete

Deletes one or more running interactive jobs, which are the HI jobs that manage user sessions. The Super user can delete any interactive job. Other users can delete only those jobs with the same user ID as their own.

Syntax

```
jobdelete job_id_list
```

Parameter

`job_id_list`

One or more job ID numbers separated by commas, specifying the interactive jobs to be deleted. Use the **initstatus** command to display the current job IDs.

Additional Information

Deleting an interactive job causes the HI to terminate the corresponding user session. The **jobdelete** command cannot be used to delete background jobs; for those, use the **kill** command.

When you invoke **jobdelete**, it first attempts to delete the interactive job's offspring jobs (for example, a submit file or a program invoked as a result of an **rqe_create_io_job** system call). It deletes multiple levels of offspring jobs. However, **jobdelete** cannot delete any interactive or offspring job that contains extension objects.

See also: Deleting offspring jobs, *System Concepts*

Normally, when a user's interactive job is deleted, the HI logs the user off the system and issues a new logon prompt. If the job is on a static terminal, the HI automatically re-creates the interactive job, with no logon prompt. However, if the **lock** command has been invoked for the terminal, the HI does not reissue a prompt or re-create interactive jobs after a **jobdelete** command. The system manager can use the combination of **lock** and **jobdelete** to remove users from the system before a system shutdown.

Unless you delete your own interactive job, **jobdelete** displays this message as it deletes each job:

```
<job_ID>, deleted
```

If you delete your own interactive job, the logon prompt is displayed (for dynamic terminals) or your interactive job is restarted (for static terminals).

Error Messages

`<job_ID>, does not exist`

The interactive job associated with this job ID does not exist. It has already been deleted or never existed.

`<job_ID>, invalid job id`

The specified job ID is not associated with any terminal managed by the HI.

`<job_ID>, job does not belong to you`

You do not have the same user ID as the interactive job, or you are not the system manager.

`<job_ID>, not deleted`

`<job_ID>, <condition code:mnemonic>`

The indicated condition code was encountered, preventing **jobdelete** from deleting the job.

jobs

Displays the current background jobs and their job ID numbers, in last-in first-out order.

Syntax

```
jobs
```

Additional Information

The job IDs are displayed in a list of four-digit hexadecimal ID numbers. These are the job IDs assigned when the **background** command was invoked. To cancel a background job, use the **kill** command.

This is the type of display produced by the **jobs** command, where `<job>` is a truncated copy of the command line running in the background:

```
Background Jobs:
    9B08   "<job>"
    1FF0   "<job>"
    10A8   "<job>"
```

Error Message

`<parameter>, unexpected parameter`

You entered a parameter; **jobs** does not accept any parameters.

keyb

Configures the console keyboard for a specific country, in iRMX for PCs and DOSRMX. The default keyboard setting is US.

Syntax

```
keyb [country-abbreviation]
```

Parameters

country-abbreviation

Two-character abbreviation of the country indicating which keyboard is being used, as follows:

Abbreviation	**Country**
FR	France
GR	Germany
IT	Italy
LA	Latin America
SV	Sweden/Finland
UK	United Kingdom
US	United States

Additional Information

Without a country abbreviation, **keyb** displays the syntax and list of countries supported.

For keyboards with keys that support three characters, you can type the third character only by pressing the <Ctrl+Alt+*key*> combination.

Currently, <Alt+Shift+*key*> and the <Alt Gr> key are not supported by the **keyboard** command.

Error Messages

`Invalid Language Abbreviation`

You did not enter a correct country abbreviation as listed above.

`Invalid Command Tail`

You entered a single letter instead of a two-letter country abbreviation.

kill

Cancels the specified background job or all background jobs.

Syntax

`kill [`*`job_id`*`|*]`

Parameters

`job_id`	The hexadecimal job ID number established when the background job was invoked.
`*`	Cancels all background jobs.

Additional Information

The Super user can cancel any job. Other users can cancel only background jobs started by themselves or by the World user.

If you cancel several background jobs at once and then immediately issue the **jobs** command, some of the canceled jobs may be listed. Even though these jobs are displayed, they have been canceled. Verify this with another **jobs** command.

When a job has been canceled, this message is displayed:

```
Background job <job_id> canceled
```

If you use the asterisk (*) parameter with the **kill** command, all background jobs are canceled and this message is displayed:

```
All background jobs were canceled
```

Error Messages

`kill, the job parameter is not a valid background job of the caller`
You tried to kill a background job that is not in your list of background jobs.

`kill, a job parameter is required`
The command you entered has a syntax error.

killjob

Displays current system job tree information and allows the user to specify a job to be deleted.

Syntax

```
killjob
```

Additional Information

The killjob command displays the following job tree information:

```
Used         Avail        Job IDs             Name
-------      -------      -------------       --------
1394K        29156K       0258                Root Job
9K           0K               11d0            Human Interface Job
39K          34K                 7178         /rmx386/jobs/any.job
166K         345K                3d78         CLI Job
39K          34K                     c118     :UTILS:killjob
41K          1K                  2a40         /rmx386/jobs/keybd.job
5K           0K               1118            EIOS Job
0K           23K              10d8            RTE Job
21K          2K               1028            Dispatcher Job
31K          0K               0f98            BIOS Job
0K           10K              0f58            Shared C Library Job
144K         15K              0ef0            Nucleus Comm Service
Which job to delete (RETURN to exit) ?
```

To delete a job, simply specify the ID of the job you wish to delete.. In this example, assume you want to delete /rmx386/jobs/any.job. Simply specify 7178 followed by <Enter>. If the job does not have a deletion mailbox catalogged in its object directory, or doesn’t respond to the message sent to its deletion mailbox, you will receive the following query:

See also: **sysload** command, in this chapter, for information on the format of the deletion message.

```
Job cannot unload itself. Attempt to delete it?
```

If you specify “y” followed by <Enter>, the job will be deleted with the following message:

```
Deleting job 7178
```

The resulting job tree will then be displayed.

lanstatus

An alias for the **netinfo** command. The features of the former **lanstatus** command are included in the **netinfo** command.

See also: **netinfo** command, in this chapter

listname

Lists the names and values of objects in the local network Name Server object table.

Syntax

```
listname [to|over|after outpath]
```

Parameters

`to|over|after` *`outpath`*

Writes the output to the specified file rather than to the screen.

Additional Information

This command lists only objects cataloged on the local system, not on remote systems. The output can be directed to a terminal, a file, or a printer. The output has the form:

```
Name         Property  Unique PV_Type  Value

FSTSAP       00000H    NO     SIMPLE   10 00H
FCTSAP       00001H    NO     SIMPLE   11 00H
INARELNUM    00004H    NO     SIMPLE   03H
INANLNUM     00004H    NO     SIMPLE   01H
NSCOMMENGINE 00004H    NO     SIMPLE   FFH
TLCOMMENGINE 00004H    NO     SIMPLE   00H
```

The following entries depend on the number of subnets in the iNA 960 job. For example, there can be up to 4 MYHOSTID entries, 1 for each subnet, where xx varies from 01 to 03.

```
MYHOSTID     00004H    NO     SIMPLE   00 AA 00 02 57 86H
MYHOSTIDxx   00004H    NO     SIMPLE   00 AA 00 02 57 86H
INASUBNET    00004H    NO     SIMPLE   00 01H
INASUBNETxx  00004H    NO     SIMPLE   00 01H
```

The following entries are added by file servers from the */net/data* file. The BSMB2 entry is for the server in slot 0 and the BSSLOT2 entry is needed by the client in slot 2 (note that the last two digits of addresses in the Value column are the slot number for these entries).

```
RNETSRV      00004H    NO     SIMPLE   52 4E 45 54 53 52 56 00 AA 00H
                                       02 57 86H
BSMB2        00003H    YES    SIMPLE   0B 49 00 00 00 AA 00 02 57 86 FEH
                                       00 02 10 00H
BSMB2        00005H    YES    SIMPLE   00 AA 00 02 57 86 00H
BSMB2        00006H    YES    SIMPLE   0B 49 00 00 00 AA 00 02 57 86 FEH
                                       00 02 30 00H
BSSLOT2      00005H    YES    SIMPLE   00 01 00 AA 00 02 57 86 02H
NSDONE       00004H    NO     SIMPLE   52 4D 58 00 AA 00 02 57 86H
```

The following entry is for the client (file consumer), taken from the */net/data* file.

```
MYNAME00     00002H    NO     SIMPLE   72 6D 78H
```

In the object table, `Name` means the name of the object, such as the server name `BSMB2` in this example.

The `Property` column lists the property type, a numeric code that tells what kind of information is represented by the property value in the last column.

See also: Name Server property types, *Network User's and Reference Guide*

`Unique` indicates whether this combination of object name and property type are unique on the network. The fixed entries are not unique; the object table on every node in the network includes these objects. Other non-unique objects can be added to the object table through the programmatic interface. Non-unique objects are, in effect, local objects. Each computer can read the value of the object in its own object table, but it cannot access the object with that name on a remote node. The Name Server guarantees the uniqueness of any object entered through the Human Interface. Before it accepts a new object, it checks all the other object tables on the network for objects with the same name and property type.

`SIMPLE` in the `PV_Type` column means that the property value in the last column is a simple string, rather than a complex structure in which each element is an object, such as a mail list made up of network users. Structured property types are not supported in iNA 960/iRMX-NET.

The `Value` column is the property value, a field containing specific information about this object, usually based on the network address. For objects of property types 3, 6 and 8, the `Value` column contains the server's transport address. For objects of property type 5, that column contains the host-unique ID, combining the Ethernet address and a slot ID.

See also: **findname** and **setname** commands, in this chapter

Error Messages

`illegal option`

The option specified in the command must be `to`, `over`, or `after`.

`<pathname>, illegal path`

The pathname specified in the command line is longer than 255 characters.

load

Loads iNA 960 network software into memory on the network controller board and starts the controller running.

Syntax

```
load pathname
```

Parameter

pathname
The name of the file containing iNA bootable network software.

Additional Information

The iRMX-NET software loads the iNA boot software onto the network controller board during initialization, so the **load** utility is generally not needed on iRMX III systems. However, if iRMX-NET is unable to find the iNA file and cannot load the software, iRMX-NET initialization stops. iRMX continues to initialize, and you may then invoke the **load** command to load iNA and resume iRMX-NET operation.

The iNA file being loaded must be in a format as processed by the **xlate** utility. In previous releases of iNA 960, the **load** utility had the capability that **xlate** has; it could be used for translating an OMF86 file to the iNA boot file format. However, the **xlate** utility should now be used to perform the translating function, and the **load** utility should be used to load the LAN controller. Attempting to use the **load** utility to perform the translation function produces unpredictable results.

See also: Remote Booting and *ccinfo* file, *Network User's Guide and Reference*

loadname

Adds the names and addresses of network servers listed in a specified file to the local Name Server object table.

Syntax

```
loadname [pathname]
```

Parameter

pathname

The name of the file containing the list of network servers. The default file is *:sd:net/data*. If you specify another file, it must use the format defined for the */net/data* file.

Additional Information

The **loadname** command reads the names and addresses of objects from a file and enters them into the Name Server object table. A template file, */net/data.ex*, is provided with the iRMX-NET software. Copy the template file to *:sd:net/data* and edit it. You may instead copy the */net/data* file from a Unix or Xenix system that has an edited file containing required servers. To do this, use the **setname** command to specify the network address for the Unix system, then establish a connection to the system and copy the file.

See also: Chapter 11, *Network User's Guide and Reference*, for the format and syntax of the */net/data* file

When you invoke **loadname**, a message is displayed indicating the success or failure of loading each object. If a failure occurs, the message indicates the name of the object and the cause of the failure. After failing to enter an object, **loadname** continues entering other objects from the file. File lines that are invalid are ignored.

A server object only needs to be entered in the object table of one iRMX system to be accessible to the entire subnetwork. The system that contains the names and addresses of other systems is called the *spokesman* for those systems. If the system that executed the **loadname** command is shut down, the command must be reinvoked. The number of objects that can be loaded into a single system's Name Server object table is configurable; the default is 50.

Changes to the */net/data* file are not reflected on the network until the file is reloaded using the **loadname** command. If you intend to change a file loaded with **loadname**, you should first invoke the **unloadname** command to remove the objects from the name table. Then edit the file and reinvoke **loadname**. This ensures that only the current entries in the file are cataloged with the Name Server.

To display the entries loaded after invoking **loadname**, use the **listname** command.

See also: **setname** command, in this chapter

Error Messages

`<pathname>, illegal input file format`
The input format of the file is not correct. Check the contents of the input file and correct the format.

`<object_name>, syntax error. TYPE not found`
The entry in the input file for this object does not contain the keyword TYPE=. The entry is ignored and **loadname** processes the next entry.

`<object_name>, property type too long`
The property type or the system type field for this object is not in the correct format.

`<object_name>, not valid property type`
The system type field for this object does not contain a valid value for the property or system type.

`<object_name>, syntax error.  ADDRESS not found`
The entry for this object does not contain the keyword `ADDRESS`.

`<object_name>, value too long`
The transport address specified for this object is too long.

`<object_name>, illegal property value`
The transport address specified for this object contains invalid characters.

`<object_name>, name already exists`
The object name in the input file is already present on the network.

`<object_name>, illegal name`
The object name specified in the input file is more than 16 characters long.

`<object_name>, name table full`
The local object table is full. Each server specified in the input file occupies one entry in the object table. You can delete some objects from the object table or reconfigure the Name Server to increase the size of the table.

loadrmx

Loads the iRMX OS after DOS has booted. Use only with the DOSRMX OS. Invoke **rmxtsr** before **loadrmx**.

Syntax

```
loadrmx -n bootfile_name -s system_device [-f d|n|r]
      [-i init_file_name] [-w]
```

Parameters

`-n` Specifies the bootfile name; insert a space between `-n` and the name.

`bootfile_name`
Name of the iRMX bootfile.

`-s` Specifies the iRMX system device; insert a space between `-s` and the name.

`system_device`
Name of the iRMX system device. The system device may be a DOS-formatted drive (C_DOS, E_DOS, etc.), an iRMX-formatted drive (C_RMX or D_RMX), or a remote iRMX-NET file server. The device must have been set up correctly at installation time, with the correct iRMX OS directories and system files; otherwise the iRMX OS will not initialize properly.

See also: Device names, Appendix E

`-f` Specifies the file system type. Values and corresponding file system types are:

`d`	DOS partitions such as C_DOS
`n`	named iRMX partitions such as C_RMX
`r`	remote file systems using iRMX-NET The r option invokes network remote load operations and requires the EtherExpress 16 or EWENET module. The bootfile name parameter then specifies the remote load class code (hexadecimal class code nnnn encoded as CC_nnnn). See examples.

Insert a space between `-f` and the value. If you do not specify a file system, EDOS is the default.

`-i` Specifies the iRMX initialization file name; insert a space between `-i` and the name. If you do not specify `-i`, the default is *\rmx386\config\rmx.ini*.

`init_file_name`
Name of the iRMX initialization file. If not specified, the default is *:config:r?init*.

`-w` Wait for iRMX initialization to complete.

Additional Information

During the iRMX installation process, iRMX files are copied from the installation diskettes to the hard disk. That hard disk is known to the iRMX OS as the System Device and has the logical name *:sd:*. To load the iRMX OS, specify the physical device name of the system device.

Loadrmx delays DOS execution until RMX is fully initialized.

Any DOS application that requires resetting the system (such as **fdisk**) or reconfiguring CMOS RAM must be run prior to loading DOSRMX. Even if you have shut down DOSRMX, reset the system before running such software.

Load the iRMX OS before starting large applications, such as word processors, so that memory allocation, which is done by the iRMX OS, is adequate for the application. If you load the iRMX OS from within an application, the encapsulated DOS task will have only that amount of memory available at load time, even if you quit the DOS application.

Examples

1. To load the iRMX bootfile located in the DOS subdirectory *c:\dosrmx*, and to use the first iRMX partition on the first hard drive as the iRMX system device, enter:

   ```
   loadrmx -n C:\DOSRMX\bootfile_name -s C_RMX -f n <CR>
   ```

2. To load the iRMX bootfile located in the DOS subdirectory *c:\dosrmx*, and to use the primary DOS partition on the first hard drive as the iRMX system device, enter:

   ```
   loadrmx -n C:\DOSRMX\bootfile_name -s C_DOS -f DOS <CR>
   ```

   The two batch files in the *\dosrmx* directory, *rmx.bat* and *rmxnet.bat*, use the mechanism in this example. You can modify these batch files if you need to.

3. If you are in the *\dosrmx* directory, this command will default to loading the file *dosrmx* with the current DOS drive as the system device, and using the EDOS file driver:

   ```
   loadrmx <CR>
   ```

4. This command provides an example of a remote load invocation, where the name of the remote file system is `filesrv` and the remote load class code is `4003H`:

   ```
   loadrmx -n CC_4003 -s FILESRV -f r <CR>
   ```

Error Messages

`ERROR -->Boot file is not OMF-386 type, loading aborted.`
The Object Module Format (OMF) of the specified bootfile is not valid. The file's OMF header is not present or not correct. You specified the wrong file or the file has become corrupted.

`ERROR -->Exception interrupt error, loading aborted!`
BIOS error.

`ERROR -->file -n is empty`
The specified bootfile is empty (0 bytes). Use the DOS command **chkdsk** to scan your disk, then reinstall your iRMX bootfile.

`ERROR -->file -n is too short!!`
The specified bootfile must be greater than 75 bytes to be a valid OMF bootfile. You specified the wrong file or the file has become corrupted.

`ERROR -->Gate Address A20 Failed, cannot run iRMX.`
Cannot access memory above 1 Megabyte, or BIOS error.

`ERROR -->iRMX Interface TSR is not present.`
Invoke **rmxtsr** before using **loadrmx**.

`ERROR -->iRMX Operating System is present in memory, cannot overload.`
The iRMX OS is already loaded. You cannot load more than one bootfile at any one time. Reboot the system, then invoke **rmxtsr** before using **loadrmx**.

`ERROR -->Memory configuration error; cannot load iRMX.`
The reported memory size was either less than 0 or greater than 640K.

`ERROR -->No extended memory present; cannot load iRMX.`
Loadrmx loads the specified bootfile into extended memory and requires at least 1.5 Megabytes. If insufficient extended memory is present, the iRMX OS cannot load.

`ERROR -->Can't allow iRMX to load below 1MB, loading aborted`
The specified bootfile does not contain code to load the iRMX OS in extended memory. The bootfile is probably a regular iRMX III bootfile without the DOSRMX enhancement.

`ERROR -->Protected mode software already loaded.`
Loadrmx has detected that the microprocessor is running in Protected mode. Products that use Protected mode services cannot be used with DOSRMX.

Determine what DOS application program or utility is using Protected mode services, remove it from *config.sys* (or wherever it is being invoked), reboot the system, then invoke **loadrmx**.

`ERROR -->RAM parity error, loading aborted!`
BIOS reported a parity error.

`ERROR -->Target file read error.`
The file may have been corrupted.

```
ERROR -->Unable to open file: <filename>
```
The specified bootfile is not in the specified directory. Invoke **loadrmx** again and specify the correct drive, directory, filename, and extension of the bootfile.

```
ERROR -->Unknown error from BIOS, loading aborted!
```
Run the system tests for your system.

```
***WARNING***Available Extended memory is less than 2 megabytes.
```
There is less than 2 Mbytes of extended memory in your system. The requested bootfile will load and the iRMX OS may run, depending upon how much memory is available. Some tools, application programs, compilers, etc. may not execute because insufficient memory is available.

```
***WARNING***PC junior Not supported.
```
The platform is a PC Junior. **Loadrmx** will attempt to load the bootfile but will return an error and abort.

```
***WARNING***PC Not supported.
```
The platform is not a supported PC. **Loadrmx** will not attempt to load the bootfile.

```
***WARNING***PC/XT 8088 base Not supported.
```
The platform is an 8088-based PC. **Loadrmx** will not attempt to load the bootfile.

```
***WARNING***PS/2 Model 30 Not supported.
```
The platform is a PS/2 Model 30. **Loadrmx** will not attempt to load the bootfile.

```
***WARNING***Unknown PC Not supported.
```
The platform is not an Intel386, Intel486™, or Pentium microprocessor-based PC. **Loadrmx** will not attempt to load the bootfile.

```
***WARNING***Unknown system type, loading aborted.
```
The platform is not compatible. **Loadrmx** will not attempt to load the bootfile.

locdata

Transforms a data stream, such as a physically attached RAM disk, into a located data file (a file that identifies the absolute memory address where the Bootstrap Loader loads the file). You then use the **addloc** command to integrate the located data into an existing application system.

Note
You can use this command in an esubmit file or **rq_c_send_command** system call if the form of the command does not require user input. If the command requires user input in an **rq_c_send_command** system call, it will fail. However, you can use a form of the command that requires user input in an esubmit file if you use the `eoresponse` and `coresponse` subcommands.

See also: **esubmit** command, in this chapter

Syntax

```
locdata inpath to|over outpath address=value
```

Parameters

inpath
The logical name of the physically attached RAM disk. Multiple or wildcard pathnames are not allowed.

`to|over` *outpath*
Pathname of the file to receive the output of **locdata**. Multiple or wildcard pathnames are not allowed. Specifying `to` guards against overwriting an existing file. If you receive a message that the file exists, enter `Y` or `R` to overwrite the file, or `N` or `E` (exit) to exit the **locdata** command and preserve the existing file.

`address=`*value*
The address at which the Bootstrap Loader is to load the data stream (for example, the address of a RAM disk). The address must specify a WORD boundary. Be careful not to assign an address that overlays any part of the system or the third stage of the Bootstrap Loader. By default, the value is decimal, but you may specify octal or hexadecimal by appending an O or H.

Additional Information

The **locdata** and **addloc** commands can be used together to create an application that automatically loads part of itself into a RAM disk when the system boots. Generally, to use a RAM disk you configure a system with an area of RAM dedicated to the RAM disk. When the system boots, you attach the RAM disk memory to your system, format it, and move data into and out of it just as you would with any other secondary storage device.

If you want to use a RAM disk to store part of the application system (for instance, the HI commands), the stored data must be available in the RAM disk area when the system boots. This data cannot be copied into the RAM disk until you have configured the application system into a bootable file, because the RAM disk area doesn't exist until you define it through the configuration process. Therefore, you must integrate a copy of a RAM disk data structure into an existing application system boot file.

Using the address assigned to the RAM disk during the configuration process, **locdata** creates a located data file containing the image of the RAM disk. (A located file is a file that specifies the starting address at which it is to be loaded by the Bootstrap Loader.) **Addloc** integrates the located data file with an existing application boot file, creating a file that contains a new bootloadable version of the application system. When this new file is booted, the RAM disk data structure is loaded into memory in the area defined for the RAM disk during configuration.

You own and have full access to any remote files created by the **locdata** command. (Read, append, and update access permissions constitute full access for remote files.)

Example

To create an application system with a RAM disk that is initialized by the Bootstrap Loader, perform these steps:

1. Configure a version of the OS that includes a RAM disk. Make a special note of the starting address you specify for the device.

   See also: *ICU User's Guide*

2. Bootstrap load this new version of the OS.

3. Attach the RAM disk as a named device. For example:

   ```
   attachdevice RAM AS :r: <CR>
   ```

4. Format the RAM disk as a named file. For example:

   ```
   format :r: <CR>
   ```

5. Create a directory structure on the RAM disk and copy the files that you need, such as the HI commands, to the appropriate directory. An error message is displayed if you run out of room on the RAM disk.

6. Detach the RAM disk. For example:

```
detachdevice :r: <CR>
```

7. Attach the RAM disk as a physical device. This allows you to access all the data in the device, including the formatting information. For example:

```
attachdevice RAM AS :r: physical  <CR>
```

8. Use the **locdata** command to process the information from the RAM disk and place the output in a file on the hard disk. Use the RAM disk starting address (specified during configuration) as the value for the address parameter. If you configured the RAM disk to have a base address of 0100000H, this example applies:

```
locdata :r: to commands address = 0100000H <CR>
```

9. Use the **addloc** command to add the processed output (the *commands* file) to the file that contains the bootstrap loadable version of the OS. For example:

```
addloc commands, RMX86.286 to /boot/RAMdisk.286  <CR>
```

   The processed output file of the **locdata** command (the *commands* file) is combined with a bootloadable file (*RMX86.286*) to produce a new bootloadable file (*RAMdisk.286*). The **addloc** process generates a print file (*RAMdisk.mpa*).

10. Create a Bootstrap Loader third stage for the new bootable file. For example:

```
copy /system/RMX86 to /boot/RAMdisk  <CR>
```

When you bootstrap load this new version of the OS, the RAM disk contains the commands and files copied to it during Step 5.

Error Messages

`<pathname>, is a keyword not a file name`
: One of the pathnames you specified was a command keyword, not a file.

`locdata, one input file only`
: **Locdata** requires one input file; you specified more than one.

`locdata, one output file only`
: **Locdata** requires one output file; you specified more than one.

`after, is an illegal preposition for locdata`
: The `after` preposition is not a legal **locdata** parameter.

`<string>, illegal preposition`
: The preposition you entered is not a legal **locdata** parameter.

`locdata, address parameter is missing`
: You omitted the address parameter in the invocation line.

`locdata address value is missing`
: You omitted the address value in the invocation line.

`locdata, no more than one address value`
: You entered more than one address value in the invocation line.

`locdata, illegal address value`
: The address value you specified is not within the range of 0 to 0FFFFFFH.

`<pathname>, output file same as input file`
: **Locdata** does not allow the same name for both the input and output files.

`<pathname>, write error`
: A system error caused an incorrect number of bytes to be written to the output file. Retry the command.

`<pathname>, physical address exceeded 16M bytes`
: The base address added to the size of the input file you specified exceeds 16 Mbytes (this is for iRMX II systems only).

`<pathname>, read error`
: A system error caused an incorrect number of bytes to be read from the input file. Retry the command.

lock

Locks the terminal(s) after the current interactive job is deleted; cannot be used for virtual terminals.

Syntax

```
lock [terminal_name_list|*]
```

Parameters

terminal_name_list
One or more physical device names of the terminals to be locked. Multiple names must be separated with commas. To display the terminal device names, invoke the **initstatus** command.

* Specifies that all configured terminals should be locked.

Additional Information

The lock takes effect as soon as there is no interactive job on the terminal. **Lock** prevents the HI from re-creating an interactive job or issuing a logon prompt once the current interactive job is deleted. As a result, users cannot access the HI through that terminal.

One use of the **lock** command (in conjunction with **connect**) is to take the terminal off-line for use with a modem. Note your terminal's attributes before changing them for modem use; you must restore them before the HI can use the terminal.

The Super user can lock any terminal; other users can lock only those terminals whose interactive jobs have the same user ID as their own.

The system manager can use the **lock** command followed by a **jobdelete** command either to selectively delete users from the system or to shut down the entire system. Interactive jobs are deleted with the **jobdelete** or the **logoff** command.

This message is displayed on each locked terminal as the lock takes effect:

```
Terminal is now locked and unavailable for use
```

As each terminal is locked, this message is displayed at the terminal where **lock** was invoked:

```
locked
<terminal_name>, locked
```

See also: Terminals, *System Configuration and Administration*

Error Messages

`lock not allowed`
: You attempted to lock your own terminal, which can only be done by the Super user.

`<terminal_name>, not found`
: No terminal with the indicated name is configured into your application system.

`<terminal_name>, already locked`
: The indicated terminal is already locked.

`not a multi-user system`
: The **lock** command does not function if the HI is configured as a single-user system.

logicalnames

Lists all the current logical names available to the user, including local and remote names.

Syntax

```
logicalnames [to|over|after outpath] [f|s|l[ r]] [u|sy]
```

Parameters

`to|over|after` *`outpath`*
Writes the output to the specified file rather than to the screen.

`f(ast)` Lists the logical names without any additional information. This is the default.

`s(hort)` Lists logical names along with their type, the physical device name, the current connections, and the owner.

`l(ong)` In addition to the information displayed by `short`, lists the complete pathname associated with each logical name.

`r(oot)` If specified with `long`, displays the pathname beginning at the root device.

`u(ser)` Lists only the logical names associated with the current user.

`sy(stem)`
Lists only the logical names of system-defined files and devices.

Additional Information

You own and have full access to output files created by the **logicalnames** command, including any remote files.

When invoked with the `long` or `short` parameter, **logicalnames** displays these abbreviations for the standard file driver names:

Named file driver:	NAM
DOS file driver	DOS
EDOS file driver	EDOS
Physical file driver	PHYS
Stream file driver	STR
iRMX-NET Remote file driver REM	
NFS file driver	NFS

Logicalnames also displays the loadable file driver names.

Without any parameters, **logicalnames** displays the logical names defined by the user and by the system. In this (`fast`) type of display, asterisks are shown beside logical names that refer to a device. Logical names without an asterisk refer to files.

Example

This example shows the output listing when you use the `long` parameter. Items in the example are described below it. This listing is the same as a `short` listing, with the addition of the `pathname` column.

```
User Logical Names:
  name     type  fdvr   con    dev name      owner   pathname
PROG       dir   EDOS    2     C_DOS         WORLD   :$:PROG
TERM       file  PHYS    5     T1                    :TERM:
$          dir   NAM     3     scw_0p2       WORLD   :$:
CI         file  PHYS    5     T1                    :CI:
CO         file  PHYS    5     T1                    :CO:
HOME       dir   EDOS    3     C_DOS         WORLD   :SD:user/world
REMOTE1    file  REM     0     server1       WORLD   :REMSYS:SD/remote1

       System Logical Names:
  name     type  fdvr   con    dev name      owner   pathname
SYSTEM     dir   EDOS    1     C_DOS         #0      :SD:sys386
WORK       dir   EDOS    1     C_DOS         WORLD   :SD:work
SD         ldev  EDOS    1     C_DOS         #0      :SD:
BB         ldev  PHYS          BB            #0      :BB:
STREAM     ldev  STR     1     STREAM        #0      :STREAM:
REMSYS     ldev  REM     0     server1       WORLD   :REMSYS:
W          ldev  NAM     1     scw_0p2       #0      :w:
```

Where:

`type`	Specifies the kind of logical name: `file`, `dir` (directory), `map` (system file), or `ldev` (logical device).
`fdvr`	File driver: Specifies the abbreviation for the named, physical, stream, remote, EDOS, DOS, NFS, or loaded file driver.
`con`	The number of connections a file or device has. For remote files the `con` field always contains a 0.
`dev name`	The physical device name associated with the logical name. In the case of a directory or file, the name shows on what device the file or directory exists.
`owner`	The originator of the connection to the logical name.
`pathname`	The pathname of the logical name.

When you specify the `root` parameter with the `long` parameter, the pathname is displayed beginning from the root device. If the displayed pathname has ellipses before it (*.../user/dir1/dir2/dir3/filename*), **logicalnames** truncates the pathname because it is too long to fit in its column; only the last elements are shown.

logoff

Logs the user off of a dynamic terminal and frees the terminal for use by other operators.

Syntax

```
logoff
```

Additional Information

Logoff also deletes the user's interactive job, executes the *:prog:r?logoff* file, and issues a new logon prompt (if the terminal has not been locked). If there are any active background jobs when you invoke **logoff**, you receive the message:

```
background jobs are running, do you want to exit ?
([n] or y)
```

If you respond with `Y`, your background jobs are canceled and you are logged off.

If you use the CLI, this is an internal CLI command. It is also supplied as an HI command for systems that use a custom interface. Regardless of whether you use the CLI, invoking `:system:logoff` invokes the HI command. The HI version of the command does not check for the existence of background jobs.

On static terminals, **logoff** simply terminates the session and restarts a new session for the same user, unless the terminal has been locked.

See also: Dynamic and Static Terminals, *System Configuration and Administration*

Error Messages

`:prog:r?logoff, file does not exist`

The CLI could not find the logoff file. This message is only a warning, not an error; **logoff** completes successfully.

`<parameter>, unexpected parameter`

You entered a parameter; **logoff** does not accept any parameters.

make (mk)

Automates the creation of large programs.

Syntax

`make [`*`option`*`] [`*`macdef`*`] [`*`target`*`]`

Parameters

`option`

One or more switches that modify program operation.

> ⇒ **Note**
>
> Many of these switches produce status codes, warnings, or errors:
>
> - Status codes provide useful information.
> - Warnings provide vital information that may affect programming decisions. However, warnings will not stop the creation of object files.
> - Errors are fatal to the compilation process and stop the creation of object files.

`-i`	Ignores iRMX errors.
`-w`	System exits when it receives a warning from iRMX tools.
`-n`	Displays commands but does not execute them.
`-p`	Prints the complete set of macro definitions and dependency lines in a makefile.
`-q`	Returns an iRMX status code based on the updated file.
`-r`	Ignores the built-in rules.
`-e`	Specifies that environment variables override makefile assignments.
`-f filename`	Specifies the name of the makefile. For filenames, you must supply a full path name if the file is not in the current directory.
`-s`	Executes makefile commands without displaying them.
`-t`	Changes the modification date of each target file without recreating the files. This is similar to the **touch** command, where the date is made current so that the object files are not unnecessarily created again.
`-u`	Forces an update.

`-?`	Requests help messages for various switches and version information for this command.
`-d[dd]`	DEBUG makefile. Each `d` (up to three) provides more information.
See also:	Additional Information section of this command for information on macros, dependencies, built-in rules, environment variables, and commands

`macdef`

A macro definition that provides value or meaning to a macro.

See also: Using Macros section of this command

`target`

Name of a file to be updated. Must correspond to one of the target names in the makefile. **Make** processes target names from the command line from left to right.

Additional Information

The **make** command helps you to quickly create makefiles and object files without leaving the iRMX OS. **Make** reads commands from a user-defined makefile that lists the files to be created, the commands that create the files, and the files from which they are created. This command is similar to the Unix **make** command.

When you use the **make** command to create a program, it ensures that each file on which the program depends is up-to-date. If necessary, it then creates the program by executing the given commands in the makefile. If a file is not up-to-date, **make** updates it before creating the program by executing explicitly given commands or one of the many built-in commands.

See also: Using Built-in Rules section of this command

Creating a Makefile

A makefile contains dependency lines, command lines, and comments. A dependency line shows how a given file depends on other files and what commands are required to bring a file up-to-date. You can add comments as notes for the programmer or anyone reading the makefile.

Keep the makefile in the same directory as the given source files. The filename *makefile* is provided as the default filename if you do not give an explicit name at invocation.

Dependencies

A dependency line lists the filename, its dependencies, and commands using this form:

```
target ... :[dependent ...]
     [ command ...]
```

where `target` is the name of a file to be updated, `dependent` is the name of a file on which the target depends, and `command` is the iRMX command needed to create the target file. The command line(s) should be on a newline, and should begin at the first tab stop. If a dependency line is too long, you can continue it by typing a backslash (\) immediately followed by a newline.

You can give more than one target name or dependent name if desired. Separate each name from the next by at least one space. Separate the target names from the dependent names by a colon (:). Filenames must follow iRMX naming conventions.

See also: iRMX file-naming conventions, in Chapter 1

⇒ **Note**
Names are case-sensitive within a makefile.

Commands

You can give a sequence of commands on lines following the target by beginning each line with a tab character. Specify commands exactly as they would appear on an iRMX command line. Use the ampersand character (&) in front of a command to prevent **make** from displaying the command before executing it.

Comments

You can add a comment to a makefile by starting the comment with a pound sign (#) and ending it with a newline. All characters after the pound sign are ignored.

Example

A program named *test* is made by linking three object files, *x.obj*, *y.obj* and *z.obj*. These object files are created by compiling the C language source files *x.c*, *y.c*, and *z.c*. Furthermore, the files *x.c* and *y.c* contain the line:

```
#include <defs>
```

This means *test* depends on the three object files, the object files depend on the C source files, and two of the source files depend on the include file *`defs`*.

Here is a makefile representing these relationships:

```
test: x.obj y.obj z.obj
   $(BND) $(CSTART), &
   x.obj, y.obj, z.obj, &
   $(SD)intel/lib/cifc32.lib, &
   $(SD)RMX386/lib/rmxifc32.lib &
   renameseg(code32 to code) &
   segsize(stack(+8192)) rc(dm(10000,5000000)) &
   object($@) $(DEBUG) $(TYPE)

x.obj: x.c defs
   $(CC) $*.C $(CFLAGS)

y.obj: y.c defs
   $(CC) $*.C $(CFLAGS)

z.obj: z.c
   $(CC) $*.C $(CFLAGS)
```

In the first dependency line, *test* is the target file and *x.obj*, *y.obj*, and *z.obj* are its dependents. This is the command sequence:

```
$(BND) $(CSTART), &
   x.obj, y.obj, z.obj, &
   $(SD)intel/lib/cifcf32.lib, &
   $(SD)RMX386/lib/rmxifc32.lib &
   renameseg(code32 to code) &
   segsize(stack(+8192)) rc(dm(10000,5000000)) &
   object($@) $(DEBUG) $(TYPE)
```

The next line tells how to create *test* if it is out-of-date. The program is out-of-date if any one of its dependents has been modified since *test* was last created.

The second, third, and fourth dependency lines have the same form, with the *x.obj*, *y.obj*, and *z.obj* files as targets and *x.c*, *y.c*, *z.c*, and *defs* files as dependents. Each dependency line has one command sequence that defines how to update the given target file.

Specifying a Makefile

This example **make** command reads the dependency lines of the makefile named *maketest* found in the current directory:

```
   mk -f maketest
```

You can direct **make** to read dependency lines from the standard input by giving a hyphen (-) as the filename. **Make** will read the *stdin* until an end-of-file is encountered (Ctrl-Z if *stdin* is the console).

If you specify only a target on the command line and no makefile is present, **make** will attempt to create the target using only built-in rules. This is especially useful for small, single-module programs.

Updating Makefiles

When you invoke **make**, you can update and modify one or more target files in the directory. You can also direct **make** to update the first target file in the makefile by typing just the command **make**. In this case, **make** searches for the makefile in the current directory.

For example, assume that the current makefile contains the dependency lines given in the last section. This command compares the modification dates of the *test* program and each of the object files *x.obj*, *y.obj*, and *z.obj* and recreates *test* if any changes have been made to any object files since *test* was last created:

```
mk
```

It also compares the modified dates of the object files with those of the four source files, *x.c*, *y.c*, *z.c*, and *defs*, and recreates the object files if the source files have changed. It does this before recreating *test* so that the recreated object files can be used to recreate *test*. If none of the source or object files has been altered since the last time *test* was made, **make** stops and all files are unchanged.

You can direct **make** to update a given target file by giving the filename of the target. For example, this command causes **make** to recompile, creating the *x.obj* files if the *x.c* or *defs* files have changed since the object file was last created:

```
mk x.obj
```

Similarly, this command causes **make** to recompile, creating *x.obj* and *z.obj* if the corresponding dependents have been modified:

```
mk x.obj z.obj
```

Using Pseudo-target Names

You can include dependency lines that have pseudo-target names, i.e., names for which no files actually exist or are produced. Pseudo-target names allow **make** to perform tasks and execute iRMX commands not directly connected with the creation of a program, such as deleting old files or printing copies of source files. For example, this dependency line removes old copies of the given object files when the pseudo-target name `cleanup` is given in the invocation of **make**.

```
cleanup:
    delete x.obj
    delete y.obj
    delete z.obj
```

Since no file exists for a given pseudo-target name, the target is always assumed to be out-of-date. Thus the associated series of commands are always executed.

This command causes the creation of *makefile.new* which will have a dynamically created dependency section formed by the **mkdep** command:

```
depend:
    copy makefile over makefile.new
    mkdep -p -f makefile.new -i $(CDIR) \
    mkdep.c $(SRC)
```

See also: **mkdep** command

Make also has built-in pseudo-target names that modify its operation.

The pseudo-target name `.IGNORE` causes **make** to ignore errors during execution of commands, allowing **make** to continue after an error. This is the same as the `-i` option. **Make** also ignores errors for a given command if the command string begins with a hyphen (-). To cause **make** to stop on warnings, the pseudo-target name `.WARNING` has the same effect as the `-w` option.

The pseudo-target name `.PRECIOUS` prevents dependents of the current target from being deleted when **make** is terminated by an error condition or user-input <Ctrl-C>.

The pseudo-target name `.SILENT` has the same effect as the `-s` option.

Using Macros

A makefile can contain macros. A macro is a short name that represents a filename or command option. The macros can be defined when you invoke **make** or in the makefile itself.

In a macro, the name (a string of letters and digits) to the left of the equal sign is assigned the string of characters following the equal sign. Except where noted under concatenated macro definitions, leading blanks and tabs on both sides of the operator are ignored (on both sides of the equal sign, leading blanks and tabs are stripped).

The macro definition templates shown differ only in the operator they contain (=,+= or :=). The operator distinguishes these three types of **make** macros:

```
NAME = [value]      #standard macro definition
```

Defines a standard macro, where the value of the macro is the `value` string, which can contain other macros.

```
NAME += [value]     #concatenated macro definition
```

Defines a concatenated macro, where the value of the macro is the concatenation of its current value and `value`. If you omit whitespace after the operator in the definition, **make** pastes the concatenated value immediately after the current value; otherwise **make** converts any whitespace to a single space between current and concatenated values.

```
NAME :=  [value]    #immediate macro definition
```

Defines an immediate macro, where all macros in `value` are expanded and the expanded line is the value of the macro.

These examples are valid macro definitions:

```
CFLAGS = optimize(3) debug
LIBS =
```

The last definition assigns `LIBS` the null string. A macro that is never explicitly defined has the null string as its value.

Invoking Macros

Invoke a macro by preceding the name with a dollar sign $; place macro names longer than one character in parentheses () or braces `{}`. The name of the macro is either the single character after the dollar sign or a name inside parentheses or braces. These are valid macro invocations:

```
$(CFLAGS) $(xy) $Z ${Z}
```

The invocations `$Z` and `${Z}` are identical.

Including a Standard Macro Definition in a Command Line

A macro definition argument has the same form as a macro definition in a makefile. Macros in a command line override corresponding definitions found in the makefile. For example, this command assigns the value `internal` to `RELEASE`:

```
mk RELEASE=internal
```

All environment variables are preloaded as macros before reading the makefile. If the `-e` switch is set, the environment variables override the makefile.

Using Built-in Macros

Make has built-in macros that you can use when writing dependency lines:

`$@`	Contains the full pathname of the current target. It may be used in dependency lines with user-defined target names.
`$*`	Contains the name of the current target with the suffix removed. Thus if the current target is *test.obj*, *$** contains *test*. It may be used in dependency lines that redefine the built-in rules.
`$?`	The value is the list of prerequisites newer than the target.
`$-`	Contains the filename of the dependent that is more recent than the given target.
`$(@D)`, `$(@F)`, `$(<D)`, `$(<F)`, `$(*D)`, `$(*F)`, `$(-D)`, `$(-F)`	These macros get directory and file portions of the respective macros above.
`$(MAKE)`	By default, the value of this macro is the name with which **make** was invoked, but you can change it. Using this macro on any operation line overrides the `/n` no execute control. This is useful in debugging makefiles that invoke **make** recursively.
`$(MAKEVERSION)`	This macro is the version of **make**.
`$(MFLAGS)` `$(MAKEFLAGS)`	This macro specifies the options that **make** starts with. **Make** fills this macro with all options supplied, so you can use them to pass along options when invoking **make** recursively.
`$(STATUS)`	**Make** fills this macro with the return code of operation lines that contain the ignore prefix (-).

Make supports a macro substitution feature:

```
$(macro:old_suffix=new_suffix)
```

This is used as follows:

```
SRC = x.c y.c z.c
OBJS = $(SRC:.c=.obj)         OBJS is now  x.obj y.obj z.obj
OBJLIST = $(SRC:.c=.obj,)     OBJLIST is now x.obj,y.obj,z.obj
```

vpath: Search Path for All Dependencies

The value of the **make** variable *`vpath`* specifies a list of directories that **make** should search. Dependency files are usually in the current directory, but if a file that is listed as a dependency does not exist in the current directory, **make** searches the directories listed in *`vpath`* for a file with that name. The first occurrence of that file is then used as the dependency.

The *`vpath`* variable is a list of directory paths separated by colons. Because the paths are colon-separated, iRMX logical names cannot be used.

For example, this command specifies two directory paths that **make** sequentially searches if it cannot find dependency files in the current directory:

```
vpath = intel/ic386/inc:/rmx386/demo/c/intro
```

Using Environment Variables

Make provides access to current values of the environment variables. **Make** automatically assigns the value of each environment variable to a macro of the same name. You can access a variable's value in the same way that you access the value of explicitly defined macros. For example, in this dependency line, `$(SOURCE)` will have the same value as the user's SOURCE variable (assuming the user has defined the variable `SOURCE`):

```
test:
    $(CC) $(SOURCE)/x.c
```

Make assigns the environment variable before it assigns values to the user-specified macros. Thus, you can override the value of an environment variable by explicitly assigning a value to the corresponding macro. For example, this macro definition causes **make** to ignore the current value of the `SOURCE` variable and use */usr/pub* instead:

```
SOURCE=/usr/pub
```

For another example of changing environment variables, if you add this line to the *:config:r?env* file, **make** will break to an AEDIT window if an error occurs during compilation:

```
EDITOR = AEDIT
```

The precedence of **make** macros is determined by where they are defined. You can redefine an existing macro (i.e., change its value) if the redefinition has precedence at least as high as the existing definition. This is the default precedence of macro definitions:

- Invocation command definition (highest)
- Description file definition
- Macros predefined by **make**
- Environment definition (lowest)

The `-e` environment control causes environment definitions to have higher precedence than makefile definitions (but lower precedence than **make** invocation command definitions) for a particular invocation of **make**.

Note
Some systems upper-case the name of an environment variable while the value of the variable retains its case as specified in the variable's definition. It is therefore recommended that all macro names be in uppercase.

Using the Built-in Rules

Make provides a set of built-in dependency lines, called built-in rules, that automatically check the targets and dependents given in a makefile and create up-to-date versions of these files if necessary. The built-in rules are identical to user-defined dependency lines except that they use the suffix of the filename as the target or dependent instead of the filename itself. For example, **make** can automatically assume that all files with the suffix *.obj* have dependent files with the suffix *.c*.

When no explicit dependency line is given in a makefile for a given file, **make** automatically checks the default dependents of the file, forming the name of the dependents by removing the suffix of the given file and appending the pre-defined dependent suffixes. If the given file is out-of-date with respect to these default dependents, **make** searches for a built-in rule that defines how to create an up-to-date version of the file and executes it.

There are built-in rules for these files:

`.obj`	Object file
`.c`	C source file
`.p38`	PLM386 source file
`.plm`	PLM386 source file
`.a38`	ASM386 source file
`.asm`	ASM386 source file

For example, if the file *x.obj* is needed and there is an *x.c* in the description or directory, *x.c* is compiled.

The built-in rules are designed to reduce the size of your makefile. They provide the rules for creating common files from typical dependents.

Reconsider the example given in Creating a Makefile. In this example, the program test depended on three object files, *x.obj*, *y.obj*, and *z.obj*. The files *x.c* and *y.c* also depended on the include file *defs*. In the original example, each dependency and corresponding command sequence was explicitly given. Many of these dependency and command lines were unnecessary, since the built-in rules could have been used instead.

This is all that is needed to show the relationships between these files:

```
test: x.obj y.obj z.obj
   $(BND) $(CSTART), $(@).obj, &
   $(SD)intel/lib/cifc32.lib, &
   $(SD)RMX386/lib/rmxifc32.lib &
   renameseg(code32 to code) $(TYPE) &
   segsize(stack(+8192))
   rc(dm(10000,500000)) object($@) $(DEBUG)
x.obj y.obj: defs
```

In this makefile, *test* depends on three object files, and an explicit command is given showing how to update *test*. However, the second line merely shows that two object files depend on the include file *defs*. No explicit command sequence is given on how to update these files if necessary. Instead, **make** uses the built-in rules to locate the desired C source files, compile these files, and create the necessary object files.

Changing the Built-in Rules

You can change the built-in rules by redefining the macros used in these lines. You can display a complete list of the built-in rules and the macros used in the rules by typing:

```
mk -p
```

The macros of the built-in dependency lines define the names and options of the compilers, assemblers, and other programs invoked by the built-in commands. **Make** automatically assigns a default value to these macros when you start the program. You can change the values by redefining the macro in your makefile. For example, this built-in rule contains two macros, `CC` and `CFLAGS`.

```
.c.obj:
   $(CC) $*.C $(CFLAGS)
```

You can redefine any of these macros by placing the appropriate macro definition at the beginning of the makefile. You may create your own built-in rule in your makefile. A built-in rule has the form:

```
suffix-rule :
   command
```

where `suffix-rule` is a combination of suffixes showing the relationships of the implied target and dependent, and `command` is the iRMX command required to carry our the rule. If more than one command is needed, they are given on separate lines.

For a complete list of built-in rules, check:

```
:lang:builtins.mk
```

A pair of suffixes indicates a rule that makes one file from the other. For example, *.c.obj* is the rule that creates an object file (*.obj*) from a corresponding C source file (.c).

If necessary, you can create new `suffix-rules` by adding a list of new suffixes to a makefile with `.SUFFIXES:` this pseudo-target name defines the suffixes that may be used to make `suffix-rules` for the built-in rules. The line has the form:

```
.SUFFIXES: suffix ...
```

where `suffix` is usually a lower-case letter preceded by a dot (.). If more than one suffix is given, you must use spaces to separate them.

The order of the suffixes is significant. Each suffix is a dependent of the suffixes preceding it. For example, this suffix list causes *test.c* to be a dependent of *test.obj*, and *test.plm* to be a dependent of *test.c*:

```
.SUFFIXES: .obj .c .p38 .plm .a38 .asm
```

You can create new `suffix-rules` by combining dependent suffixes with the suffix of the intended target. The dependent suffix must appear first. If a `SUFFIXES` list appears more than once in a makefile, the suffixes are combined into a single list. If `SUFFIXES` is given but has no list, all suffixes are ignored.

Troubleshooting

Most difficulties in using **make** arise from its specific meaning of dependency. If the file `x.c` has the line:

```
#include <defs>
```

then the object file *x.obj* depends on defs; the source file *x.c* does not. If *defs* is changed, it is not necessary to do anything to the file *x.c*, while it is necessary to recreate *x.obj*. To determine which commands **make** will execute, without actually executing them, use the `-n` option. For example, this command prints out the commands **make** would normally execute without actually executing them:

```
mk -n
```

If a change to a file is absolutely certain to be benign (e.g., adding a new definition to an include file), the `-t` touch option can save a lot of time. Instead of issuing a large number of superfluous recompilations, **make** updates the modification times on the affected file. Thus, this command, which stands for touch silently, causes the relevant files to appear up-to-date:

```
mk -ts
```

here Documents

Make understands Unix-style *here* documents. This enables you to include data in the makefile that would normally need to be placed in a separate file, and makes the data available as the standard input of the command. <<- (strip leading tabs) and <<\word (quoting) modes are both supported. If quoting is not specified, then the data is subject to macro expansion, at the time of command execution.

```
date
EOF
/sys286/submit heredoc.000 to :bb: <<-\EOF
ed today.h
v/local/d
s/  local//
s/.*/static char xxxtime[] = "@(\#) Compiled: &";/
w
q
EOF
```

Error Messages

Make does not generate error messages. However, it does pass through any error messages generated by the iRMX tools it invokes.

memory

Displays the amount of memory currently allocated to the user, and the total system memory available to the user.

Syntax

```
memory [e]
```

Parameters

`e`	Also displays the total amount of initial and currently available system memory.

Additional Information

This is an example of the listing produced when you use the `e` parameter:

```
-memory  e <CR>
User Private Memory (pool minimum) :   300 k Bytes
Available Memory (Private + Shared): 1.545 M Bytes
Initial Available Shared System Memory: 13.99 M Bytes
Current Available Shared System Memory: 7.650 M Bytes
```

Where:

`User Private Memory`
: The amount of memory currently allocated to the user

`Available Memory`
: The amount of memory available for the user; that is, the private memory and the amount of memory the user job can borrow from parent jobs. For example, if the private memory is 300 Kbytes and the total memory is 1.545 Mbytes, as shown above, your interactive job can still borrow 1.245 Mbytes.

`Initial Available Shared System Memory`
: The amount of memory initially assigned to the Free Space Manager after the root job allocates its memory.

`Current Available Shared System Memory`
: The amount of memory currently available in the root job from the Free Space Manager.

mirror

Manages disk mirroring on a pair of matched hard disks. The **mirror** command provides several distinct functions and must be invoked once for each function desired. This command is supported in:

- iRMX III systems using Multibus I and II
- DOSRMX and iRMX for PCs systems using Multibus II
- DOSRMX and iRMX for PCs systems using a PC bus with an Adaptec 1542/1742 host adapter

Syntax

```
mirror create primary secondary
mirror setopt primary read alt|prim|sec
mirror resync primary p2s|s2p
mirror waitevent primary
mirror getstat primary
mirror attstat primary
mirror disable primary
```

Parameters

`create`
Creates a mirror set with a primary and secondary hard disk.

`primary`
Primary hard disk's logical name (for example, :w:).

`secondary`
Secondary hard disk's DUIB name (for example, M4380_3)

See also:	**physname** command, in this chapter device names, Appendix E

`setopt` Sets special options for the mirror set.

`read` Sets the read policy for the mirror set to one of the following:

`alt`	Reads are performed alternately from the primary and secondary hard disks. If `setopt` is not specified, this is the default.
`prim`	Reads are performed only from the primary hard disk.
`sec`	Reads are performed only from the secondary hard disk.

`resync` Enables disk mirroring on a mirror set and resynchronizes the set's hard disks while on-line. The direction of resynchronization is one of these:

`p2s`	Primary to secondary.
`s2p`	Secondary to primary.

`waitevent`
Waits for a disk mirroring event and returns when an event occurs.

`getstat`
Reports the mirroring status of a mirror set.

`attstat`
Reports the attachment status of a hard disk.

`disable`
Disables disk mirroring on a mirror set.

Additional Information

➡ **Note**
You cannot use this command with a device that you access through NFS.

Disk mirroring is a hard disk configuration that maintains identical copies (mirrors) of data on two disks for increased reliability. Disk mirroring requires you to create a mirror set: a pair of hard disks configured to write the same data to both disks, read data from alternate disks (by default), and perform error checking for read and write operations on the set.

A mirror set has a primary and secondary hard disk. The mirror set takes its name from the primary hard disk, and disk mirroring operations are directed at that disk. The primary hard disk must be already attached and is identified by a logical name, for example, *:sd:* or *:m:*. The secondary hard disk works together with the primary hard disk to do disk mirroring operations. The secondary hard disk is identified by its physical (DUIB) name. The secondary hard disk should be formatted, but detached.

To create a mirror set, use the **mirror** command with the `create` parameter. This creates a mirror set and specifies the primary and secondary hard disks in the set.

➡ **Note**
The two hard disks must have the same formatted capacity, device granularity and should be the same model type to ensure the same formatted disk capacity.

To set the read policy for a mirror set, use the **mirror** command with the `setopt` and `read` parameters. This determines whether data is read from one or both disks. By default, data is read alternately from the primary and secondary disk; this gives the best performance for multiple I/O requests.

To enable disk mirroring on a mirror set, use the **mirror** command with the `resync` parameter. This enables disk mirroring and causes on-line resynchronization to occur. The *`primary`* parameter specifies the mirror set name. Resynchronizing a mirror set involves copying data from one hard disk of the set to the other. The resynchronization direction is specified in the command. This command must be used only after a mirror set is created or after a rollover event (described later). During execution, the command ensures that the destination hard disk is a good hard disk. The resynchronization operation runs in the background and is done one track at a time. I/O system read and write operations are allowed on the mirror set while resynchronization is in progress. If an I/O system write is directed at the same disk address where the resynchronization is being performed, the driver delays the write operation. The write operation is resumed when the disk address no longer conflicts with the resynchronization address.

The **mirror** `resync` command returns with either a completion or abort status. Use the **mirror** command with the `waitevent` parameter to get the resynchronization status. Issue this command as a background job.

To get mirroring status for a mirror set, use the **mirror** command with the `getstat` parameter. The status information includes the state of the mirror set, the names of disks in the set, the name of the good hard disk after a rollover event, the error status, the error's address, whether resynchronization is in progress, and the percentage of resynchronization completed. This example shows a display of disk mirroring status:

```
State                  = Mirroring Enabled
Primary Unit           = M4380_2
Secondary Unit         = M4380_3
Read Policy            = Alternate Read
```

For a mirror set to be operational, the I/O system must successfully have attached the hard disk. To get the attachment status for a disk, use the **mirror** command with the `attstat` parameter. The status report contains such information as the name of the mirror set and the state of the disk when it was last detached. The incarnation number is a unique 9-digit number assigned at shutdown. This example shows a display during a shutdown when you request attachment status:

```
Mirror Attach Status   = Mirror Set Valid
Other Unit Name        = M4380_3
Incarnation Number     = XXXXXXXXX
Disk Status            = Marked Good
```

These events can occur for a mirror set: rollover, resynchronization complete, and resynchronization abort.

A rollover is an operation done by the device driver when a failure occurs on one disk in the set. All I/O is automatically directed to the surviving disk. After fixing the problem that caused the rollover, you must resynchronize the disks.

To get notification of an event, invoke the **mirror** command with the `waitevent` parameter, as a background job. The command returns only when an event occurs. After the command returns, you must reissue the command to continue event notification. An example of the message returned by `waitevent` is:

```
Mirror Event Status = rollover
```

When the command returns, use the **mirror** command with the `getstat` parameter to get more information about the mirror event.

To disable a mirror set, use the **mirror** command with the `disable` parameter. If resynchronization is in progress on the set, the resynchronization is aborted. All pending I/O operations on the mirror set are completed before mirroring is disabled.

See also:	Disk mirroring, Appendix A, for more detailed information and a tutorial

mkdep

Assists the **make** command in creating makefiles or appending dependencies to a given makefile.

Syntax

```
mkdep -?
```

`mkdep [-s] [-i `*`include_path`*`] [-f `*`filename`*`] `*`file`*` ...`

Parameters

`-?`	Displays the correct format of the command.
`-s`	Short form. Lists the dependencies from files in the current directory.
`-i` *`include_path`*	The path to the include files.
`-f` *`filename`*	Name of the output file (default is *makefile*).
`file` `...`	Files that contain dependencies.

Additional Information

This **mkdep** example:

```
mkdep -f mkfile x.c y.c
```

will either create a makefile named *mkfile* or it will append to a current filename *mkfile* these dependencies:

```
#DO NOT DELETE THIS LINE
#These dependencies came from mkdep
#If you place information here, it will go away
x.obj: x.c
y.obj: y.c
```

If the name *mkfile* is used in another **mkdep** call, the dependencies below the three comment lines will be deleted and replaced with the new dependency lines. To avoid this condition and append further dependency lines, either delete the comment lines or move the dependencies above the comment lines.

To use **mkdep** with a makefile, set up this structure in your makefile. If you call your makefile anything other than the default name *makefile*, be sure to include the `-f filename` in the **mkdep** line.

```
   depend:
      mkdep -i $(INC)\
      $(SRCDIR)check.c &
   $(SRCDIR)error.c
```

Then, running `make depend` will append this to the makefile:

```
#DO NOT DELETE THIS LINE
#These dependencies came from mkdep
#If you place information here, it will go away
src/check.obj:\
   src/check.c\
      :INCLUDE:stdio.h\
            :INCLUDE:reent.h\
                  :INCLUDE:locale.h\
            :INCLUDE:stdlib.h\
#  h.h
src/error.obj:\
   src/error.c\
      :INCLUDE:stdio.h\
            :INCLUDE:reent.h\
                  :INCLUDE:locale.h\
            :INCLUDE:stdlib.h\
      :INCLUDE:stdlib.h\
      :INCLUDE:rmxerr.h\
```

modcdf

A menu-driven utility that displays, adds, or deletes information about network client systems in the Client Definition File (CDF). Only the Super user can use **modcdf.**

Syntax

```
modcdf
```

Additional Information

The **modcdf** utility allows the system manager of an Administrative Unit (AU, or subnetwork) to add and delete iRMX client systems from the Client Definition File (CDF) of a server. The name and password of an iRMX client are defined in the User Administration configuration source file or the CDF screen of ICU. The client name is limited to eight characters.

When you invoke **modcdf**, this message is displayed:

```
The following commands are available

    A  -         Add a client
    D  -         Delete a client
    L  -         List the CDF
    Q  -         Quit
    E  -         Exit

Enter the command:
```

To add a client system, enter `A`. The utility prompts for the client's name and password. The name and password are both case-sensitive. The name of the client must be unique within the CDF; a client with the same name must not be already defined. The password you enter is not echoed to the screen.

To delete a client system, enter `D`. The **modcdf** utility prompts for the name of the client to be deleted from the CDF. The name is case-sensitive.

Enter `L` to display the contents of the CDF.

Enter `Q` to quit without updating the CDF. Any changes made during the current session are lost.

Enter `E` to exit the utility and save changes made during the current session.

Error Messages

`invalid command`
The command is not recognized.

`cannot add a client name to the CDF which exceeds 8 characters`

`in length.`

The specified client name exceeds the maximum length of eight characters.

`invalid password`

The second password entered while adding a client does not match the first.

`client <name> is not defined in the CDF`

The name specified for deletion does not exist in the CDF.

`CDF is not in the proper format.  Delete the CDF and start again.`

Improper format for the CDF file was used. This might be a line terminated by a carriage-return/line-feed rather than just with a line-feed.

`The CDF is too big to add a new client.`

The CDF has a 5000-byte buffer maximum. Adding the specified new client would exceed the buffer maximum.

`client <name> is already defined in the CDF`

The client being added already exists in the CDF.

`CDF is too big to handle`

The CDF already contains 5000 bytes of information. The CDF buffer is full.

`cannot attach :config:CDF`

An error was encountered while attempting to access the CDF.

`Only the System Manager can access the CDF.`

Access is only permitted to user ID 0. Enter the **super** command, then invoke **modcdf** again.

modinfo

Displays or changes the sizes of memory pool values in OMF86 or OMF286 object modules.

Syntax

```
modinfo inpath_list [to|over|after outpath_list]
      [mempool = min,max] [a] [q]
```

Parameters

`inpath_list`
: Pathname(s) of one or more OMF86 or OMF286 object modules, separated by commas. Wildcards are permitted.

`to|over|after` *`outpath_list`*
: Writes the modifications in the output file(s) rather than in the original file(s). If multiple pathnames with separating commas are specified in the *`inpath_list`*, use the same number of pathnames in the *`outpath_list`*. If you do not specify this parameter, but do specify changed values, the input files are modified.

`mempool`
: New minimum and maximum values to be established for the dynamic memory pool parameters in the object module. By default the values are decimal, but you may specify octal or hexadecimal by appending an O or H.

`a(sk)` After displaying current pool values, prompts for new values.

`q(uery)` Prompts for permission to process each file. Enter `Y` or `R` to process the file, `E` to exit the command, or any other letter to indicate a `no`.

Additional Information

If `ask` or `mempool` is not specified, the current static and dynamic segment sizes of the given object module are displayed, rather than modified. If an output pathname is specified, the values are changed in the output file, not in the input file. If no output pathname is specified, the input file is changed.

CAUTION

Avoid using wildcards to specify input files, especially if you don't specify corresponding output files. You might modify files you did not intend to change.

netinfo

Displays the Ethernet address, subnet ID, and iNA 960 information for each network controller in a system.

Syntax

```
netinfo
```

Additional Information

Netinfo does not indicate if iNA 960 software is running properly. Use the **inamon** command to get the status of iNA960. **Netinfo** displays a message similar to this for each network controller board in the system:

```
iRMX II/III NIA Board NETINFO Utility Version x.x
   Copyright Intel Corporation 1995

     INA 960 OSI-Transport COMMputer Configuration
     INA 960 OSI-Network Layer : NULL2
     INA 960 Running On        : Local Board - 486/166SE
         Subnet (1)
             ID     : 0001
                Name: SBx586
             Address: 00 AA 00 06 A4 9E
```

`iNA 960 OSI-Transport`
: Lists the type of hardware environment iNA 960 is running in. This entry is either `COMMputer Configuration` or `COMMengine Configuration`.

`iNA 960 OSI-Network Layer`
: The network layer addressing scheme. This entry is either `NULL2` or `ES-IS`.

See also: ES-IS and Null2 addressing, *Network User's Guide and Reference*
i.job*, ES-IS and Null2 jobs, *System Configuration and Administration*

`iNA Running ON`
: The type of board iNA 960 is running on.

`Subnet` Lists the subnet ID and Ethernet address of each subnet. In the case the ES-IS network layer, the subnet name also is listed.

netstat

Symbolically displays the contents of TCP/IP network-related data structures. The command can show the status of active connections (the default), configured interfaces, routing tables, network statistics, Streams buffer allocation failures, and packet traffic.

Syntax

```
netstat [-A] [-a] [-n] [-p protocol]
netstat -i [-n]
netstat -r [-n]
netstat -s [-r|-p protocol]
netstat -S netstat interval
```

Parameters

`-A` Adds the associated protocol control block (PCB) to the connection display.

`-a` Includes the inactive connections (listening servers).

`-n` Disables the symbolic translation of local and remote addresses, causing both to be displayed in their Internet dot notation.

`-p` *`protocol`*
Limits the display to the specified protocol.

`-i` Shows the status of configured network interfaces. The display includes the interface name, the maximum transfer unit (MTU) in bytes, the network and interface addresses, the number of packets received and sent, and the number of send and receive errors.

`-r` Shows the status of the configured routes.

`-s` Displays network statistics for the ip, icmp, tcp, and udp protocols.

`-S` Shows the Streams display.

`interval`
Displays packet traffic at given intervals, in units of seconds. Interrupt the display with a <Ctrl-C>.

Additional Information

The **netstat** command symbolically displays the contents of a number of TCP/IP-related data structures. Although **netstat** is an administrative command, it can be used by anyone to check on the status of the network. If several options are used, they can be concatenated with one leading hyphen; for example, **netstat -an**.

Where local and remote addresses are part of the display, they are shown as *host.port* or *network.port*. The latter format is used if a transport endpoint's address specifies a network but no specific host address. The port designates a network service, either well-known or local, as defined in the */etc/services* file.

The symbolic names of *host*, *network*, and *port* are displayed where they are available from the network databases (*hosts*, *networks*, and *services*). The domain names are stripped from the host and network names. If the symbolic name for an address cannot be determined, the address is displayed in the Internet dot notation. Where applicable, the `-n` option to **netstat** disables the symbolic translation of the address fields. Unspecified or wildcard addresses and ports are identified by an asterisk (*).

The Connection Display

The connection display shows the status of active Internet connections. For this display, invoke **netstat** with no parameters or with any combination of the `-A`, `-a`, `-n`, or `-p` parameters. With no parameters, the display is similar to:

```
Active Internet connections
Proto  Recv-Q  Send-Q  Local Address    Foreign Address  (state)
tcp    0       0       napalm.telnet    flamex1.1817     ESTABLISHED
tcp    0       0       *.telnet         *.*              LISTEN
tcp    0       0       *.ftp            *.*              LISTEN
udp    0       0       *.tftp           *.*
udp    0       0       *.bootps         *.*
```

The first column identifies the protocol through which the connection was made. The second and third columns show the number of bytes of data currently in the local receive and send queues, respectively. The fourth and fifth columns identify the local and remote transport endpoints of the connection, showing the host and port addresses. An asterisk (*) in either part of the endpoint address is a wild-card character. The sixth column shows the state of the connection.

The effect of the parameters is described above. The `-A` option displays a PCB, which is an address in kernel space not generally useful except for debugging purposes. When listening servers are displayed with the `-a` option, the local transport endpoint has a wildcard address and the port assigned to the server. Both parts of the remote transport endpoint are wildcards.

The Interface Display

Specify the interface display with the `-i` parameter. The display is similar to:

```
Name   Mtu   Network    Address       Ipkts    Ierrs   Opkts   Oerrs
en0    1500  129.84.25  129.84.25.13  179843   0       122361  0
lo0    4096  127        127           12       0       10      0
```

One line is displayed for each interface configured in the *inetinit.cf* file. The first column is the interface name as specified in that file. The second column is the maximum transfer unit (MTU) for the interface. The MTU is the largest number of bytes that can be delivered to the device driver from the ip module. It should be equal to or evenly divisible by the maximum size of the actual physical transmission unit to minimize the amount of packet fragmentation in the driver and maximize the throughput. This number is generally 4096 for the loopback interface and 1500 for an Ethernet interface.

The third and fourth columns show the network and interface Internet addresses. The fifth and sixth columns show the number of packets received through the interface and the input errors, while the seventh and eighth columns show packets sent and output errors.

The Routing Table Display

When the network is brought up, a direct route for each configured interface is automatically added to the routing table. Routes can also be added with the **route** command. You display the routing table with a **netstat -r** command. The display is similar to:

```
Routing tables
Destination     Gateway         Flags     Refcnt     Use   Interface
default         129.84.25.4     UG        0          1964      en0
129.84.25       129.84.25.13    U         0          120422    en0
127             127             UH        0          10        lo0
```

One line is displayed for each route in the routing table. The first column contains the address of the destination host or network, or the word `default`. The second column is the address of the gateway through which packets for that destination are routed. The third column shows flags that indicate the status and type of the route. The flags have this meaning:

Flag	**Description**
U	Route is up and usable
G	Route is a gateway to another network
H	Destination of the route is a host

The fourth and fifth columns are the number of active connections using the route (`Refcnt`) and the number of packets that have been sent (`Use`). The `Refcnt` value is always shown as 0. The sixth column shows the name of the local interface through which the packets are sent, as assigned in the *inetinit.cf* file.

See also: **route** command, in this chapter, for information about the default route

The Statistics Display

The network statistics display shows the current values of the statistics maintained by the kernel for each protocol. Specify this display with the `-s` parameter. The default display includes statistics for the ip, icmp, tcp, and udp protocols. The full display scrolls off a typical monitor screen; redirect it to a file that you can view with the **skim** command. Use the `-p` *`protocol`* parameter to limit the display to statistics for a specified protocol.

This command displays statistics about the ip protocol:

```
- netstat -sp ip
```

```
ip:
0 bad header checksums
0 with size smaller than minimum
0 with data size < data length
0 with header length < data size
0 with data length < header length
```

The Streams Display

The Streams display shows the number of failed requests for Streams buffers. There is one line for each TCP/IP kernel Streams module or driver. Modules and drivers that are not configured into the TCP/IP kernel, such as the SLIP driver in the example, are identified by messages like `can't open /dev/slip`. Such a message does not necessarily indicate an error; it means that the indicated driver or module could not be accessed by **netstat** to retrieve the statistics.

The columns in the display represent the size in bytes of the requested buffers, rounded to the next higher power of two. A counter is incremented each time a buffer of a defined size is requested and cannot be obtained. For example, if the ip module requests a Streams buffer of 1500 bytes and that request is refused, the ip module counter for buffers of 2048 bytes is incremented.

The counters are reset only when the system is shut down and rebooted. They are not reset when you stop and restart the network jobs without rebooting.

Specify the Streams display with a `-S` parameter. The output is similar to:

```
Module    0    2    4    8   16   32   64   ...  1024   2048   Other
arp       0    0    0    0    0    0    0   ...     0      0       0
ip        0    0    0    0    0    0    0   ...     0      0       0
loop      0    0    0    0    0    0    0   ...     0      0       0
raw       0    0    0    0    0    0    0   ...     0      0       0
can't open /dev/slip
somod     0    0    0    0    0    0    0   ...     0      0       0
tcp       0    0    0    0    0    0    0   ...     0      0       0
telnet    0    0    0    0    0    0    0   ...     0      0       0
udp       0    0    0    0    0    0    0   ...     0      0       0
```

If any entry in the Streams display contains a number other than 0, adjust the allocation of Streams buffers in the kernel to prevent future failures. The failure of even one or two buffer requests can have a very noticeable effect on the overall performance of the network. You can change the available number of buffers of each size with tunable parameters in the *stune.ini* file.

See also: Streams tunable parameters, *TCP/IP and NFS for the iRMX Operating System*

The Packet Traffic Display

The packet traffic display is a running summary of packet transmission statistics. Specify this display by invoking **netstat** with a single numeric argument (*`interval`*), indicating the number of seconds between updates to the display. No options can be used with this command. The display is similar to:

```
input    (en0)   output             input   (Total)  output
packets   errs   packets   errs     packets   errs   packets   errs
180212     0     122496     0       180224    0      122506    0
1          0     2          0       1         0      2         0
1          0     1          0       1         0      1         0
```

The first line of each screen of information is a summary of activity since the network was last started. Subsequent lines show values accumulated over the preceding *`interval`*. The first four columns show the input and output statistics for the primary interface (in this example, the first Ethernet interface, *en0*). The columns show the number of packets sent and received and the number of input and output errors. The second set of four columns shows the total statistics for all configured interfaces.

The heading for the packet traffic display is repeated approximately every 24 lines of output, as the monitor screen scrolls. The first line under the heading always contains cumulative totals since the network was last initialized. The display continues until you interrupt the command with a <Ctrl-C>.

Diagnostics

Exit status is 0 for normal termination or a positive number for error termination.

The message `can't open device` in the Streams display indicates that **netstat** cannot open the device to obtain the requested statistics, either because the module or device has not been configured into the kernel or because all of the allocated minor devices are already in use.

offer

Gives remote iRMX-NET users public network access to a local directory.

Syntax

`offer` *`pathname`* `as` *`public_name`*

Parameters

`pathname`

The actual pathname of the local directory.

`public_name`

The pathname assigned for use by remote users.

Additional Information

The number of public directories that may be offered at any one time is configurable, in the Public Directory Screen (PDIR) of the ICU.

See also: **publicdir** and **remove** commands, in this chapter

Example

These commands make available the *:sd:utils* directory, your *:bb:* device, and a diskette installed in your machine. Remote users can access these as files named *utilities*, *byte_bkt*, and *floppy*.

```
offer :sd:utils as utilities
offer :bb: as byte_bkt

attachdevice a as :f:
offer :f: as floppy
```

Error Messages

`missing parameter`

The *`actual-name`* or *`public-name`* parameter was omitted.

`<name>, unrecognized control`

The keyword `as` in the command was omitted, or extra information was supplied after *`public-name`*.

`illegal public name`

Colons are not permitted in the syntax when specifying the public name.

`<name>, invalid pathname`
: The specified pathname does not exist as given in the *`actual-name`* parameter.

`<name>, cannot look up prefix`
: The prefix (logical name) part of the pathname is invalid.

`cannot offer <actual_name> as <public_name>`
: Select another public name.

`cannot offer <actual_name> as <public_name> <condition code:mnemonic>`
: A typical example of the condition code is E_LIMIT, which means the limit for public directories has been reached.

paginate

Displays or copies the input file(s) in page-sized parts, optionally putting a title, date and time, and page number on each page.

Syntax

```
paginate inpath_list [to|over|after outpath_list] [q]
      [n] [ti=text] [pw=num] [pl=num] [ta=num]
```

Parameters

`inpath_list`
: One or more pathnames of text files, separated with commas. Wildcards are permitted.

`to|over|after outpath_list`
: Writes the output to the specified file(s) rather than to the screen. If you specify multiple input files and one output file, the output is appended.

`q(uery)` Prompts for permission to process each file. Respond to the prompt with:

Y	Display the file
R	Display remaining files without further query
E	Exit the command
N or other	Don't display the file; query for the next

`n(otitle)`
: Do not display the title, date or page number.

`ti(tle)=`*text*
: Specifies text to be used as the page heading. The default title is the filename.

`pw (or pagewidth)=`*num*
: Maximum number of characters in the output line, 132 by default.

`pl (or pagelength)=`*num*
: Maximum number of lines on the output page, 66 by default.

`ta(bwidth) (or lg)=`*num*
: Number of spaces to print for a tab character, 4 by default.

Additional Information

The command inserts formfeeds (0CH) into the output so it can be printed in pages. Several lines are added to each page as header information; adjust the `pagelength` parameter accordingly. If the input file contains a formfeed, a new page is started. The values you specify for page width, page length, and tab width are decimal by default. You can specify an octal or hexadecimal number by appending an O or H.

password

A menu-driven utility that only the Super user can invoke to add or delete users or to change a logon password. Other users invoke **password** to change their own passwords, assuming the User Definition File (UDF) has World read access.

Syntax

```
password
```

Additional Information

If you are not the Super user, you can invoke the **password** command to change the password you enter when logging onto the HI from a dynamic terminal. However, if your system's UDF resides on a remote system, the Super user must change your password for you, or allow you to do it while logged on as Super. When you invoke the command, these messages are displayed:

```
Enter your user name -
Enter the old password -
```

In response, enter your logon name and your current password. The password is case-sensitive. For security reasons, the password you enter is not echoed on the screen. The command then prompts you for the new password and asks you to repeat it:

```
Enter the new password -
Repeat the new password -
```

Enter your new password at each prompt. The password must be no longer than eight characters (more will be ignored). After confirming that both entries of the new password are identical, the command associates the new password with your logon name and displays the messages:

```
Password change successful
Updating the master UDF .......... Done
```

The next time you log on to the system, you must use the new password. Continue using it until you change your password again with the **password** command.

If you are the Super user, the **password** command performs a variety of functions, including maintaining the User Definition File (UDF). The UDF contains the logon name, user ID, and password of all users who can access the HI using a dynamic terminal. Because this file is also used to validate user access to the network, the file is a nonstandard format; do not use an ordinary text editor to maintain the file. The passwords listed in the UDF are encrypted to prevent unauthorized access. The

password command is the sole mechanism for maintaining the UDF, and only the Super user can access it. The **password** command maintains the format of the file and automatically encrypts the passwords.

When you invoke the **password** command as Super, this menu is displayed. Enter the letter corresponding to the operation you want to perform:

```
The following commands are available:

A - Add a user
D - Delete a user
L - List the UDF
C - Change password
Q - Quit
E - Exit

Enter the command:
```

Adding a User to the UDF

Choose the `A` option to add a new user; **password** prompts you to enter information about the new user. The prompts and valid answers are as follows:

```
Enter the user name -
```

Enter the logon name of the new user. This name must be three to eight characters long, and is not case-sensitive. If you respond with more than eight characters, the command ignores the extra characters.

```
Enter the new password -
```

Enter the password for the new user. The password must be eight characters or less (additional characters are ignored), and it is case-sensitive. The password is not displayed. If you enter <CR> at the prompt, the new user's password is a carriage return. You may enter, in upper or lower case:

```
NO LOGIN
```

This entry prevents the user from logging onto the system using a dynamic terminal. This can be useful for restricting a user to a static logon terminal.

```
Repeat the new password -
```

Enter the password again. This validates the password and ensures that you spelled it correctly. **Password** returns an error message if the two passwords don't match and re-prompts for the new password. This continues until you enter the new password the same way twice.

```
Enter the user ID -
```

Enter a decimal number in the range 0 to 65535 as an ID to associate with this user. If you enter <CR>, **password** assigns the next higher unassigned user ID and responds with:

```
Assigned user ID of <ID>
```

Assigning a user ID that is not unique can cause problems in a network environment. If there are no unique user IDs available or the ID you enter is not unique, **password** displays:

```
Warning - Not a unique user ID
```

Entering any other value causes the command to display an error message and repeat the prompt. This continues until you enter a valid user ID, <CR>, or a Q (to abort this session of adding a user).

```
Enter the group ID -
```

If your system is part of the OpenNET network and includes Unix workstations, assign a group ID consistent with the group access you want for this user (refer to the Unix documentation for more information). Otherwise, enter a second user ID which will be added to this user's iRMX user object. If neither user ID is 65535 (World), the HI automatically adds a third ID of 65535 to the user object when this user logs on, providing World access.

```
Enter the comment -
```

Respond with <CR> unless your system is an OpenNET workstation. The iRMX OS does not use this field. It is typically used for a name or other information; refer to the Unix documentation.

```
Enter the default UNIX directory -
```

For OpenNET workstations, enter the complete pathname of the user's home directory on Unix systems. Otherwise, respond with <CR>.

```
Enter the default UNIX shell -
```

For OpenNET workstations, supply the new user's default Unix shell (for example, */bin/sh*; refer to the Unix documentation). Otherwise, respond with <CR>.

Once you have responded to all the prompts, **password** summarizes and displays your answers. At the bottom of the summary is this prompt:

```
Do you want to add this user to UDF?
```

If the summary is correct, respond with a `Y` to add the user. If you respond with any character other than `Y`, **password** disregards your previous input and returns to the initial menu.

If you enter `Y`, **password** updates the copy of the UDF it maintains in memory (the permanent copy will be updated when you invoke the Exit command), and displays this message:

```
Do you want to create the user directories?
```

A `No` response means you must manually create the user's home directories. In this case, **password** only creates the user configuration file *:config:user/<username>* (unless it already exists).

If you enter `Y`, **password** creates user directories, copies the *alias.csd* and *r?logon* files from the *:config:default* directory, and creates an empty *r?logoff* file in the new user's *prog* directory. (You can modify the default files so that each time you create a new user, the user gets the initial configuration you want.) After the files are created, you are prompted for the pathname of the initial program:

```
Initial-program pathname =
```

Enter <CR> to give the new user the standard CLI interface. If you do not use the standard CLI, enter the full pathname of the command interface you use. After adding the new user, **password** displays:

```
Default Initial Program is RMX HI CLI
Added user <user name>
```

Then the main menu is displayed. You may add another user or start another operation, but the UDF is not updated until you enter the Exit (`E`) option.

Deleting a User from the UDF

Choose the `D` option to delete a user from the UDF. **Password** displays:

```
Enter the user name -
```

Enter the logon name of the user to be deleted. If the name you enter is currently listed in the UDF, **password** deletes the entry from the copy of the UDF it maintains in memory and responds with this message:

```
Deleted user <logon name>
```

The permanent copy of the UDF will be updated when you invoke the Exit option. You must manually delete the user's logon directory and *:config:user/<username>* file.

Listing the Contents of the UDF

Choose the `L` option to list the contents of the UDF. **Password** displays a table of entries containing this information:

```
<logon name>:<password>:<user id>:<group
id>:<comment>:<dir>:<shell>
```

Where:

`<logon name>`	The name that the user enters to log on to the system.
`<password>`	The encrypted password. No entry indicates that the user does not require a password to log onto the system. The characters `NO LOGIN` indicate that the user is prohibited from logging on.
`<user id>`	A decimal number representing the user ID. Value 0 is Super, the system manager, and value 65535 is the World user.
`<group id>`	A second ID that can be implemented as a group convention, and corresponds to Unix group file access in OpenNET systems.
`<comment>`	The comment field, used only in OpenNET systems.
`<dir>`	The Unix home directory, used only in OpenNET systems.
`<shell>`	The Unix shell, used only in OpenNET systems.

Changing Passwords

Choose the `C` option to change the logon password for yourself or for another user. The instructions for changing the password are the same as shown at the beginning of this description. However, as Super you have the option of entering:

```
NO LOGIN
```

as the new password for another user. This prevents the user from logging onto the system.

Quitting the Password Command

To abort the **password** command without saving any of the changes you made during this session, choose the `Q` option. If you have made changes that will be lost, **password** displays:

```
Do you really want to quit without saving your changes?
```

If you want to abort the session and lose the changes you made, enter `Y`. Entering any other character returns you to the main menu without discarding your changes. If you quit a session where you have added a user, you must manually delete the logon directory and the *:config:user <username>* file (the logon directory is created if you answer `Yes` to the `create user directories?` prompt).

Exiting the Password Command

To leave the **password** command and save all of the changes you made during this session, choose the `E` option. **Password** writes the changes to the UDF.

Error Messages

`Cannot attach to the UDF`
The OS encountered an error, either when attempting to read the password you entered or when attempting to access the UDF.

`Illegal name`
The logon name you specified is invalid. The name must be between three and eight characters long, contain no embedded spaces, and contain no unprintable characters.

`Invalid command`
You entered an invalid command at the password menu. The valid commands are `A`, `D`, `L`, `C`, `Q`, and `E`.

`Invalid Password`
Either the password you entered was longer than eight characters, or you made a typing error when you confirmed the password by entering it again.

`Invalid response`
Your response to a prompt was invalid. For example, you might have entered alphabetic characters when a numeric value was expected.

`Maximum size of UDF reached`
The UDF can grow to a maximum of 32 Kbytes. It has reached this limit, and no more new users can be added.

`<Master/Local> UDF is not available`
An error occurred while **password** was attempting to attach the UDF. If your system is part of an iRMX-NET environment, the error occurred while attaching the remote master UDF. Otherwise, the error occurred while attaching the local UDF. In either case, **password** does not change the UDF.

`Old Password is incorrect`
The password you entered did not match the password listed in the UDF.

`UDF does not exist.`
Your system is not configured to support nonresident users; therefore, the UDF does not exist.

`UDF does not exist.  Creating new UDF.`

The UDF did not exist on your system before, because your system is not configured to support nonresident users. As the system manager, you can add a UDF. The **password** command creates a UDF to contain your additions.

`UDF is corrupted`

The UDF has an invalid format that must be fixed. This might have been caused by editing the file with a text editor. To correct this problem, the system manager might need to delete the UDF (with the **delete** command) and use the **password** command to rebuild it. A copy of the original UDF is in the *:config:default/udf* file.

`UDF is not available`

The UDF can be written by only one user at a time. Someone else is using the **password** command now and has exclusive write access to the UDF. Try again in a few seconds.

`User <logon name> is already defined in the UDF`

The user you attempted to add is already listed in the UDF.

`User <logon name> is not defined in the UDF`

The user you attempted to delete is not listed in the UDF.

path

Lists the full pathname of a data file or directory on local or remote systems.

Syntax

`path [`*`inpath_list`*`] [to|over|after `*`outpath_list`*`] [r]`

Parameters

`inpath_list`

One or more filenames, separated by commas, whose pathnames you want to list. Wildcards are permitted.

`to|over|after` *`outpath_list`*

Writes the output to the specified files rather than to the screen. If you specify multiple input files and a single output file, **path** appends the remaining input file pathnames to the end of the output file.

`r(oot)` Specifies that the pathname should start from the root directory of whatever device holds the file or directory.

Additional Information

This command is useful for finding where you are located within the file structure. The output is similar to this when invoked with no input file list:

```
-path <CR>
:sd:user/world
```

pause

Displays an optional message and waits for you to enter a <CR>.

Syntax

```
pause [message]
```

Parameter

message

The text that appears on the console when the **pause** command is executed.

Additional Information

This command works ideally when executed from within a submit or esubmit file. You cannot use **pause** as part of a background job. Invoking **pause** without a message causes the console to display a blank line before waiting for the carriage return.

The message is restricted to the length of the command line, but you may enter command continuation lines, using the & character.

pci

Displays or sets a threshold size for disk I/O read and write requests to be made without Peripheral Controller Interface (PCI) server buffering, when the PCI client and server are on the same host board.

Syntax

```
pci direct :logical_name: [threshold]
```

Parameters

`direct`

Specifies that this board will make direct I/O requests to the PCI server.

`:`*`logical_name`*`:`

The logical name of the PCI device, surrounded by colons; for example, *:sd:*.

`threshold`

A number specifying the size in bytes of I/O read or write requests to be made as direct requests. The value is decimal by default, but you may specify hexadecimal with a `0x` prefix or by appending an H. If *`threshold`* is not specified, the current threshold value is displayed. The default value is the maximum, 0FFFFFFFFH, which causes all read and write requests to use PCI buffering. A value of 0 causes all read and write requests to be direct.

Additional Information

A PCI client and server may be on the same host board or on separate hosts. The default communication method between the client and server assumes they are on separate hosts. This method uses a buffer on the server host to hold the read and write data associated with I/O requests. When a PCI client and server are on the same host, it can be more efficient for the client to bypass the I/O request buffer and make direct requests to the PCI server. Direct requests copy data directly between the peripheral device and the user's buffer, and avoid buffering on the PCI server.

An I/O request for an equal or greater number of bytes than the threshold value is made as a direct request. A request for fewer bytes than the threshold value is buffered by the PCI server.

Direct requests can only be made to hard disk devices. The device cannot be part of a mirrored disk drive set. If you specify direct I/O requests for a hard disk that becomes part of a mirrored set, the PCI server uses the default method for I/O requests while the disk is part of the mirrored set.

Generally, you should not do direct requests for all I/O requests. Bypassing the buffers can be detrimental to performance for small I/O operations. It is better to set the threshold value close to the size of a cache line in the PCI server; 16 Kbytes or 18 Kbytes are reasonable threshold values.

See also: *How to Use the Peripheral Controller Interface (PCI) Server*

pcnet

A NetBIOS driver that provides the interface to iNA960-based iRMX-NET.

Syntax

```
pcnet [/s sessions][/c commands]
```

Parameters

/s sessions

The number of NetBIOS sessions supported. The default is 6, and the maximum is 32.

/c commands

The number of NetBIOS commands that can be queued to the NetBIOS driver simultaneously. The default is 12, and the maximum is 32.

Additional Information

When you set up network access from DOS, this command is used in the process of redirecting the MS-NET server and client through iRMX-NET, usually as part of a batch file.

The option indicators, `s` and `c`, are not case-sensitive. If you enter invalid options, a usage message is displayed.

See also: **pcnet** command, *Network User's Guide and Reference*

permit

Grants or revokes user access to files that you own or files in directories for which you have change access.

Note

You can use this command in an esubmit file or **rq_c_send_command** system call if the form of the command does not require user input. If the command requires user input in an **rq_c_send_command** system call, it will fail. However, you can use a form of the command that requires user input in an esubmit file if you use the `eoresponse` and `coresponse` subcommands.

See also: **esubmit** command, in this chapter

Syntax

```
permit pathname_list access[value][, ...] [u= id_list|world|*]
      [data] [dir] [map] [q]
```

Parameters

`pathname_list`
One or more pathnames, separated by commas, of files to have their access rights or list of accessors changed. Wildcards are permitted.

`access` One or more access characters that grant or cancel the corresponding access to the file(s), depending on a following `value` parameter. If specified with no value, each access character grants the specified access. (The interpretation for DOS, NFS, and remote file access is somewhat different; these are described later.) From the list below, you may use `L` or `R` for data files and directories; likewise `C` and `U`.

Access	**Meaning**
D	Delete
L or R	List (for directories); Read (for data files)
A	Add entry (for directories); Append (for data files)
C or U	Change (for directories); Update (for data files)
N	With no other characters, cancels all access. With other characters, cancels access not explicitly granted.

`value` A value that specifies whether to grant or revoke the associated access right.

Value	**Meaning**
0	Cancel the access right
1 (default)	Grant the access right. Specifying an access character without a value grants the corresponding access.

`u(ser) = id_list`
A list of decimal or hexadecimal user IDs for which the access rights apply, separated with commas. Each file is limited to three user IDs in the access list. If you omit the `user` parameter, the default is your user ID (the ID associated with your interactive job).

`= world`
Specifies user ID 65535, giving all users access to the file.

`= *` The access rights apply to all users currently in the file's access list.

`data` The access information applies to data files in the pathname list. If you omit both the `data` and `directory` parameters, **permit** assumes both.

`dir(ectory)`
The access information applies to directories in the list.

`map` The access information also applies to map files and volume label files in the pathname list. If you use the `map` parameter, you must specify the full pathname of map or volume label files in the list.

`q(uery)` Prompts for permission to modify the access rights associated with each file. Respond to the prompt with:

Y	Change the access
R	Change access for remaining files without further query
E	Exit the command
N or other	Don't change access; query for the next

Additional Information

Table 2-5 shows the possible access rights for files and directories, and describes how they relate to each other.

Table 2-5. How Access Rights Apply to Files and Directories

File Access		**Directory Access**	
Delete	Delete or rename the file	Delete	Delete or rename the directory
Read	Read the file (if the parent directory has list access)	List	List the contents of the directory and read files in it (if they have read access)
Append	Add information at the end of the file, but no permission to overwrite existing data	Add	Add files or subdirectories to the directory, but no permission to change existing files in it
Update	Overwrite information in the file or truncate it, but no permission to append data to the file	Change	Change the access rights or accessors of files and subdirectories in the directory, but not of the directory itself; no permission to add or delete files in the directory

You can use **permit** to perform one or both of these functions:

- Add or subtract users from a file's list of accessors. This list determines which users have access to the file. Only three user IDs may be listed as accessors, but one of these can be the World ID, which grants access to all users.
- Set which access rights are granted or revoked for the users in the accessor list.

When you change the list of accessors for a file, specify the appropriate access for an added user or `N` access for a user to be deleted. To change the access rights but not the list of accessors, specify `user=*`.

The Super user can change accessors and access rights for any file. Other users can only change access information for files owned by themselves or World, or for files in directories where the user or World has change access. You can display the access rights for files and directories with the **dir** command.

Specifying Access Rights

If specified without an accompanying value, each access character grants the specified access. You can concatenate access characters and values together or you can use commas to separate individual access/value specifications. For example, if you want to grant delete access and cancel add and update access, you could enter any of these combinations; the order in which you specify access characters is not important:

```
A0DU0
A0,D,U0
A0D1U0
A0,D1,U0
```

If there are multiple occurrences of an access character, **permit** uses the last such character to determine the access. For example, these specifications are equivalent; in the first list, D1 overrides D0:

```
D0,A1,R1,D1
A1,R1,D1
```

Specifying `N` by itself revokes all access for the specified users and removes the users from the file's access list. However, the `N` character can also be useful when changing access rights, if you don't remember the user's current access rights. In this case, specify the `N` character first, to clear all access rights, and follow it with other characters to grant the desired access. For example, if you want to grant list access only, you could specify `NL` instead of `D0A0C0L`.

When changing access information for volume map files and volume label files, always specify the full pathnames. For example, this command changes the access rights for all map files and volume label files on the volume, except for *r?save*, which is unaffected by the map parameter. In this instance the HI does not interpret the ? as a wildcard character:

```
permit :f0:r?* DLAU map
```

See also: Map files and volume label files, **format** command, in this chapter

Access to Remote iRMX-NET Files

File access rights for remote iRMX-NET files are treated somewhat differently than for local files. You may grant or revoke access by other users to remote files you or World own, but change access for directories does not apply. This list shows how access characters apply when you invoke **permit** for remote files.

Value	**For Directories**	**For Files**
D	Delete: The value of the delete bit is always 0. Attempts to change the value to 1 are ignored. Add-entry access is required to delete a directory.	The value of the delete bit is always 0. Attempts to change the bit to 1 are ignored. Users must have both append and update access to delete a file.
L or R	List directories	Read files (if the directory has list access)
A	Add entry: if set to 1, the user may add entries to the directory or delete the directory	Append: must be set the same as Update
C or U	Change: the value of the change bit is always 0. Attempts to change the bit to 1 are ignored.	Update: when both Append and Update bits are 1, the user can append, update, or delete a file. If you attempt to set different values for the append and update bits, an error is returned.
N	Cancels access not explicitly granted by a value.	Cancels access not explicitly granted by a value.

Accessor Fields in Remote iRMX-NET Files

When you access files on a remote system with iRMX-NET, your system obtains from the remote system the user name associated with the accessor IDs for the files. Your system gets the user ID that matches the name it receives from its own User Definition File (UDF).

In one Administrative Unit (subnetwork), all the user names match the same user IDs. However, different subnetworks may associate different user IDs with the same user name. Therefore, the user ID displayed in the accessor fields of a remote **permit** display may be different from the user ID that the server would display locally for the same file. If the user name that is received from the remote server does not exist in the client UDF, the user ID is displayed as 65534.

The rules governing the `N` access character, multiple occurrences of the same access character, access value defaults, and the interchangeability of access characters apply to remote files in the same manner as local files.

See also: Remote files, *Network User's Guide and Reference*

Access to NFS Files

File access rights are mapped between different operating systems when accessing remote files through NFS. When you change access from an iRMX client, access rights map as follows:

Setting any of these bits on an iRMX client		**Results in all of these bits being set on iRMX, Unix, and DOS servers**		
	iRMX	**iRMX**	**Unix**	**DOS**
Files	`D-AU` `-R--`	`D-AU` `-R--`	`-w-` `r-x`	read/write read-only
Directories	`D-AC` `-L--`	`D-AC` `-L--`	`-w-` `r-x`	read/write read-only

For example, setting just the `D` access from an iRMX client results in `D-AU` access on the iRMX server.

When you change access rights from another OS through NFS, the access permissions on an iRMX server are set as follows:

Setting any of these bits on Unix and DOS clients			**Results in all of these bits being set on an iRMX server**
	Unix	**DOS**	**iRMX**
Files	`-w-` `r-x`	read/write read-only	`D-AU` `-R--`
Directories	`-w-` `r-x`	read/write read-only	`D-AC` `-L--`

If, for example, you set the read (`r`) or the execute (`x`) bit from Unix, it results in a file with `-R--` access on the iRMX server.

File Ownership with NFS

File ownership mapping occurs between iRMX, DOS, and Unix files when using NFS. The following list describes the mapping:

- When you use NFS between two iRMX systems, file owners are maintained on a one-to-one basis.
- When you use NFS between an iRMX system and a Unix system the following mapping occurs regardless of which OS is the NFS client:

iRMX	**Unix**
First owner in access list	"owner"
Second owner in access list	"group"
Third owner in access list	(ignored)
World	owner is user ID 60000 and group is user ID 1 (other)
Super	owner and group user IDs are 0 (root)

Note

You can modify iRMX to Unix file ownership mapping values for the World user by setting parameters in the */etc/stune.ini* file.

See also: Tunable Parameters, *TCP/IP and NFS for the iRMX Operating System*

- When you use NFS between an iRMX system and a DOS system file ownership mapping does not apply. This is because DOS has no concept of file owners. The NFS package you use on a DOS system may make certain assumptions. For example, a DOS-based NFS product might translate a file owned by user ID 0 (Super) as read-only from the DOS side. See the documentation for your non-iRMX NFS product for such details.

User ID Translation with NFS

User IDs map one-to-one across NFS except as noted for the Super and World users between iRMX and Unix systems described in the previous section.

When you use NFS between two machines that happen to have different user login names with the same user ID number, the file's ownership is determined by the client's account. For example, assume that a file on an NFS server is owned by Sam with the login *sam* and user ID of 33. User Sarah on an NFS client also has a user ID of 33 but her login is *sarah*. If Sarah accesses the file on the NFS server through NFS, the user IDs map one-to-one. However, Sarah's access rights to the file will be whatever rights Sam has for the file on the server machine. Also, if Sarah lists the directory that contains the file, the owner will appear as Sarah, not Sam.

This user ID mechanism works similarly between iRMX systems or between iRMX and Unix systems.

See also: Accessing NFS Files, File Ownership, and User ID Translation, *System Concepts*

DOSRMX Systems

The DOS file system does not support users other than World, and supports limited access rights. For preconfigured DOSRMX systems, iRMX users and tasks can change their DOS file access to correspond to the DOS read-only and read/write attributes. DOS directories cannot be made read-only. Use these values with the **permit** command (read and list access are not used):

Access Character	**Value**	**Access Granted**
D, A, or U (any)	NOT 0	Read and Write (including permission to delete)
D, A, and U (all)	0	Read only

For example, these commands make a file read-only:

```
permit file1 d0a0c0
permit file2 nr
```

iRMX for PCs Systems

If you are using the DOS file driver, you can use DOS access rights only. If you are using the iRMX named file driver, you can use all iRMX access rights.

Output

After changing the access information for a file, **permit** displays a list of changed files, containing this information:

```
<pathname>, accessor = <accessor ID>, <access>
```

Where:

`<pathname>`
The name of the file.

`<accessor ID>`
The user ID of one of the file's accessors.

`<access>` That user's access rights, displayed as DLAC for directories and DRAU for data files. If a particular access right is not allowed, the display replaces the corresponding character with a dash (-). For example, the display `-L-C` indicates that the corresponding user has list and change access, but not delete and add-entry access.

Error Messages

`<pathname>, accessor limit reached`

The OS permits only three user IDs in the accessor list of a file. Before you can add another accessor, you must remove one of the current accessors by setting its access rights to `N`.

`<pathname>, directory CHANGE access required`

Either you are not the owner of the specified file or you do not have change access to the file's parent directory. You must satisfy one of these two conditions in order to use the **permit** command.

`<user ID>, duplicate user control`

You must specify the keyword and parameter combination `user=`*`user-list`* only once during the **permit** command. However, you can specify multiple user IDs by separating them with commas in the user list. **Permit** exits without updating the access rights.

`<character>, invalid access switch`

The character you entered to indicate the access rights for the file was not a valid access character; **permit** exits without updating the access rights.

`<invalid id>, invalid user id`

The user IDs you supply with the user parameter must consist of decimal or hexadecimal characters, the characters `world`, or the `*` character. **Permit** exits if you supply other characters.

`missing access switches`

You must specify one or more access characters with the **permit** command; **permit** exits without updating the access rights.

`no files found`

There were no files of the type you specified (data, directory, or both) in the pathname list.

`pathname, E_NAME_NEXIST`

The pathname is a remote file. The accessor whose access is to be changed is not defined either at the Administrative Unit containing the local client or at the AU containing the file server where the remote file resides.

physname

Displays system DUIB names and information.

Syntax

```
physname *|target_device_name [-e]
```

Parameters

`*` Lists all of the DUIBs in the system.

`target_device_name`
Displays DUIBs associated with the physical device name specified.

`-e` Displays extended information.

Additional Information

Use **physname** to obtain information about your system's available DUIBs.

If you specify a *`target_device_name`* that has more than one match in the system **physname** lists the DUIBs that include the specified name. Do not use a * within a *`target_device_name`* parameter.

See also: Physical Device Names, Appendix E

Examples

1. To view a list of the DUIBs in the system, enter:

   ```
   physname *
   ```

   The DUIBs are displayed as shown below. The names of loadable devices are listed first, followed by the names of standard devices:

   ```
   Dynamic DUIB Cluster 1

   D_CONS

   Intel's Standard DUIB Cluster

   BB          STREAM       COM1        COM2        B

   BH          BM           BMH         A           AH

   AM          AMH          C_RMX       C_RMX0      C_RMX1

   C_RMX2      C_RMX3       C_RMX4      D_RMX       D_RMX0

   D_RMX1      D_RMX2       D_RMX3      D_RMX4      A_DOS

   B_DOS       C_DOS        D_DOS       E_DOS       F_DOS

   G_DOS       H_DOS        I_DOS       J_DOS       K_DOS

   L_DOS       M_DOS        N_DOS       O_DOS       P_DOS

   Q_DOS       R_DOS        S_DOS       T_DOS       U_DOS

   V_DOS       W_DOS        X_DOS       Y_DOS       Z_DOS
   ```

2. If more than one DUIB name matches the name you specify, **physname** displays a list of fully or partially matching DUIB names. For example:

   ```
   physname c_rmx
   ```

   This command displays:

   ```
      Searching Dynamic DUIB Cluster 1

      Searching Intel's Standard DUIB Cluster

   C_RMX    C_RMX0    C_RMX1    C_RMX2    C_RMX3    C_RMX4
   ```

3. This command returns extended information about the specified device:

   ```
   physname c_rmx3  -e
   ```

   This information is displayed:

```
Searching Dynamic DUIB Cluster 1

Searching Intel's Standard DUIB Cluster

Device Name:        C_RMX3

Functions:          ff              DUIB address:  09b8:000133af

Device Granularity: 0200            Max Buffers:   ff

Device Size:        00000200        Device:        04

Unit:               03              Device Unit:   000a

Device$Info$P:      09c8:000000bd   Unit$Info$P:   09c8:000000e8

Update Timeout:     0064            Num Buffers:   0008

Priority:           82              Fixed Update:  ff

Flags:              31

Init$IO:            09c8:000031b4   Finish$IO:     09c8:00003564

Queue$IO:           09c8:00002c0f   Cancel$IO:     09c8:000030b4

File Drivers:       0009

  Physical          TRUE            Named          TRUE

  EDOS              FALSE           Stream         FALSE
```

See also: DUIB structure and fields, *Driver Programming Concepts*

ping

Tests communication between two hosts, at the lowest level of TCP/IP communications, to determine whether a connection can be made and to assess its reliability. Used primarily to manually isolate faults.

Syntax

```
ping [-r] [-v] host [packetsize [count]]
```

Parameters

`-r` Bypass the normal routing tables and send datagrams directly to a host. An error is returned if the host is not on a directly attached network. Use this option to ping a local host through an interface that has no route.

`-v` Display a message any time an ICMP packet other than an ECHO_RESPONSE is received.

`host` Name or Internet address of a host or gateway.

`packetsize`
The size in bytes of data for the packet; the default is 56 (for a 64-byte packet).

`count` Send the specified number of ECHO_REQUESTS and exit when all responses have been either received or assumed lost. If *`count`* is not specified, the command sends datagrams until it is interrupted. The value 0 is the same as no parameter.

Additional Information

The Internet is a large and complex group of network hardware connected by gateways. Tracking a single-point hardware or software failure can often be difficult. **Ping** uses the Internet Control Message Protocol (ICMP) mandatory ECHO_REQUEST datagram to elicit an ICMP ECHO_RESPONSE from a host or gateway. The command sends datagrams at one-second intervals until it is interrupted or until it has sent and received *`count`* datagrams.

As each ECHO_RESPONSE is received from the target host, the packet number (`icmp_seq`) and round trip time is displayed. If **ping** cannot reach the target host, nothing is displayed. Similarly, a gap in the sequence numbers of the packet display indicates the ECHO_REQUEST failed to reach the target or the ECHO_RESPONSE failed to make it back to this host. When **ping** ends or is interrupted, it summarizes the packet loss and round trip timing statistics for the session.

The only mandatory parameter in the command is the `host`. However, if you don't specify a `count` parameter, **ping** continues until interrupted. This can significantly increase the load on the network and prevent automated scripts from functioning as intended. It is safer to supply **ping** with a packet size and iteration count. If you don't specify `count`, interrupt the command with a <Ctrl-C>. This command specifies 1024 bytes of data and 3 iterations.

```
- ping sophocles 1024 3
PING sophocles.intel.com: 1024 data bytes
1032 bytes from 128.215.12.22: icmp_seq=0. time=2 100th of sec
1032 bytes from 128.215.12.22: icmp_seq=1. time=2 100th of sec
1032 bytes from 128.215.12.22: icmp_seq=2. time=2 100th of sec
----sophocles.intel.com PING Statistics----
3 packets transmitted, 3 packets received, 0% packet loss
round-trip (100th of sec)    min/avg/max = 2/2/2
-
```

When using **ping** for fault isolation, first ping the local host to verify that the local network interface is up and running. Then ping hosts and gateways farther and farther away to determine where a fault occurs.

ECHO_REQUEST datagrams (pings) consist of IP and ICMP headers followed by a `struct timeval` and an arbitrary number of bytes to fill out the packet. Determine the maximum `packetsize` by subtracting 48 bytes (for the UDP and IP headers with options) from the value of the tunable parameter SOMOD_MSGSZ.

See also: **netstat** and **ifconfig** commands, in this chapter
Tunable parameters, *TCP/IP and NFS for the iRMX Operating System*

Diagnostics

Exit status is 0 for normal termination or a positive number for error termination.

publicdir

Displays pathnames of public iRMX-NET network directories on this system.

Syntax

```
publicdir [l]
```

Parameter

`l(ong)`	Lists the directory including the full pathname and the device name where the directories reside.

Additional Information

Invoking **publicdir** without parameters lists the server's public directories, but does not list the pathnames and the device names. If you specify the `long` parameter, the display is similar to:

```
PUBLIC DIRECTORIES OF THE SERVER
Offered Name        Dev Name         Pathname

WORK                 QMA0            /WORK
LANG                 QMA0            /LANG286
SYSTEM               QMA0            /SYS386
WORLD                QMA0            /USER/WORLD
SD                   QMA0            /
BB                   BB
F                    A               /
```

See also: **offer** and **remove** commands, in this chapter

Error Messages

`cannot show public Directories`
An I/O error occurred while executing the command.

`not enough user memory`
The system does not have enough user memory to satisfy the request.

rdisk

Configures partitions on a DOS hard disk or an iRMX SCSI hard disk managed by PCI. The DOS version of **rdisk** uses ROM BIOS functions to access hard disks to retrieve disk configuration information and for reading and writing the partition table.

The DOS **rdisk** command runs on DOS Version 3.3 or later. In addition to standard ROM BIOS-supported drives, you can set logical partition information for Logical Block Address (LBA) drives that use Enhanced IDE. The DOS **rdisk** command is used with the DOSRMX and iRMX for PCs OSs.

The iRMX **rdisk** command runs on iRMX Version 2.2 or later and can be used with the iRMX III OS. **Rdisk** supports both primary and extended iRMX partitions. You must include the physical name (DUIB) of the hard disk drive being partitioned on the command line with the iRMX **rdisk** command.

⚠ **CAUTION**
If a hard disk drive is partitioned with the DOS version of **rdisk**, use only the DOS version of **rdisk** to view or modify the partition table. The different OS versions of **rdisk** get the CHS (cylinder, head, sector) information in two different ways. The two ways are not consistent and trying to use the two different versions of **rdisk** interchangeably will corrupt the hard disk drive.

See also: Appendix F, Partitioning PCI Hard Disk Drives, in this manual

Syntax

`rdisk`	(at the DOS prompt)
`rdisk` *`physical_name`*	(at the iRMX prompt*)*

Parameter

`physical_name`
The DUIB name for the disk to be partitioned. The DUIB must be for the entire disk, not a partition. The DUIB name is required for the iRMX version of **rdisk.**

Options

This is the main **rdisk** menu:

```
           RDISK          Version Vx.y

    (1)  Display partition table
    (2)  Modify partition table
    (3)  Set active partition
    (4)  Check partition table
    (5)  Reinitialize partition table
    (6)  Select next fixed disk
    (7)  LBA physical configuration

  Enter Selection:  1
```

Option 1: Display Partition Table

This option displays the main partition table and any extended partitions. For example, in the display of Extended Partition 4 below, there are three logical drives defined. In other words, there are four master partitions, and in the fourth one, there are three extended partitions defined. Note that the “Usage” column in the Extended partition lists the percentage of the main partition used by each extended partition, not the percentage of the total hard disk used.

```
  Disk 1 LOGICAL Configuration:   518 cylinders   128 heads  63 sec/track

  -- Partition Table For Fixed Disk 1 --
        System Active  Mbytes Usage  START:Cyl Head Sect  END:Cyl Head
Sect
  1        DOS    No      394  19%          0    1    1       99  127
63
  2    DOS EXT    No      394  19%        100    0    1      199  127
63
  3       iRMX   Yes      394  19%        200    0    1      299  127
63
  4   iRMX EXT    No      854  42%        300    0    1      516  127
63
  -- Partition Table For Extended Partition 2 --
        System Active  Mbytes Usage  START:Cyl Head Sect  END:Cyl Head
Sect
-->Note: No logical drives defined...
  -- Partition Table For Extended Partition 4 --
```

```
        System Active  Mbytes Usage  START:Cyl Head Sect  END:Cyl Head
Sect
  1        DOS    No      197  23%        300    1    1      349  127
63
  2       iRMX    No      197  23%        350    1    1      399  127
63
  3       iRMX    No      394  46%        400    1    1      499  127
63
```

Option 2: Modify Partition Table

CAUTION
Creating or deleting a partition or logical drive will make existing files on the entire hard disk inaccessible.

When you choose option 2 from the main menu, you are presented with the menu below. The “Display” choice is the same as Option 1 above.

```
Enter selection: 2

  (1)  Display partition table
  (2)  Create a partition
  (3)  Delete a partition
  (4)  Create or delete logical drives
  <CR> Return to previous menu

Enter selection: 2
```

If you choose item 2 or 3 to create or delete a partition or logical drive, the current partition table is displayed and you choose the partition number to create or delete:

```
  Disk 1 LOGICAL Configuration:   518 cylinders   128 heads   63
sec/track

  -- Partition Table For Fixed Disk 1 --
        System Active  Mbytes Usage  START:Cyl Head Sect  END:Cyl Head
Sect
  1        DOS    No      394  19%          0    1    1       99  127
63
  2    DOS EXT    No      394  19%        100    0    1      199  127
63
  3       None    No        0   0%          0    0    0        0    0
0
```

```
  4       None    No         0    0%           0    0    0        0    0
0

Enter partition (<CR> for previous menu): **3**
```

Then, if you are creating a partition, you choose which type of partition to create, as shown below. Choices 1 and 3 are primary partitions; choices 2 and 4 let you create Extended partitions, which can hold one or more logical drives.

```
  (1)      DOS partition
  (2)  DOS EXT partition
  (3)     iRMX partition
  (4) iRMX EXT partition
  <CR> previous menu

Enter selection: 3
```

⚠ **CAUTION**

Do not create more than one DOS primary partition or more than one DOS Extended partition.

You can create DOS or iRMX Extended partitions on partition numbers 2 - 4 of the partition table, but not on partition number 1.

You can use the “Create” option to change the OS on the partition or to change the starting and the last cylinder number for the partition. Any new partition tables or logical drives that you create are not written to disk until you exit **rdisk**.

At the prompt, enter the starting and the last cylinder number for the partition you are creating. DOS Version 3.3 has a 32-Mbyte size restriction; DOS Versions 4.01 and later have no size restriction.

If the starting cylinder is 0, and the last cylinder is non-zero, the starting head will be head one to avoid overwriting the master boot record. The last cylinder must be greater than or equal to the starting cylinder and less than the total cylinders configured for this disk. The ending head and sector will always be the maximum values supported by this disk's configuration. The last cylinder is reserved by **rdisk**.

```
Selected partition type:  iRMX EXT
Enter starting cylinder: 300

Enter ending cylinder: 516
```

Note

If you define partitions with overlapping cylinder numbers, you will be notified at either of these points:

- When you check the partition table (option 4 on the main menu)
- When you try to exit **rdisk**, before the partition information is written

If you choose item 4 to create or delete a logical drive, the main partition table must already hold at least one Extended partition. Specify which Extended partition on which you want to create or delete the logical drive, as shown in the next set of menus. You are prompted whether to create or delete a logical drive.

```
  (1)  Display partition table
  (2)  Create a partition
  (3)  Delete a partition
  (4)  Create or delete logical drives
  <CR> Return to previous menu

Enter selection: 4

  Disk 1 LOGICAL Configuration:   518 cylinders   128 heads  63 sec/track

  -- Partition Table For Fixed Disk 1 --
        System Active  Mbytes Usage  START:Cyl Head Sect  END:Cyl Head
Sect
  1        DOS    No      394  19%          0    1    1       99  127
63
  2    DOS EXT    No      394  19%        100    0    1      199  127
63
  3       iRMX    No      394  19%        200    0    1      299  127
63
  4   iRMX EXT    No      854  42%        300    0    1      516  127
63
  -- Partition Table For Extended Partition 2 --
        System Active  Mbytes Usage  START:Cyl Head Sect  END:Cyl Head
Sect
-->Note: No logical drives defined...
  -- Partition Table For Extended Partition 4 --
        System Active  Mbytes Usage  START:Cyl Head Sect  END:Cyl Head
Sect
-->Note: No logical drives defined...

Enter partition (<CR> for previous menu): 4

  (1)  Create logical drive
  (2)  Delete logical drive
  <CR> Return to previous menu

Enter selection: 1
```

You then have the choice of creating a DOS or iRMX logical drive.

```
  Disk 1 LOGICAL Configuration:   518 cylinders   128 heads  63 sec/track

  -- Partition Table For Extended Partition 4 --
```

```
        System Active  Mbytes Usage  START:Cyl Head Sect  END:Cyl Head
Sect
  Extended Partition Table Empty

  (1)  DOS logical drive
  <CR> RMX logical drive

Enter selection: 1
```

Note

On an iRMX Extended partition you can create either or both DOS and iRMX logical drives. However, on a DOS Extended partition, you can create only DOS logical drives.

A logical drive is simply another partition within an Extended partition. As when creating a main partition, specify the starting and ending cylinders to define the extent of the logical drive:

```
Enter starting cylinder: 300

Enter ending cylinder: 349
```

Option 3: Set Active Partition

Select this option from the main menu to specify which partition number is activated for booting. Since only one partition can be active at a time, activating a new partition automatically deactivates the last one. For DOSRMX, always make the DOS primary partition active. After you activate a partition, the partition table is displayed, similar to the display above for Option 1.

You can make a primary partition active. You cannot make an Extended partition active.

Option 4: Check Partition Table

Select this option to verify that the partition table is valid, including checks for:

- Overwriting the master boot record
- Partitions that have an ending address less than the starting address
- Overlapping partitions
- Partition addresses greater than disk size

Option 5: Reinitialize Partition Table

Select this option to read the partition table contents from the selected hard disk. If the current contents of the partition table have been modified, a query asks if the modifications should be saved.

Option 6: Select Next Fixed Disk

➡ **Note**
The Select Next Fixed Disk option is not implemented for the iRMX version of **rdisk**. To change disks from the iRMX OS, invoke **rdisk** with the appropriate DUIB name for the disk drive.

Select this option in the DOS version of **rdisk** to switch between the two hard disks. The **rdisk** utility defaults to hard disk one.

If the current partition table has been modified, a query asks if the modifications should be saved. If the current disk is disk one and no second disk is configured, the warning message shown below appears and the partition table for hard disk one is reestablished as it was before the option was selected.

```
Enter Selection: 6

Fixed disk 2 not configured in ROM BIOS data area
Press any key to continue
```

Option 7: LBA Physical Configuration

➡ **Note**
The LBA Physical Configuration option is not implemented for the iRMX version of **rdisk**.

Rdisk shows the logical configuration of the drive, which is the data maintained in the partition table. If you use an LBA (Logical Block Address) drive, the Enhanced IDE management sets up logical parameters appropriate for DOS, and hides the actual physical drive parameters from DOS. However, the PC's setup program for CMOS memory displays physical parameters for an LBA drive. To display the physical parameters within **rdisk**, enter option 7.

➡ **Note**
When configuring the partition table, you must enter logical parameters, not physical parameters.

If the drive is an LBA drive, the display is similar to the following:

```
Enter Selection: 7

Disk 1 PHYSICAL Configuration: 1024 cylinders  32 heads  63 sec/track
NOTE: PARTITION TABLE ACCEPTS ONLY THE LOGICAL DRIVE CONFIGURATION
 Press any key to continue
```

If the drive is not an LBA drive, this message is displayed:

```
Enter Selection: 7

Sorry, but disk 1 is NOT an LBA (Enhanced IDE) drive
 Press any key to continue
```

Exit

Press <CR> at the main menu to exit **rdisk**. At this point, if you have made partitioning changes, **rdisk** writes the partition table to the hard disk. The partition table is first validated. If any errors occur, a warning message appears, and the write/exit is aborted. If no errors occur, the partition table is written to the master boot record on the hard disk and **rdisk** exits.

Additional Information

➠ **Note**
You cannot use this command with a device that you access through NFS.

DOS-based **rdisk** provides the full functionality of DOS-based **fdisk** for examining and modifying a PC-based hard drive partition table.

See also: **fdisk**, in your DOS documentation

Rdisk uses the ROM BIOS is used to acquire the hard disk parameters. Since ROM BIOS supports only two hard disks, hard disk one and hard disk two are the only disks supported. These disks must be configured in the CMOS RAM data storage area of the ROM BIOS prior to invoking **rdisk**. Use the ROM BIOS **setup** utility.

Use the **fdisk** utility to assign DOS logical drives.

If your version of DOS is older than Version 3.0, **rdisk** exits with a warning message before executing any other functions.

Since the Version 3.3 or older DOS utility **fdisk** allows only two partitions, **fdisk** displays partition numbers 3 and 4 as partition number 2.

Setting up a Partition

DOS and the iRMX for PCs OS each require their own partitions.

Set up the partition table using the **rdisk** utility. Each OS to be installed requires a partition; no partition can share disk cylinders with another partition or overlap any other partition. If you intend to install DOS, you must leave disk space for a DOS partition when installing iRMX for PCs. See your DOS manual for information on the size for this partition.

➠ **Note**
Systems with versions earlier than 2.2 of the iRMX OS contain an incompatible bootstrap loader. To install disks on these systems, you must invoke the **rdisk** utility and update the partition table, even if you do not make changes.

If you are installing your own hard disk drive, you must perform a low-level format before partitioning.

To start the partitioning, invoke **rdisk**. When the **rdisk** screen appears, write down the number of cylinders shown at the top of the screen; this number is the maximum number of cylinders in your system. For example, if **rdisk** displays 518 cylinders, they are numbered 0 through 517. **Rdisk** always reserves the last cylinder, so the highest number you can specify during partitioning would be number 516.

Four partitions are available; their locations cannot overlap. Enter the next unused number for your partition number at the prompt. For example, if DOS is in partition 1, partition 2 is the next available partition. Multiple iRMX partitions can exist on a single hard disk.

The first track of cylinder 0 is reserved for the partition table and the master boot record. **Rdisk** reserves the last cylinder. To decide how many cylinders to give to each OS partition, you can use an approximation:

```
Total Number of Cylinders/3 = one third of the disk for a given
partition
```

Or you can make a more exact determination using:

```
cylinders * heads * sectors * 512 = bytes in a given partition
```

If bad sectors are encountered at the start of a partition, **rdisk** decreases the size of that partition by mapping out the bad sectors. This may result in a partition that is smaller than you anticipated.

After you select the partition number, the system asks you to select the OS: enter 82 to indicate that this new partition will run the iRMX OS. The system prompts you for the starting cylinder. This prompt and the next prompt define the size of the new partition. If your system runs only the iRMX OS, the starting cylinder is 0 and the ending cylinder is (maximum cylinders - 1).

If you also have a partition for DOS, the Starting Cylinder Number for the iRMX partition depends on the location of the DOS partition. Be certain that the cylinder numbers do not overlap.

Note

If your system contains both an iRMX partition and a DOS partition, you should leave one track between the ending of one partition and the beginning of the next.

At the Enter Last Cylinder prompt, enter the last cylinder in the iRMX partition. If the iRMX partition fills the rest of the disk, this number is the number of cylinders displayed on the first line of the **rdisk** main menu screen.

This description assumes only one iRMX partition; to create more you must repeat the process.

The main screen is displayed again and now contains the information that you just entered for the iRMX partition. You must now activate the iRMX partition. Select 3 from the main menu to activate one of the partitions. This causes the system to bootstrap load the OS resident in that partition upon system reset.

Enter the number of your iRMX partition at the prompt. This marks the iRMX partition as **active.** The main screen is displayed again. To complete the process, at the main menu press <CR> to exit and write the information back to the table.

If any errors are displayed on the screen, the partition table information you entered may not be valid. **Rdisk** does not exit; reenter your information, making certain that partitions do not overlap.

Once the partition table has been successfully written, you are ready to format the iRMX partition.

See also: **format**, in this chapter

Error Messages

`Disk X is NOT an LBA`
This disk drive is not controlled by the LBA mechanism.

`Duplicate DOS EXT partition;`
You can define only one DOS Extended partition.

`Error during ROM BIOS function execution`
The ROM BIOS returned the indicated error.

`Extended Partition #X, Bad Partition Signature Detected`
Invalid information was detected.

`Extended partition X address greater than extended partition cylinders`
The specified cylinder number for a logical drive is greater than the highest defined cylinder for the extended partition in which you are creating the logical drive.

`Extended partition X contains logical device address greater than the maximum number of free disk cylinders`
`Partition x address greater than maximum number of disk cylinders`
The starting and/or ending address for partition `x` is greater than the maximum address supported by this disk.

`I/O error while reading disk drive parameters`
The disk could not be read.

`Illegal partition table read from fixed disk`
The invalid table is displayed and you can choose to modify it to correct the partition table.

`Illegal Partition: x`
The starting address in partition `x` is greater than the ending address, or the ending address is greater than the disk size.

`Initialization Failed`

The iRMX version of **rdisk** could not get the partition table from the device specified by this DUIB.

`Invalid partition table, table not saved`

Rdisk found an error in the changes you attempted to make and has not written the partition table.

`No logical drives to delete.`

You attempted to delete a logical drive, but there are none defined in this extended partition.

`Not a bootable partition`

You attempted to make an extended partition active; you can only make a primary partition active.

```
Not allowed to start at cylinder=0, head=0, sector=1 in extended
      partition x
Not allowed to start at cylinder=0, head=0, sector=1 in partition x
```

The specified partition address would overwrite the master boot record.

`Not allowed to start at cylinder=0, head=0, sector=1 in partition`

The specified partition address would overwrite the master boot record.

`Not an extended partition.`

You attempted to create a logical drive on a primary partition, not an extended partition.

```
Overlapping extended partitions
Overlapping partitions  -->  x : y
```

Partition number `x` overlaps with partition number `y`.

`Partition exists`

You attempted to create a partition that already exists. You must first delete the existing partition.

`Specified start_cylinder less than extended partition start cylinder.`

The specified start address for a logical drive is lower than the specified starting address for the extended partition.

remini

Translates the *rmx.ini* file into the iNA 960 load file format (also known as remote file format).

> **Note**
> You can use this command in an esubmit file or **rq_c_send_command** system call if the form of the command does not require user input. If the command requires user input in an **rq_c_send_command** system call, it will fail. However, you can use a form of the command that requires user input in an esubmit file if you use the `eoresponse` and `coresponse` subcommands.

See also: **esubmit** command, in this chapter

Syntax

remini *rmxinifile* to|over *remfile*

Parameters

rmxinifile
Name of the file to translate.

`to|over`
Specify `to` create a new file or `over` to overwrite an existing file.

remfile
Name for the file produced.

Additional Information

You can use this command to create an *rmx.ini* remote load file for use in the remote booting of iRMX for PCs.

Example:

```
remini rmx.ini to rmxini.rem
```

remove

Revokes iRMX-NET public network access to one or more local directories.

Syntax

```
remove public_name_list
```

Parameter

`public_name_list`
One or more public names, separated by commas, which were previously assigned to local directories for access by remote users.

Additional Information

The **remove** command revokes public access to a directory that was previously defined as public, either by configuration of the File Server or with the **offer** command. Specify the public name, not the local directory name, if they are different.

Error Messages

`missing parameters`
The public name of the directory must be entered as part of the command syntax.

`cannot remove <name>`
The first public directory configured in the File Server is used for a work file, and cannot be removed. The default for the first public directory is *:sd:work*.

rename

Changes the pathname of one or more data files or directories. The **rename** command may be used to move a file to a different directory on the same volume.

Note
You can use this command in an esubmit file or **rq_c_send_command** system call if the form of the command does not require user input. If the command requires user input in an **rq_c_send_command** system call, it will fail. However, you can use a form of the command that requires user input in an esubmit file if you use the `eoresponse` and `coresponse` subcommands.

See also: **esubmit** command, in this chapter

Syntax

```
rename inpath_list to|over outpath_list [q]
```

Parameters

inpath_list
One or more pathnames, separated by commas, of files or directories that are to be renamed.

`to|over` *outpath_list*
A list of new pathnames for the files, separated by commas. The number of pathnames must be the same as in the *inpath_list*. If you specify `to`, you are prompted to overwrite existing files of the same name. If you specify `over`, existing files by these names are replaced by the input files. You cannot use `over` to rename a directory over an existing directory unless it is empty.

`q(uery)` Prompts for permission to rename each file in the list. Respond to the prompt with:

Y	Rename the file
R	Rename remaining files without further query
E	Exit the command
N or other	Don't rename this file; query for the next

Additional Information

To use **rename**, you must have delete access to the current file and add-entry access to the destination directory. If you rename a file over an existing file, you must also have delete access to the second file.

The **rename** command cannot be used across volume boundaries; that is, you cannot rename a file to move data from a volume located on one secondary storage device to a volume located on another device (for example, from one diskette to another). Attempting to do so causes an `E_NOT_SAME_DEVICE` error message. Use the **copy** command or a combination of **copy** and **delete** commands to rename files or move data across volume boundaries.

You can rename an existing directory pathname to a new, nonexistent pathname anywhere in the directory tree. You cannot rename an existing directory over another existing directory unless the destination directory is empty (an `E_DIR_NOT_EMPTY` condition code is returned).

Note
Changing the name of a directory also changes the pathnames of all files listed in that directory. All subsequent access to those files must specify the new pathnames for the files.

With the EDOS file driver, you can use **rename** to assign a different name to a directory, but you cannot rename the directory to a different spot in the directory hierarchy. If there is a directory structure */dir1/dir2/file_a*, you cannot rename *dir2* as */dir3* to place it under the root directory.

You cannot rename a server's virtual root directory or public directories. Also, you cannot rename a file into a server's virtual root directory.

Error Messages

`<old pathname>, delete access required`
You cannot rename a file unless you have delete access to that file.

`<new pathname>, directory add ENTRY access required`
You cannot rename a file unless you have add-entry access to the destination directory.

`<new pathname>, new pathname same as old pathname`
You specified the same name for the input pathname as you did for the output pathname.

`to or over preposition expected`
Either you used the `after` preposition with the **rename** command or the number of files in the `inpath_list` did not match the number in the `outpath_list`.

`pathname, invalid access to remote file or directory`

The pathname is either a remote file to be renamed or a remote output filename. One of three conditions caused this error:

- You do not have add-entry access to the file's parent directory.
- You do not have append and update access to the file.
- A user at the server system has removed delete access to a file; you cannot change delete access on a remote file. A user at the server system must grant delete access before this command will succeed.

`<pathname>, 0023:E_SUPPORT`

You attempted to rename a DOS directory to a different spot in the directory tree, which is not supported by the EDOS file driver.

restore

Transfers files from a backup volume to a named, remote, NFS, or DOS volume.

Note
Do not use this command in an esubmit file or an **rq_c_send_command** system call, because queries for user input will not be received.

Syntax

```
restore :backup_device: to|over pathname [name=name] [verify]
      [q] [select= (pathname_list)]
```

CAUTION
While the **restore** command is executing, no other activity should be occurring on the volume you are restoring. If other users access the volume during a **restore** operation, the volume's data could become corrupted, possibly requiring the volume to be reformatted.

Parameters

:`backup_device`:

Logical name of the backup device from which **restore** retrieves files. The backup device must always be a local device; it cannot be a remote device.

`to|over` *`pathname`*

Pathname of a file to receive a single restored file, or of a directory to receive multiple files. If you specify a logical name for a device, **restore** places the files under the root directory for that device. To restore files to the directory in which they originated, specify the same pathname as you used with the **backup** command. Specify `over` to overwrite existing files on the volume. If you specify `to`, and files being restored already exist on the volume, **restore** prompts:

```
<pathname>, already exists, overwrite?
```

Enter one of these in response:

Y or R	Delete the file and replace it from the backup volume.
E	Exit from the **restore** command.
N or other	Do not restore the file; continue with the next file.

`name=`*`name`*

Specifies a particular named data set from the backup device. If no name is given, only the first logical volume encountered is restored.

`verify`

No files are restored; use this parameter to verify that **backup** has produced a restorable set of volumes. When you specify this parameter, use *:bb:* (byte bucket) as the output pathname. The data on the volume is validated and **restore** displays:

```
<pathname>, Verified                        or
<pathname>, Directory Verified
```

`q(uery)` Prompts for permission to restore each file or directory. Respond to the prompt with:

Y	Restore the file
R	Restore remaining files without further query
E	Exit the command
N or other	If a data file, do not restore the file; if a directory, do not restore the directory or any file in that portion of the directory tree. Query for the next file, if any.

`select = (`*`pathname_list`*`)`

A list of pathnames, separated by commas, designating specific files or directories to be restored. The complete list must be enclosed in parentheses. The pathnames cannot include the logical volume name and must be the exact pathnames used in the **backup** command. If you don't know the pathnames, use **restore** with the `verify` parameter to display them.

Additional Information

The **restore** utility copies files from backup volumes to target volumes in either local or remote directories. **Restore** copies the files to any directory you specify, maintaining the hierarchical relationships of the backed-up files. **Restore** allows the transfer operation to begin at any named data set or at any physical volume in a backup volume set. By using the `select` parameter you can specify individual files or directories to be restored.

Each backup volume used as input to the **restore** command must contain files placed there by the **backup** command. If the backup operation required multiple backup volumes, you must restore these volumes in the same order as they were backed up.

You must have sufficient access rights in the target volume to allow **restore** to operate. To create new files, you must have add-entry access to the parent directories. To restore files over existing files, you must have add-entry and change access to directories; and delete, append, and update access to data files. Normally, when **restore** copies files, it copies only those files to which you have access. It establishes your user ID as the owner ID, regardless of the file's previous owner ID. However, if you are the Super user, all files from the backup volume are restored with the owner ID and access rights intact.

When copying files, **restore** reconstructs the filename, access list, extension data, file granularity, and the contents of the file. However, when the destination is a remote or a DOS volume, the extension data is not copied and file ownership is not preserved. Restored files will be owned by the user who performed the **restore**.

When you invoke the **restore** command, it displays this sign-on message, where `V`*`x.y`* is the version number of the utility:

```
iRMX Restore Utility Vx.y
Copyright <years> Intel Corporation
All Rights Reserved
```

Then the command prompts you for a backup volume. Whenever **restore** requires a new backup volume, it issues this message:

```
<backup device>, Mount Backup Volume #<nn>, Enter Y to
Continue:
```

Where `<nn>` is the number of the requested volume. (In some cases **restore** displays additional information to indicate problems with the current volume.) In response to this message, place the indicated backup volume in the backup device and enter one of these:

Y or R	Continue the restore process.
E	Exit from the restore command.
N	Reprompt for a new volume.
any other	Invalid entry; reprompt for entry.

If you supply the requested volume, **restore** starts restoring files from that volume and, if necessary, requests additional backup volumes. Once you supply the first backup volume, you must supply all the other backup volumes in the data set, in numerical order, when **restore** requests them.

However, when **restore** requests the first backup volume, you can supply a higher-numbered backup volume, if you know that all the files you want to restore reside on higher-numbered volumes. **Restore** starts copying files from the higher-numbered volume and maintains the proper directory structure for the files it restores. Once you supply the first volume, you must supply all the remaining backup volumes in numerical order when **restore** requests them.

As it restores each file, **restore** displays one of these messages:

```
<pathname>, Restored/Verified
```

```
<pathname>, Directory Restored/Verified
```

If a `not restored` message is displayed, a more detailed error message is displayed.

Error Messages

`<pathname>, access to directory or file denied`

> **Restore** could not restore a file; either you do not have add-entry access to the parent directory or you do not have update access to the file. **Restore** continues with the next file.

`<backup device>, Backup Volume #<nn>, <date>, Mounted`

`<backup device>, Backup Volume #<nn>, <date>, Required`

`<backup device>, Mount Backup Volume #<nn>, Enter Y to Continue:`

> **Restore** cannot continue because the backup volume you supplied is not the one that **restore** expected. Either you supplied a volume out of order or you supplied a volume from a different backup session. **Restore** reprompts for the correct volume.

`<backup device>, Cannot Attach Volume`

`<backup device>, <condition code:mnemonic>`

`<backup device>, Mount Backup Volume #<nn>, Enter Y to Continue:`

> **Restore** cannot access the backup volume. This could be because there is no volume in the backup device or because of a hardware problem with the device. The second line of the message indicates the condition code encountered. **Restore** continues to issue this message until you supply a volume that restore can access.

`<pathname>, <condition code:mnemonic>, error during backup, file not restored`

> The **backup** utility encountered this condition code while attempting to save this file. **Restore** is unable to restore this file.

`<pathname>, <condition code:mnemonic>, error during backup, restore incomplete`

> The **backup** utility encountered this condition code while attempting to save this file. **Restore** restores as much of the file as possible to the target volume.

`<backup device>, error reading backup volume`

`<backup device>, <condition code:mnemonic>`

> **Restore** tried to read the backup volume but encountered an error condition, possibly because of a faulty area on the volume. The second line of the message indicates the condition code encountered.

`<pathname>, <condition code:mnemonic>, error writing output file, restore incomplete`

> **Restore** encountered this condition code while writing a file to the named volume. **Restore** writes as much of the file as possible to the named volume.

`<pathname>, extension data not restored, <nn> bytes required`

The amount of space available on the named volume for extension data is not sufficient to contain all the extension data associated with the specified file. The value `<nn>` indicates the number of bytes required to contain all the extension data. This message indicates that the target volume to which files are being restored is formatted differently than the source volume which originally contained the files. To ensure that you restore all the extension data from the backup volume, you should restore the files to a volume formatted with an extension size set equal to the largest value reported in any message of this kind.

See also: Setting the extension size, **format** command, in this chapter

`<backup device>, Invalid Input Specification`

The logical name you specified for the backup device was not a logical name for a device. Example invalid names are *:ci:*, *:co:*, and *:home:*.

`<backup device>, logical name does not exist`

The logical name specified for the backup device does not exist.

`<backup device>, Not a Backup Volume`

`<backup device>, Mount Backup Volume #<nn>, Enter Y to Continue:`

The volume you supplied on the backup device was not a backup volume. **Restore** continues to issue this message until you supply a backup volume.

`<pathname>, E_IFDR Not Restored`

For some reason, **restore** was unable to restore a file from the backup volume; it continues with the next file. Another message usually precedes this message to indicate the reason for not restoring the file.

`output specification missing`

You did not specify a pathname to indicate the destination of the restored files.

`<pathname>, READ access required`

You do not have read access to a file on the backup volume; **restore** cannot restore the file.

`<pathname>, too many input pathnames`

You entered a list of logical names for backup devices. You can enter only one input logical name per invocation of **restore**.

`Select List Too Long`

The pathname list you supplied with the `select` parameter exceeded 255 bytes. Invoke **restore** again with a shorter list of pathnames.

`Invalid Select : select = (filename [, filelist])`

The pathname supplied with the `select` parameter was not enclosed in parentheses.

`select, unrecognized control`

You supplied a list of pathnames with the `select` parameter and the list was not enclosed in parentheses.

`cannot attach VOLUME`

The backup device is a remote device.

retension

Retensions a tape, which winds the tape evenly on the spool. This can eliminate potential problems when reading or writing the tape.

Syntax

```
retension :logical_name:
```

Parameter

:*logical_name*:
Logical name of a tape device.

Additional Information

Note
You cannot use this command with a remote devices such as those that you access through iRMX-NET or NFS.

Invoking this command does a fast-forward to the end of the tape, then rewinds the tape back to the load point. This winds the tape evenly. The command displays this message:

```
Starting retension operation
```

Error Messages

`Invalid logical name`
The logical name does not exist.

`Device does not support retension`
The specified logical name refers to a file (condition code `E_IFDR`) or to a device other than a tape drive (condition code `E_IDDR`).

rmextdbg

Improves binding (linking) efficiency by removing `SRCLINES` entries from OMF-386 linkable modules and producing a smaller version of the file.

Syntax

```
rmextdbg filename.obj [filename.obj] [filename.obj]
```

Parameters

`filename.obj`
Object files to be processed.

Additional Information

`SRCLINES` are debug information segments in linkable modules (.obj files). They contain the full pathname to the source code file that the object code came from. Normally, there is one `SRCLINES` entry for every line of code, which uses a lot of disk space and is not needed by iRMX debugging tools.

Removing this unneeded information improves binding speed while leaving in all other debug information. Use this command on output from the PL/M compiler.

Rmextdbg processes the object files you enter on the command line, one at a time. Memory is reserved to load the entire file. If there isn't enough memory for the entire object file to be loaded, the program exits with an error. Otherwise, **rmextdbg** scans for `SRCLINES` debug segments, removes them, and thus shrinks the file.

When **rmextdbg** is finished, it writes the object file back out to disk.

See also: Example of a modified submit file using **rmextdbg**, in the PL/M directory under */rmx386/demo*
For C programs, use the **nosourcelines** compiler switch

rmxtsr

Provides the interface between DOS, ROM BIOS services, and the iRMX OS.

Syntax

```
rmxtsr
```

Additional Information

Invoke **rmxtsr** before using **loadrmx**. This utility performs all DOS and ROM BIOS calls on behalf of the iRMX OS.

⟹ **Note**

Rmxtsr runs at INT 85H; do not install other TSRs that chain themselves to this interrupt level.

Rmxtsr is a DOS terminate and stay resident (TSR) program which runs in the background, allowing other DOS programs to run. When the iRMX OS invokes **rmxtsr**, the current DOS application program is halted and **rmxtsr** services the iRMX request.

Rmxtsr must load in conventional DOS memory, the first 640 Kbytes, so your system must not use DOS extended memory managers. These memory managers put the microprocessor into Protected Mode, which interferes with DOSRMX.

The **rmxtsr** program is divided into two parts:

Transient part
: Executes when invoked. It reserves a portion of DOS conventional memory for the resident part of the utility, sets up software interrupt vectors to allow the iRMX OS to invoke the resident part of the utility, and then terminates and removes itself from memory.

Resident part
: Provides the DOS and ROM BIOS extension to the iRMX OS by interpreting iRMX requests, issuing DOS or ROM BIOS calls and sending the results back to the iRMX OS.

Rmxtsr handles requests as follows:

1. An application program makes an **rqe_dos_request** system call.
2. **Rqe_dos_request** sends the request to the TSR.
3. The TSR performs the appropriate DOS/ROM BIOS function and returns the results to **rqe_dos_request**.

When **rmxtsr** runs, and no errors occurred, this message is generated:

```
iRMX Interface TSR Version x.x Installed
```

Error Messages

`iRMX Interface TSR requires DOS V3.0 or later`

`Unknown DOS version`

You are running the wrong version of DOS: **rmxtsr** will not work on systems running DOS earlier than Version 3.3. Use `ver` at the DOS prompt to determine the DOS version.

To reinstall a later version of DOS, first back up the DOS partition, and then reformat the primary DOS partition. If you use the earlier version DOS **backup** utility to do this, use the earlier version DOS **restore** utility; the later version of **restore** will not work.

Alternatively, you can boot from a DOS System diskette and then run **rmxtsr**. You may have problems invoking some DOS utilities on your hard disk, as these utilities are an earlier version than the DOS utilities provided with the DOS version you booted.

`iRMX Interface TSR is already installed`

Rmxtsr has already been invoked and cannot be invoked again. To reload the utility, reboot the system.

set

Displays or changes CLI environment values. Only one value may be set at a time.

Syntax

```
set [terminal|minbackpool|maxbackpool|aliastable|prompt
      [= value|myslot]]
```

Parameters

`terminal`
: The terminal type for which CLI line-editing features are set.

`minbackpool`
: The minimum memory pool size for background jobs.

`maxbackpool`
: The maximum memory pool size for background jobs.

`aliastable`
: The size of the table used to store aliases.

`prompt` The prompt displayed by the CLI.

`=` *`value`*
: The corresponding string or numeric value for each keyword. Values for `minbackpool`, `maxbackpool`, and `aliastable` are a decimal number of Kbytes. The prompt string can be up to 14 characters. If you omit the *`value`* parameter, values are displayed rather than set.

`myslot` An option only for the prompt that sets the prompt to the slot number of the board in a Multibus II system.

Additional Information

If you enter this command with no parameters, the CLI displays the current values, similar to:

```
CLI PARAMETERS are:
terminal = ANY
prompt = -
minbackpool = 6K
maxbackpool = 384K
alias table size = 2K
```

If you enter the command with a parameter name but no value, the current value for that parameter is displayed.

Options

Set terminal

Your initial terminal name is defined in the *:config:terminals* file. The **set terminal** command changes how the CLI supports line-editing by specifying a new terminal type. The **terminal** command has the format:

```
set terminal=<terminal name>
```

In the command above, `<terminal name>` is the name of a terminal defined in the *:config:termcap* file. This file contains several default terminal definitions. If the name is not defined in this file, the CLI displays this error message and sets the terminal name to the default ANSI standard:

```
<terminal name> is not found in :config:termcap
default ANSI standard assumed
```

You can add terminal definitions to the *:config:termcap* file. This file also contains additional configuration commands for AEDIT Version 2.2, Inamon Version 1.8, and the Virtual Terminal Consumer V3.1 or later versions.

See also: *termcap* file, *System Configuration and Administration*

Assignments made with the **set** command are only valid for the current logon session. To change the terminal definition permanently, change the terminal name in the *:config:terminals* file.

See also: Terminal configuration files, *System Configuration and Administration*

Set minbackpool and set maxbackpool

The `minbackpool` and `maxbackpool` parameters establish new default values for the minimum and maximum memory pool sizes used in background jobs. (The default values can be overridden for a specific background job with an entry in the **background** command.) The initial minimum default is 6 Kbytes. The initial maximum default is 384 Kbytes, unless you have a maximum memory partition less than 384 Kbytes; then the default is 0. The default values provide enough memory for most ordinary jobs. The commands have the format:

```
set minbackpool=<size>
set maxbackpool=<size>
```

Enter a decimal number of Kbytes (do not enter the K). Use a minimum value large enough to accommodate the background stack and a maximum value less than (user_pool_max - 200 Kbytes). If the maximum value is greater than (user_pool_max - 200 Kbytes), you may not have enough memory to execute foreground jobs. The values are set as you entered them, but you may want to set different values. If this occurs, the CLI displays this warning:

```
WARNING:  maxbackpool attribute can avoid foreground
          execution due to memory limits
```

If the maximum value you enter is less than the minimum value, this message is displayed:

```
WARNING:  maxbackpool < minbackpool, value was assigned use
          set command to set background memory pools
```

Set aliastable

The default size of the memory table used to store aliases is 2 Kbytes. The `aliastable` parameter establishes a new size, either smaller or larger. The format of the command is as follows, where <*size*> is a decimal number of Kbytes (do not enter the K).

```
set aliastable = <size>
```

Set prompt

The default CLI prompt is `-` (a hyphen). In DOSRMX it is `RMX>`. The `prompt` parameter sets a new prompt string. The format of the command is as follows, where `<string>` is a string of up to 14 characters:

```
set prompt = <string>
```

On a Multibus II system or on a Multibus I system using the Multibus II Nucleus communication system, you may set the prompt to the string `myslot`. This causes the CLI to include the Multibus II host ID in the prompt. If the Multibus II board is in slot 2, the new prompt would be:

```
[2]-
```

Multibus I and PC bus boards are considered to be in slot 0.

Error Messages

```
terminal name is not found in :config:termcap:
```

```
default ANSI standard assumed
```

The terminal name you entered is not defined in the terminal definition file. The default ANSI standard is assumed to be the terminal name until you redefine it using the **set** command.

```
<alias size>, new alias table is not enough to hold user aliases
```

The new value you entered is too small to contain all the aliases you have assigned. The actual table size is not changed. This message does not appear if you reduce the size of the alias table and the new size is still large enough for the current aliases you have assigned.

```
set, wrong syntax
```

You entered the command incorrectly.

```
set illegal parameter, parameters are:
       terminal     prompt       aliastable
       minbackpool  maxbackpool
```

You entered the command with an illegal parameter.

setconfig

Places the contents of the specified configuration file into a system memory segment so that it is available to subsequently loaded applications .

Syntax

```
setconfig file_name
```

Parameters

file_name Full pathname of a file containing configuration information

Additional Information

The configuration information in the file passed to the setconfig command must be in the same format as that of the RMX.INI file described in the *System Configuration and Administration* on-line manual.

Note

In DOSRMX and iRMX for PCs systems, the contents of the file passed to the setconfig command overwrite the contents of the system configuration segment that initially was filled with the contents of the RMX.INI file by the boot process. The setconfig command allows MSA booted Multibus II systems and standard Multibus I systems to have dynamic configuration capabilities similar to those provided by the RMX.INI file in PC-booted systems.

setname

Enters iRMX-NET server names and addresses in the local Name Server object table.

Syntax

```
setname server_name [SNIDx|network_address] [nfs|hid|rls] [r1]
```

Parameters

server_name
: The name of a local or remote server system. The maximum length is 16 characters and the name must be unique within the network. If the network address is omitted, the name is assigned to the local server.

SNIDx
: The configured subnet in the iNA 960 job. The number x can be in the range 1-4. The transport address is built using the xth subnet configured in the iNA 960 job.

network_address
: A transport address that includes the Ethernet address of the system specified by *server_name*. This is the same format as the 34-character transport address entries in the *:sd:net/data* file.

See also: */net/data.ex* file, Chapter 11, *Network User's Guide and Reference*, for the other addresses you can set

`nfs`
: The entry is to be made only under property type 3H, which specifies that this name and address represent a file server. (This parameter has no relationship to the TCP/IP-based NFS.)

`hid`
: The entry is to be made only under property type 5H, which specifies that the address is the host-unique ID. When you use this parameter, the Name Server catalogs the address for use by the **getname** command. Specify this parameter for systems acting only as clients.

`rls`
: The entry is to be made only under property type 6H, which specifies that the address is the iRMX load server.

If neither `nfs`, `rls`, nor `hid` is specified, the *network_address* is cataloged in different forms under property types 3H (file server), 6H (iRMX load server), and 5H (host-unique ID).

`r1`
: The address is to be entered in iNA Release 1.0 format rather than the current format. This option is not available if a subnet ID is specified.

Additional Information

If a system is configured as an iRMX-NET server only, or as both a server and client, it must be given a server name before it can respond to client requests. If the name is not set during system initialization, the system manager must invoke the **setname** command at least once to catalog the local server name with the network Name Server.

The first command shown below catalogs the local system under the property type *file server*; the second catalogs the host-unique ID, making the local system name available to users who invoke the **getname** command. The third command catalogs both entries.

```
setname server_name nfs
setname server_name hid
setname server_name
```

If the local name and address exists in the *:sd:net/data* file, the name is automatically cataloged when the system initializes, or if network initialization fails you can catalog the file's contents with the **loadname** command. In this case, you do not need to use **setname** to catalog the local name. However, you may want to catalog the name and address of a system that is not in the *:sd:net/data* file. To do this, specify the remote system address in the **setname** command.

The format of the transport address is shown above, where you insert a TSAP ID and an Ethernet address. If you invoke **setname** from a Multibus II system and catalog the address under property type 5H (using the `hid` parameter or using neither `nfs` nor `hid`), **setname** catalogs the Ethernet address and appends the slot number of the board where it is invoked.

An example Ethernet address has the form `00AA00025A70`. A TSAP ID indicates the type of system and its purpose. Table 2-6 shows TSAP IDs for various types of systems.

Table 2-6. TSAP IDs Used in Transport Addresses

TSAP ID	Type of System
0001	Any MS-DOS system
1000	iRMX-NET file server
1100	iRMX-NET file consumer
8000	Unix (and other OS) file server
8100	Unix (and other OS) file consumer

Note

In Multibus II systems, use the slot number of the host board in the last two digits of the TSAP ID. This allows multiple hosts in one system to share a single network controller board.

You can invoke the **setname** command multiple times, giving different names for local and remote servers. Use the same name to catalog a server with the `nfs` and `hid` parameters. Use unique names to catalog different systems. The names are cataloged with the Name Server only as long as the local system is running; if you reboot the system, invoke **setname** to catalog them again.

See also: **deletename**, **getname**, and **listname** commands, in this chapter

The format of the transport address shown here is for iNA 960 Release 3.0 or later. The format is different if you specify the `R1` parameter. This switch is used for compatibility with systems running iNA Release 1.0 software.

See also: *Network User's Guide and Reference*

Error Messages

`illegal option`

The option specified for the command is not correct. Choose `nfs`, `hid`, or `r1` as the command option.

`<server>, name table full`

The local object table is full. Each server specified with **setname** occupies two entries in the object table. You can increase the table size (it is configurable) or delete some objects from the object table. Use the **listname** command to display entries in the table.

`<server>, name already exists`

The specified server name is already defined on the network. Select a different server name.

`illegal name`

The specified server name is more than 16 characters long. Select a shorter name.

`illegal value`

The specified network address is in the wrong format. Re-enter the address.

shutdown

Shuts the system down in an orderly fashion; can only be invoked by the Super user. All HI users are warned at fixed intervals of an impending shutdown, until the shutdown takes place.

Syntax

```
shutdown [p] [w = num] [sd=:device_name:]
      [b [d= list|all]]
```

Parameters

`p(artial)`
: Requests a partial **shutdown**. HI terminals are locked and all HI jobs except this operator's are aborted.

`w(ait) = num`
: The delay period in minutes (0 to 30) before shutdown procedures begin. The default value is 10. A value of 0 indicates no delay.

`sd = :device_name:`
: A logical name for the system device containing the system directory and the volume master files. Colons are required. The device name must be a named volume that is currently attached. The default value is *:sd:*. Although the system device may be different than the default, do not change it unless you have a specific reason to do so.

`b(ackup)`
: The **shutdown** utility creates a backup of the system device volume master files and any other devices specified in the `devices` parameter.

`d(evices) = list|all`
: Backs up the fnode files on the specified devices and marks the devices as shut down. `List` is a list of logical device names surrounded by colons and separated by commas. `All` specifies all attached EIOS logical named devices.

Additional Information

This command indicates a 10 minute wait, a backup of the fnode file, and the marking of *:dev1:* and *:dev2:* as shut down on the volumes.

```
shutdown W=10 B D=:dev1:,:dev2:,:sd: <CR>
```

You may use the `partial` option to delete only a limited number of HI users, such as when backing up a disk. When the system is ready to return to general use, invoke the **unlock** command to reinitialize all users.

The logical operations defined in the **shutdown** utility are shown below:

Operation	**Function**
Terminal locking	Locks all HI terminals.
Warnings	Issues a warning every 5 minutes until 5 minutes before shutdown, then issues a warning every minute.
Job deletion	Deletes all HI user jobs, excluding the caller's job.
Time stamping	Time-stamps the system directory.
Backup	Backs up all fnode files.
Detaching	Detaches all EIOS named and remote devices.
Marking	Marks the volume as shutdown.
Delete job tree	Deletes the caller's job tree.

All HI terminals are locked and the associated HI User Job Tree is deleted.

The default delay period of 10 minutes allows time to complete any cleanup procedures; you may specify a different delay. When you invoke **shutdown**, this message is issued to all terminals except your own at 5 minute intervals. When less than 5 minutes remain, this message is issued at one minute intervals:

```
*** system WILL BE shutdown IN nn MINUTE(S)
```

All terminals remain active during the delay period, except the terminal from which **shutdown** is invoked. This terminal becomes locked and cannot be used. If the `partial` option is specified, the terminal used to invoke **shutdown** unlocks after the delay period and can be used.

If **shutdown** is unable to delete one of the HI users for a period of five minutes, it displays this, specifying the user name as defined by the HI:

```
****   unable to delete user, <HI-user>
****   Continue? (Y/N)
```

The user has the choice of proceeding with the shutdown or aborting it.

During the shutdown process, **shutdown** catalogs the *r?shutdown* object in the root directory to ensure that first-level jobs are able to close down and exit in an orderly fashion. If **shutdown** is aborted the *r?shutdown* object is uncataloged.

The system directory on the system device volume is stamped, enabling HI initialization to set the system clock the next time the system is booted. This ensures that the system clock, which is used to time-stamp files, moves forward chronologically.

You can request that the system volume fnode file be copied to its duplicate file *r?save*, by specifying the `backup` parameter. If the `devices` parameter is also specified, the fnode files of those device are also backed up. When a successful backup has been made, the HI displays this, where the first message indicates any devices specified with the `devices` parameter :

```
****backup OF VOLUME files ON <logical_device> COMPLETED
****backup OF VOLUME files ON (system-device> COMPLETED
```

Any errors detected while trying to back up the files are displayed immediately. For instance:

```
***  error in device fnode <number>
***  shutdown COMPLETED
```

Shutdown detaches all target devices, including the system device, that have been logically attached using the EIOS. This closes all file connections on the devices and flushes all EIOS and BIOS buffers associated with the devices.

Regardless of whether you specify a backup of specific devices, all EIOS logical named and remote devices are marked as shut down. If an error is detected while detaching a device or while marking a volume as shut down, one of these messages is displayed:

```
*** error detaching device, <logical_name>
*** error marking shutdown device, <device>
```

When an error is detected during the backup and marking process of a logical named device, as opposed to the system device, the processing continues. After named volumes are marked as properly shut down, this message is displayed and the system manager job tree is deleted:

```
:sd:, outstanding connections to device have been deleted
***shutdown COMPLETED
```

Any errors detected during the **shutdown** process cause the utility to abort and display:

```
***  shutdown ABORTED
```

If a syntax error is encountered in the invocation of **shutdown**, the proper syntax is displayed. The utility then aborts and returns control to the system command level.

Shutdown cannot be called from a program because **shutdown** removes logical names, but cannot do so before the program terminates.

Aborting the Shutdown Utility

During operation of the **shutdown** utility, the system manager can enter <Ctrl-C> to abort the procedure. **Shutdown** can be aborted only at the completion of a logical operation; that is, only after all the terminals have been locked, but not during the terminal-locking process. If you use <Ctrl-C> to abort **shutdown**, you must invoke **unlock** to free each terminal.

Failure to Issue Shutdown

If the system manager does not invoke **shutdown** before powering down or rebooting the system, a warning message is displayed when the system is next powered on. This is the default warning message:

```
*** WARNING: The System Device was not shutdown properly.
```

You may establish a different message in a file named *:config:shutdown.msg*. To eliminate any message, create a 0 length *:config:shutdown.msg* file.

Note
If you use iRMX-NET on a system with a local hard disk, any previous shutdown message is removed. Therefore, if there was a problem with the previous shutdown procedure, the system cannot detect it and notify the system manager.

Error Messages

This list contains only syntax errors not previously explained in the Additional Information section.

`<keyword>, unknown keyword or switch`
A keyword other than `partial`, `wait`, `sd`, `backup` or `devices` was encountered.

`illegal keyword`
A switch was used as a keyword.

`illegal value`
A keyword was assigned an illegal value.

`<system_device>, not a logical device name`
The name you entered is not cataloged as a logical device.

`<system_device>, not a named device`
The logical device name entered is not a named device.

skim

Displays one or more text files one screenful at a time, enabling you to page up and down within the file.

Syntax

`skim` *`pathname`* `[q] [tabwidth =` *`num`*`]`

Parameters

`pathname`
The path name of the file to display. Specify more than one file by using wildcards.

`q(uery)` Prompts for permission to display each file. Respond to the prompt with:

Y	Display the file
R	Display remaining files without further query
E	Exit the command
N or other	Don't display this file; query for the next

`tabwidth` = *num*
The number of spaces to display for each horizontal tab character.

Additional Information

As each page is displayed, this prompt appears at the bottom of the screen:

```
more?
```

To scroll the text one line, press <CR>. To display the next screen, press the spacebar. Press ? or H to see this display of other command characters used by **skim**:

```
A          - repeat the last command
B          - back one page
D          - next half page
cr         - display next line
E or Q     - exit
N          - next file
P          - current path name
T          - top of file
W          - window
Z          - last page of file
? or H     - this display
space      - next page
```

When the end of the file is reached, **skim** displays:

```
    --(EOF)--more?
```

At this point, pressing <CR> or the spacebar terminates **skim** (unless you specified multiple files), but other commands may be used to continue displaying the current file.

If terminal translation is not enabled, the screen commands for clear screen and clear line are simulated. Long lines are wrapped to subsequent lines and unprintable characters are displayed in hexadecimal.

sleep

Suspends execution for a given number of seconds.

Syntax

```
sleep seconds
```

Parameter

`seconds`
The number of seconds to suspend execution.

Additional Information

The time needed to load the **sleep** command is not counted in the delay.

sort

Sorts lines alphanumerically in a text file and displays the output or writes it to another file.

Syntax

```
sort inpath_list [to|over|after outpath_list] [q]
```

Parameters

`inpath_list`
One or more pathnames, separated by commas, of text files to sort.

`to|over|after` *`outpath_list`*
One or more output files where sorted data is to be written rather than to the screen. Multiple pathnames must be separated with commas.

`q(uery)` Prompts for permission to sort each file in the list. Respond to the prompt with:

Y	Sort the file
R	Sort remaining files without further query
E	Exit the command
N or other	Don't sort this file; query for the next

Additional Information

If the input file contains these lines:

```
field1
FIELD1
FIELD2
field2
field10
This is a long line without a carriage return at the edge of
the screen, allowing the line to wrap if possible.
New line.
```

This is the sorted output:

```
FIELD1
FIELD2
New line.
This is a long line without a carriage return at the edge of
the screen, allowing the line to wrap if possible.
field1
field10
field2
```

submit

Reads and executes a set of commands from a file rather than from the keyboard.

Syntax

`submit` *`pathname`* `[(`*`param_list`*`)] [to|over|after` *`outpath`*`] [e]`

Parameters

`pathname`
: Name of the file from which the commands are executed. This file may contain nested **submit** commands. Typically the filename has the extension *.csd*, which you do not include in the pathname. If no such file is found, the filename is assumed to be exactly as entered here.

`param_list`
: One to ten actual parameters, separated by commas, that are to replace formal parameters in the submit file. You must surround this parameter list with parentheses. To omit a parameter in the middle of the list, reserve its position by entering a comma. If a parameter contains a comma, space, or parenthesis, enclose the parameter in single or double quotes. The sum of all characters in the parameter list must not exceed 512 characters.

`to|over|after` *`outpath`*
: Writes the output from each command in the submit file to the specified file rather than to the screen. Commands in the submit file may redirect their own output, in which case the output is not written to this file.

`e(cho)` Data written to an output file is also echoed to the screen. Nested **submit** commands do not have their contents echoed to the screen unless they are also invoked with the `echo` parameter.

Additional Information

If you use the CLI, this is an internal CLI command. It is also supplied as an HI command for systems that use a custom interface. Invoke `:system:submit` for the HI version of the command. The HI command does not support CLI features; you cannot include such commands as **alias** and **background** in the submit file, nor can you use an alias for a command.

To use the **submit** command, you must first create a data file that defines the command sequence and formal parameters (if any). Any program that reads its commands from the console input (*:ci:*) can be executed from a submit file.

If the submit file itself contains a **submit** command, another submit file is invoked. You can nest submit files to any level until memory is exhausted. When a nested submit file completes execution, it returns control to the next higher level of submit file.

Indicate formal parameters in the submit file by specifying the characters `%`*n*, where *n* ranges from 0 through 9. When **submit** executes the file, it replaces the formal parameters with the actual parameters listed on the invocation line. The first actual parameter replaces all instances of %0, the second parameter replaces all instances of %1, and so forth. If the actual parameter is surrounded by quotes (to avoid command-line interpretation of a comma, space, or parenthesis in the parameter), **submit** removes the quotes before performing the substitution. If there is no actual parameter that corresponds to a formal parameter, **submit** replaces the formal parameter with a null string.

If you specify an output file and do not specify the `echo` parameter in the **submit** command, only your **submit** command entry is echoed on the console screen; command entries in the submit file are not displayed as they are loaded and executed. You own and have full access to output files created by the **submit** command and to new files created by commands within the submit file.

If your command interface is the CLI, you may invoke the **submit** command as a background job to execute large tasks while you continue entering data from the terminal. If you invoke **submit** as a foreground job and enter <Ctrl-C> to abort processing, all **submit** processing ends (including any nested **submit** commands), and control returns to you.

When all commands in the submit file have been executed, this message is displayed:

```
END submit <pathname>
```

Examples

Following are two examples showing the use of submit files. The first uses the BND386 utility; the second uses the MAP386 utility.

1. This example of the submit file invokes the BND386 utility. This utility creates a bound object module (the `&` characters are syntax required by the Binder). The example uses the file, *bind.csd*. It is located in the */intel/gen* directory.

```
bnd386                        &
/intel/lib/cstrmx3c.obj     , &  C startup module
%0.obj                      , &  User module - include other
                                  modules here
```

```
/intel/lib/crmx3c.lib      , &  iRMX III Floating-point
                                 C-library
/intel/ndp387/cl387n.lib   , &  Floating point support
                                 libraries
/intel/ndp387/80387n.lib   , &
/rmx386/lib/rmxifc32.lib     &  iRMX III System Call
                                 Interface library &
                                 bind controls
renameseg (code32 to code)   &
segsize (stack(2400h))       &
nodebug                      &  Change to 'debug' if debug
                                 info desired
object(%0)                   &
rc(dm(4000h,0FFFFFh))
;
```

Execute the submit file by issuing this command:

```
- submit /intel/gen/bind file.c echo
```

The *`file`* variable is the name of any C program which will be compiled under the iC-386 compiler. The command executes as a foreground job. The **submit** command substitutes the actual parameter of the file name in place of the formal parameter `%0` in the submit file. When the binding process starts, the CLI displays the *bind.csd* file as it processes each line.

This system message shows that processing has begun:

```
    iRMX III 386(TM) BINDER, <version>
    Intel Corporation Proprietary Software
```

When the job is complete, the CLI displays:

```
- END SUBMIT bind.CSD
```

See also: Using the 80386 Binder, *Intel386 Family Utilities User's Guide*

2. This example of the submit file, titled *map.csd*, invokes the MAP386 utility. This utility generates informational maps, such as table, segment, and cross-reference maps, about any input object module (the & characters are syntax required by the Binder).

   The *map.csd* submit file contains this command sequence:

```
    map386 %0 printcontrols(tables)    &
```

   Execute the submit file by issuing this command:

```
    - submit map (file.obj) printcontrols(tables)
```

The *file* variable is the name of any object file created by a compatible 32-bit compiler, such as the iC-386 compiler. The **submit** command substitutes the actual parameter of the file name in place of the formal parameter %0 in the submit file. The printcontrols option specifies Global Descriptor, Local Descriptor, and Interrupt Descriptor tables.

This system message shows that the job has begun:

```
iRMX III 386(TM) MAPPER, <vers>
Copyright 1986,1989,1990 Intel Corporation
```

When the job is complete, the CLI displays:

```
- END SUBMIT map.CSD
```

See also: Using the 80386 Mapper, *Intel386 Family Utilities User's Guide*

Error Messages

`<pathname>, end of file reached before end of command`
The last command in the input file was not specified completely. For example, the last line might contain a continuation character.

`<parameter>, incorrectly formed parameter`
You separated parameters in the parameter list with a character other than a comma.

`<pathname>, output file same as input file`
You attempted to place the output from **submit** into the input file.

`<pathname>, too many input files`
You specified more than one pathname as input to **submit**; only one file can be processed per invocation.

`<parameter>, too many parameters`
You specified more than ten actual parameters in the parameter list.

`<condition code:mnemonic>, during submit execution`
The commands in the submit file produced the error indicated by this condition code.

super

Makes you the system manager (Super user), with user ID 0. You must know the password (the default is *passme*).

Syntax

```
super
```

Additional Information

If you use the CLI, this is an internal CLI command. It is also supplied as an HI command for systems that use a custom interface, in the *:system:super* file. The HI command does not recognize any of the CLI features such as line-editing and aliasing.

If you logged on as Super, you are already the system manager. You only need to invoke **super** if you want to issue the **changeid** command to take on another user ID. In this case the **super** command doesn't require you to enter the password.

If you logged on as any user other than Super, invoke the **super** command to become the system manager; your user ID is changed to 0. In this case the **super** command prompts you to enter the password. Although you have the privileges of the system manager, the Super user logon files are not executed. For example, if Super has different aliases defined than in your logon files, those aliases are not defined when you invoke the **super** command.

After invoking the command, your prompt changes to `super-`. You can enter any commands and access any files available to the system manager. You become a verified user, which allows you to access any files with iRMX-NET. If you create new files, they are listed as owned by user ID 0, unless you previously invoke **changeid** to become another user.

The **super** command can be used only in the foreground. If you try to invoke it as a background job, you receive a failure message. To return to your logon user ID after invoking **super**, use the **exit** command.

See also: **changeid** and **exit** commands, in this chapter

Error Messages

`<condition code:mnemonic> cannot set default user`

A problem prevented the CLI from changing your user ID. The user definition file (UDF) may be corrupted.

`<condition code:mnemonic>`

An internal system problem occurred. For example, the CLI could not find the default user.

`<condition code:mnemonic>, super is unavailable`

The CLI encountered an error while reading the password you entered or while accessing the UDF (to determine if the password is correct).

`<parameter>, unexpected parameter`

You entered a parameter; the **super** command does not accept any parameters.

sysinfo

Displays information about the boot system that is currently running.

Syntax

```
sysinfo [l]
```

Parameter

`l(ong)`	Displays an iRMX Job Tree which lists the jobs currently running and their memory usage.

Additional Information

The displayed information varies, depending on the boot system and the associated CPU board. The output has the general format:

```
    The System Device DUIB Name is <duib_name>
    The System Boot File Name is <boot_system>
    The System Performance Index is <delay_constant>
    The currently specified Time Zone is <time_zone>
    The System Bus is <bus_type>
    The CPU Type is <cpu_type> <cpu_model>
    The System Board Type is <board_type>

The System Comments are:
<contents of ICU Comment Screen >
```

Where:

`<duib_name>`
The DUIB name of the physical device that is currently attached as the system device (:SD:).

`<boot_system>`
The name of the boot device and file which was booted and is currently executing.

`<delay_constant>`

A value computed by the Nucleus during initialization which is used by the OS for timing purposes. All iRMX device drivers use this value for timing loops so that the actual delay reflects the hardware's requirements. This avoids having to increase the timing loop values when faster hardware is available. It also avoids penalizing slower hardware so that sufficient delay is present for faster hardware. The higher the number, the faster the hardware. For Intel386 and Intel486 CPUs, the delay_constant is used for System Performance Index. In Pentium systems, the System Performance Index is 2.5 times the delay_constant.

`<time_zone>`

Always 0; this feature is reserved for future Intel use.

`<bus_type>`

Indicates your system bus: Multibus I, Multibus II, or PC Bus.

`<board_type>`

The value can be:

Value	**System Board Type**
0H	System unknown
1H	SBC386/12, SBC386/12S
3H	SBC 386/2x, SBC 386/3x
4H	SBC 386/116, SBC 386/120, SBC 386/133, SBC 386/258
5H	SBC 486/125
6H	SBC 486/12, SBC 486/12S
7H	SBC 486/133SE
8H	MIX 386/020
0FAH	SBC PCP4DX2, SBC PCP4X4, SBC PCP4SX33
0FBH	SBC P5090
0FEH	SBC 486SX25, SBC 486DX33

`<comments>`

The entry on the COMNT screen of the ICU. This lets you refer to the notes you placed in the definition file when you created the boot system. In an iRMX for PCs system, the comments field identifies the version of the OS as well as the licensed user and software serial number.

When the `l(ong)` parameter is specified, this type of additional information is given:

```
                          iRMX Job Tree

    MEMORY          JOB ID       JOB NAME
USED   AVAILABLE
5872K  7694K  0258          Root Job - Has Free System Memory
115K   0K        5E60       Application Starter Job
9K     0K        1108       Human Interface Job
69K    442K         80B8    CLI
19K    15K          A9B8    sysinfo
518K   0K           62A8    iRMX-Net File Server Job
274K   0K           5290    iRMX-Net File Client Job
307K   5K           4828    /rmx386/jobs/iethxpn.job
37K    10K       45D0       /rmx386/jobs/smw.job
78K    4017K     3E50       /rmx386/jobs/himem.job
47K    2K        3578       /rmx386/jobs/keybd.job
101K   15K       2D10       /rmx386/jobs/sdb.job
120K   19K       2680       /rmx386/jobs/clib.job
6K     0K        1050       EIOS Job
20K    3K        1010       RTE Job
151K   0K        0F68       DOS
46K    0K     0ED8          BIOS Job
```

The sum of the Root Job Used and Available Memory is the total amount of Free Space Memory available in the system when the boot device was loaded. Also, the sum of the Used and Available Memory in jobs other than the root job is equal to the Used Memory of the Root Job.

sysload

Loads a dynamically loadable device driver or user job as a child job of the HI. The driver or job remains resident in memory until the job is unloaded or the system is reset.

Syntax

```
sysload [-i name] [-o name] [-w] [-r] [poolmin, poolmax]
      pathname [target_params]
```

```
sysload -l
```

```
sysload -u job_name|job_token
```

Parameters

`-i name`
: Used to specify a file, logical name, or logical device as the *:ci:* for the loaded job. *:CI:* is the standard input for the job.

`-o name`
: Used to specify a file, logical name, or logical device as the *:co:* for the loaded job. *:CO:* is the standard output for the job.

`-w` Instructs the **sysload** command to wait until the loaded driver/job indicates that its initialization is complete before terminating.

`-r` Replaces an existing instance of the job to be loaded with the new job. If the job to be loaded already exists, the previous job is deleted. This has the same effect as deleting a job with **sysload -u** and then loading a new version of the same job.

`poolmin`
: A decimal number specifying the minimum allowable memory pool size for the job being loaded, in Kbytes. The default is 296 Kbytes. Do not follow the number with the character K, and do not use hexadecimal or octal numbers.

`poolmax`
: A decimal number specifying the maximum allowable memory pool size for the job being loaded, in Kbytes. The default is 16 Mbytes (0FFFFFH). Do not follow the number with the character K, and do not use hexadecimal or octal numbers. For use with **himem**, *`poolmax`* should be equal to *`poolmin`*.

See also: *himem.job, System Configuration and Administration*

`pathname`
: The pathname of the driver or job to be loaded.

`target_params`

Parameters specific to the driver/job being loaded. These may be optional, depending on the driver or job. The syntax of any parameters is defined by each driver and I/O job; **sysload** passes the parameters without interpreting them.

`-l` Used without parameters to display a list of current jobs and their job tokens loaded from a previous **sysload** command. For example:

```
sysload -l

Loaded Jobs: (6)
   c470  clib.job
   dbf0  paging.job
   54a0  remotefd.job
   4ae8  netrdr.job
   36a0  netat.job
   2dc8  keybd.job
```

`-u` *`job_name|job_token`*

Used to unload a driver or a job. Use the job name or token returned by **sysload -l**.

⚠ **CAUTION**

Most jobs and drivers provided with the OS are not unloadable. Attempting to unload such a job may cause unpredictable results such as a General Protection fault.

See also:Reference to Loadable Jobs and Device Drivers, *System Configuration and Administration*, to determine if a particular job or driver supports unloading (`-r` and `-u` options)

Additional Information

If **sysload** is invoked without parameters, it displays a usage message and the list of currently loaded jobs.

A loadable device driver is a device driver built as an HI command. Because you load the driver while the system is running, rather than configuring it with the ICU, you can dynamically change driver configuration. However, do not unload jobs with interrupt handlers.

Loaded jobs are user applications that can be added to the OS in a semi-permanent fashion. Once the job is loaded with the **sysload** command, the job remains part of the OS until it explicitly exits or until the system is rebooted. Also, if the loaded job supports the `-u` option, the job can be deleted by specifying that option with the **sysload** command.

Typically, you only load a driver or job once each time the system is started. The loaded driver is not deleted even after you log off, since **sysload** loads the driver as a child job of the HI rather than the CLI. You may use the **sysload** command in a submit file, such as *r?logon* or *loadinfo*.

If a driver is already loaded and you reload it without resetting the system, a new instance of the driver is loaded. For example, you may load a RAM disk driver, attach the device, and format it. If you then use **sysload** to reload the driver, and attach to the same device, the **attachdevice** command reports an unformatted volume, since it is a new RAM disk.

The loaded driver has access to standard *:ci:* and *:co:*. The default *:ci:*/*:co:* connections are inherited from the user job that invoked the sysload command. These defaults can be overridden by using the *-i* and/or *-o* command line options.

The OS provides loadable drivers for most uses. These are some of the drivers provided:

- a RAM disk driver
- a terminal driver for Multibus I serial controller boards
- a driver for the system debug monitor, SDB
- a driver for the network redirector, Netrdr
- a driver for iRMX-NET

See also: Loadable device drivers, Loadable jobs, *System Configuration and Administration* and *Driver Programming Concepts*

You may also write your own drivers or jobs to be loaded with **sysload**. OS drivers follow a standard convention for log files. The driver writes to a log file in the same directory as the driver. The log file has the same name as the driver file, with the extension *.log*. By convention, the load operation is successful if the log file contains only the sign-on message from the driver. Otherwise, an appropriate error message is written to the log file.

By convention, a sysloadable job or driver should have the following components:

- Initialization section

  Initializes application variables

  Creates a deletion mailbox and catalogs it in the job's object directory as R?EXIT_MBOX

  Creates one or more worker tasks

  Falls through to cleanup section

- Useful work section

Includes one or more tasks that perform the functions and services provided by the job. Error conditions are either handled locally with the tasks continuing their work, or by starting the termination process by signaling the cleanup section.

Termination conditions that arise locally due to function completion or remotely via some sort of message cause the cleanup section to be signaled.

- Cleanup section

  Waits at the exit mailbox for termination instructions. Termination message is a byte of 0xff.

  Cleans up any resources that require special attention such as interrupt handlers, regions, or alarms.

  Does the appropriate job exitting function based on job type (rq_delete_job or rq_exit_io_job).

You can also use **sysload** to add terminals defined by a loadable device driver to the *:config:terminals* file, enabling those DUIB names to automatically become part of the system during initialization.

See also: Loading and unlocking terminal devices, loading the PCX driver, *System Configuration and Administration*

Examples

This example loads the RAM disk driver. *`Poolmin`* and *`poolmax`* are not specified, so the default values are used:

```
sysload /rmx386/drivers/ramdrv (64)
```

This example loads the XMS server, specifying a *`poolmin`* of 500K, and a *`poolmax`* of 500K:

```
sysload (500,500) /rmx386/jobs/himem.job
```

See also: *himem.job* and terminals, *System Configuration and Administration*
terminals, *Driver Programming Concepts*

Error Messages

`Invalid PoolMin Value`

`Invalid PoolMax Value`
`Poolmin` and *`poolmax`* must be decimal numbers without a suffix.

`PoolMin larger than PoolMax`
`Poolmin` must be equal to or smaller than *`poolmax`*.

`Missing input parameter`
You did not specify the driver's pathname.

`Invalid Command Tail`
You used a delimiter other than a space preceding the *pathname* parameter.

`E_FILE_NOT_EXIST`
You must use a fully specified pathname.

`Could not attach <name> as CI, using default CI`
You specified <name> with the *-i* option, but an error occurred when an attempt was made to attach to it. The default *:ci:* will be used.

`Could not attach <name> as CO, using default CO`
You specified <name> with the *-o* option, but an error occurred when an attempt was made to attach to it. The default *:co:* will be used.

telnet

Communicates with another host using the TELNET protocol.

⚠ **CAUTION**
Do not use this command in an esubmit file or an **rq_c_send_command** because queries for user input will not be received.

Syntax

```
telnet [-ec] [-8] [host[port]]
```

Parameters

`-ec`	Changes the escape character to *c* for a **telnet** session.
`-8`	Enables the transmission of 8-bit data.
`host`	The remote host name or its Internet address.
`port`	The service number or its name.

Additional Information

Use **telnet** to connect to a remote host.

When invoked without the *`host`* and *`port`* arguments, **telnet** enters command mode, as indicated by its prompt, `telnet>`. In this mode, it accepts and executes the commands discussed below.

When invoked with a *`host`* (and/or *`port`*), **telnet** performs an **open** command with those arguments. If *`port`* is not specified, **telnet** attempts to contact the server at the default port. Once a connection has been opened, **telnet** enters input mode. In this mode, all text entered from the keyboard is sent to the remote host for processing.

See also: *services* file, *TCP/IP and NFS for the iRMX Operating System*

To enter command mode from input mode, enter the **telnet** escape character. To return to input mode, enter a <CR> at the `telnet>` prompt. To execute a single TELNET command from input mode, and return automatically to input mode, enter the command preceded by the escape character (for example, `^]linemode`). The default escape character is `^]` when TELNET is invoked with the **telnet** comm. Use the `-e` command line option or the **escape** command to change the escape character for a telnet session.

The `-8` option lets you communicate with hosts that use an 8-bit character set, such as the Asian and European character sets. If this option is not used, parity bits are stripped from the data.

Logging out of the shell on the remote host terminates the **telnet** connection, returning you to the local shell if the connection was opened from the **telnet** command line or to the `telnet>` prompt if the connection was opened from command mode. This can also be accomplished with the **close** command. The **quit** command terminates both the open connection and the **telnet** session, always returning you to the local shell.

Commands

These commands are recognized by the **telnet** command interpreter. They may be abbreviated, as long as they remain unique. The normal terminal editing conventions are available in command mode.

close	Close an open **telnet** connection, returning to the `telnet>` prompt (command mode) or to the local shell (input mode).
display	Display the current operating parameters of telnet.
environ	Change environment variables (type 'environ ?' for more environment options).
logout	Forcibly logout a remote user and close the connection, returning you to the local shell.
mode	Try to enter line or character mode (type 'mode ?' for more mode options.
open [**-e***c*] [**-8**] *host* [*port*]	Open a connection to the named host. The `-e` option specifies an alternate escape character and `-8` enables eight-bit mode. These options apply only to the session being opened. *Host* can be a host name or Internet address. *Port* can be a service name or number; if not specified, **telnet** attempts to contact the server at the default port.
quit	Close the open TELNET connection, if there is one, and exit to the local shell.
send	Transmit special characters to the remote host (type 'send ?' for more send options).
set	Set the operating parameters of the TELNET connection (type 'set ?' for more set options).

slc	Change the state of the TELNET connection’s special characters (type 'slc ?' for more slc options).
status	Show the current status of the TELNET connection, modes, and options.
telnet	Open a connection to the named host
toggle	Toggle the operating parameters of the TELNET connection (type ‘toggle ?' for more toggle options).
unset	Unset the operating parameters of the TELNET connection (type 'unset ?' for more unset options).
? [*command*]	Display a list of **telnet** commands (no arguments), or a description of the specified *command*.
!	Invoke a new shell.

Note
The TELNET specifications specify defaults for line mode transmission with the local *tty* driver echoing. This implementation, by default, provides character mode transmission with the local *tty* driver echoing.

Diagnostics

Exit status is 0 for normal termination or a positive number for error termination.

term

Displays attributes of a connection or terminal, or modifies terminal attributes.

Syntax

```
term [logical_name] [query] [display] [halfduplex|fullduplex]
      [vdt|hardcopy] [modem|nomodem] [translate|notranslate]
      [xy|yx] [inputrate=num] [outputrate=num] [width=num]
      [height=num] [offset=num] [overflow=num] [scroll=num]
      [rpc= zero|ignore|even|odd|num]
      [wpc= zero|one|even|odd|pass|num]
      [flowcontrol|noflowcontrol] [highwater=num]
      [lowwater=num] [fcon=num] [fcoff=num]
      [linkparity= noparity|even|odd] [linklength= 6|7|8]
      [linkstop= 1|1.5|2] [spchighwater=num]
      [nospecialcharacter|specialcharacter (num [,num...])]
```

Parameters

`logical_name`
: The logical name of the terminal. Colons are not required.

`query` Prompts you whether the changes are correct before applying them.

`display`
: After setting terminal attributes, displays the new settings.

`halfduplex|fullduplex`
: Sets the terminal to full- or half-duplex transmission.

`vdt|hardcopy`
: Specifies whether the terminal is actually a video display terminal or a printer (hard copy) device.

`modem|nomodem`
: Specifies whether the terminal is connected to a modem.

`translate|notranslate`
: Specifies whether the iRMX Terminal Support Code (TSC) should translate between ANSI standard X3.64 escape sequences and unique terminal character sequences.

`xy|yx` Specifies whether horizontal (`xy`) or vertical (`yx`) screen coordinates are sent first.

`inputrate=num` `outputrate=num`
: A decimal input and output baud rate.

`width=`*`num`*   `height=`*`num`*

The number of characters in the screen width and the number of lines in the screen height.

`offset=`*`num`*   `overflow=`*`num`*

The cursor offset that starts the numbering sequence on X and Y axes, and the overflow value that axis numbering falls back to after reaching 127.

`scroll=`*`num`*

The number of lines to send to the terminal when the operator enters the scrolling control character (default: <Ctrl-W>).

`rpc=zero|ignore|even|odd|`*`num`*   `wpc=zero|one|even|odd|pass|`*`num`*

Input (`rpc`) and output (`wpc`) parity control settings that indicate how the TSC treats the high bit of each character. Input refers to data entered at the terminal; output refers to data sent to the terminal. `Zero` means the parity bit is always set to 0, yielding 128 8-bit characters; you may also set the value to 1, which has the same effect. `Ignore` means the parity bit is unchanged by the TSC, enabling 256 8-bit characters. `Even` or `odd` means the parity bit is used to validate the parity; these must be set the same, and yield 7-bit data.

`flowcontrol|noflowcontrol`

For buffered devices, enables or disables use of output flow control characters (<Ctrl-S> and <Ctrl-Q> by default, or as defined by `fcon` and `fcoff`).

`highwater=`*`num`*   `lowwater=`*`num`*

For buffered devices, specifies the number of bytes in the buffer at which controller board firmware sends an *off* flow control character to stop receiving input data (highwater) or an *on* flow control character to begin receiving data (lowwater).

`fcon=`*`num`*   `fcoff=`*`num`*

For buffered devices, the decimal value of the ASCII character to use for *on* and *off* flow control characters. The recommended value for `fcon` is 17 (<Ctrl-Q>) and for `fcoff` is 19 (<Ctrl-S>).

`linkparity=noparity|even|odd  linklength=6|7|8  linkstop=1|1.5|2`

For buffered devices, these specify how data is handled by the physical link between the terminal and the controller device. `Linklength` is the number of bits per character and `linkstop` is the number of stop bits.

`spchighwater=`*`num`*

For buffered devices, if `specialcharacter` is set this is the number of bytes in the input buffer above which Special Character Mode is enabled and below which this mode is disabled. Entering Special Character Mode means that the terminal driver and the TSC use special characters (defined below) as interrupts for signaling purposes.

`nospecialcharacter|specialcharacter (`*`num`*` [,`*`num`*`...])]`

For buffered devices, this specifies whether Special Character Mode can be enabled and defines up to four ASCII characters as special characters. Surround the values with parentheses and separate them with commas.

Additional Information

To display terminal attributes, enter only the logical name of the terminal or connection. If the logical name is omitted, the attributes of the current terminal are displayed. When setting terminal attributes, the control names need not be typed in completely. Enter only enough characters of the keyword to make it unique from the other parameters. All values are decimal by default.

Buffered devices are controllers that buffer input and output for the terminal. The parameters that apply to buffered devices do not apply to the SBC 544A controller.

The **term** command cannot change connection attributes, since the changed attributes would only be valid for the connection held by the **term** job and would disappear whenever **term** exited. The command does not support translation specifications.

time

Displays the current time or sets the time of the local (OS) or global (battery-backed) time-of-day clock.

➠ **Note**
You can use this command in an esubmit file or **rq_c_send_command** system call if the form of the command does not require user input. If the command requires user input in an **rq_c_send_command** system call, it will fail. However, you can use a form of the command that requires user input in an esubmit file if you use the `eoresponse` and `coresponse` subcommands.

See also: **esubmit** command, in this chapter

Syntax

```
time [hh:mm:ss|q] [local|global]
time synchronize
```

Parameters

`hh:mm:ss`
Numerical designation for the hour, minute, and second. Specify only as many digits as needed: hours in the range 0-23 and minutes and seconds in the range 0-59. You may specify the hour only, the hour and minute, or all three. Any field not specified is assumed to be 0.

`q(uery)` Displays the current date, time and clock type, then prompts you to enter the new time. Enter a valid time as described above or the letter `E` to exit.

`local` Displays or sets the time portion of the local time-of-day clock maintained by the OS. This is the default if `local` or `global` is not specified. Any user may set the time.

`global` Applies only to systems with hardware clock/calendar components, typically backed up by battery power. Specifying `global` displays or sets the time portion of this clock. Any user may display the time, but only the Super user can set it. If you set the global clock, the local clock automatically takes on the same value.

`synchronize`
For systems with a global clock/calendar, this sets the time portion of the local clock to the current time of the global clock. If you set the global clock, this parameter is unnecessary.

Additional Information

You must separate the individual time parameters with colons. If you omit the time parameters, **time** displays the current date and time in this format:

```
dd mmm yyyy, hh:mm:ss  <local or global clock type>
```

If you have a system without a global clock/calendar, whenever you start up or reset the OS the time is automatically set to the time you last accessed the :*system*: directory plus the time that elapsed since the system was started. You can reset the time to any acceptable value.

If your system has a global clock/calendar and the OS is configured to recognize it, the local clock is automatically set to the time maintained in the global clock when you turn on or reset your system.

Error Messages

`<time>, invalid time`
: You specified an invalid or out-of-range entry for one or more of the time parameters.

`<parameter>, invalid syntax`
: You specified an illegal combination of parameters, such as both a time and the `query` parameter.

`only the system manager may set the global clock`
: You specified the `global` parameter, but you are not the system manager.

`E_SHARE, global clock busy`
: You attempted to access the global clock while another job was accessing it. Try the command again.

`<condition code:mnemonic>, while getting system time`
: This condition code occurred while the **time** command was getting the time from the global clock. Possibly you specified the `global` or `synchronize` parameter, but there is no global clock in the system.

`E_INVALID_DATE, global date read was invalid`
: The date returned from the global clock was invalid. This condition usually occurs when the global clock has never been initialized or when power to the clock has been interrupted. The BIOS system call **get_global_time** gets the date from the global clock, which the **time** command then displays.

`E_INVALID_TIME, global time read was invalid`

The time returned from the global clock was invalid. This condition usually occurs when the global clock has never been initialized or when power to the clock has been interrupted. The BIOS system call **get_global_time** gets the time from the global system clock, which the time command then displays.

`E_SUPPORT, no global clock`

There is no global clock in the system.

timer

Times the execution of a given command and displays the elapsed time in seconds.

Syntax

```
timer command
```

Parameter

`command`

Any valid command line; continuation lines are allowed, using the `&` character.

Additional Information

The elapsed time cannot be measured in fractions of a second. The time needed to load the command is included in the result. The reported time is only as accurate as the system time.

touch

Changes file time stamps.

Syntax

```
touch inpath_list [date=date] [time=time]
      [all|access|create|modify] [query]
```

Parameters

inpath_list
One or more pathnames of files to be touched. Multiple pathnames must be separated by commas. Wildcards are permitted.

date=*date*
A fully specified date of the form: `mm/dd/yyyy`. If you omit this parameter, the current date is used.

time=*time*
Time in the form: `hh:mm:ss`. Both `mm` and `ss` are optional. If you omit this parameter, the current time is used.

all
Modifies all available time stamps. Some file systems support full create/access/modify time stamps (named file driver) and others only support last modification time stamps (DOS file driver).

access (acc, a)
This parameter modifies only the last accessed time stamp, if supported by the file system.

modify (modified, mod, m)
This parameter modifies only the last modification time stamp, if supported by the file system.

create (cr, c)
This parameter modifies only the file creation time stamp, if supported by the file system.

query (q)
Prompts for permission to touch each file. Respond to the prompt with:

Y	Touch the file.
E	Exit the command.
R	Touch the remaining files without further query.
N or other	Do not touch this file; go on to the next file in the inpath-list.

Additional Information

If you do not specify any time stamps, the default action of the **touch** command is to modify the last accessed and last modified time stamps. If you invoke **touch** without any parameters, a help message listing the correct syntax and parameter descriptions is displayed.

When you invoke touch, your user ID must have write permission for the files to be modified by **touch**.

Error Messages

`Invalid time specified`
: The `time` parameter was entered in an invalid format.

`Invalid date specified`
: The `date` parameter was entered in an invalid format.

`Missing parameter(s)`
: Either the `time` or the `date` parameter was specified without a corresponding ***`time`*** or ***`date`*** value.

`Request is not supported by the file driver`
: The file driver associated with one of the files in the inpath-list does not support the **s_set_file_status** system call.

translate

Copies a file to the screen or to another file, converting the case of upper- or lower-case characters as specified.

Syntax

```
translate inpath_list [to|over|after outpath_list] [q] [u] [l]
      [n [=value]]
```

Parameters

`inpath_list`
: One or more pathnames, separated by commas, of files to be translated. Wildcards are permitted.

`to|over|after outpath_list`
: Writes the output to the specified file(s) rather than to the screen.

`q(uery)`
: Prompts for permission to process each file. Respond to the prompt with:

Y	Translate the file
R	Translate remaining files without further query
E	Exit the command
N or other	Don't translate this file; query for the next

`u(pper)`
: All lower-case characters are forced to upper-case.

`l(ower)`
: All upper-case characters are forced to lower-case.

`n(onprinting)`
: If no value is specified, nonprinting characters are displayed as question marks. If a value is specified, nonprinting characters are displayed as the ASCII character represented by the numeric value. The value is decimal by default, but may be specified in octal or hexadecimal by appending an O or H.

Additional Information

If no parameters are given, the **translate** command performs a slightly slower **copy** function. If you specify both `upper` and `lower` in the same invocation, all characters are changed to the opposite case. You cannot specify what characters are considered non-printable.

traverse

Recursively travels a directory hierarchy, executing the specified command in each directory in the tree. The command line may use the *:$:* logical file; *:$:* is set to indicate whatever directory is being traversed at the moment.

Syntax

`traverse` *`directory command`*

Parameters

`directory`
: Pathname of the topmost directory in the hierarchy to be traversed.

`command`
: The command, along with arguments and parameters, to be executed in each directory.

Example

To change the access rights for all files under the */helps* directory to have read permission, and for all subdirectories to have list permission, enter:

```
traverse /helps permit * R U=world
```

Error Messages

`<file> is not a directory`
: The starting path is not a directory.

`rq_c_send_command, exception 0021: E_FILE_NOT_EXIST`
: The HI **rq_c_send_command** system call cannot process the specified command.

tree

Displays the name (and optionally, size) of each data file and/or subdirectory in a directory tree.

Syntax

```
tree pathname [to|over|after outpath] [s] [i] [noda|nodi]
```

Parameters

pathname
: The topmost directory of the tree to be displayed. Wildcards may be used to indicate more than one directory. However, if a wildcard pattern matches a filename in the tree, the name is displayed regardless of a `nodata` or `nodirectory` parameter.

`to|over|after` *outpath*
: Writes the output to the specified file rather than to the screen.

`s(ize)` Displays sizes of files and directories.

`i(ndent)`
: Displays filenames using indentation.

`noda(ta)`
: Data files are not displayed.

`nodi(rectory)`
: Directory files are not displayed.

Additional Information

By default, the **tree** command lists all files and subdirectories. If you enter the command with no parameters, the tree begins in the current working directory. If you specify the `size` parameter, the number of bytes and blocks is displayed for files, as well as the number of files in directories. When you use `size`, directories are denoted by an asterisk in the first column. The sizes of directories reflect the sum of all files contained in the directory.

To display the size of all directories beginning at the root directory, enter:

```
tree / s noda
```

The size displayed for the / directory (which is the final entry) is the size of the entire file system.

uniq

Finds duplicated lines in a file and displays either the duplicated lines or non-duplicated lines, or a combination. A line is only considered a duplicate if the second line immediately follows the first.

Syntax

`uniq` *`pathname`* `[to|over|after` *`outpath`*`] [s] [m] [d]`

Parameters

`pathname`

The text file to be processed. If a wildcard is used, **uniq** processes only the first file found.

`to|over|after` *`outpath`*

Writes the output to the specified file rather than to the screen.

`s(ingle)`

Displays only lines with no duplicates.

`m(ultiple)`

Displays only lines that are duplicated.

`d(uplicate)`

Displays the extra line of lines that are duplicated.

Additional Information

The `single`, `multiple`, and `duplicate` parameters may be used in any combination. If none of these is entered, the default is `single` and `multiple`, which causes **uniq** to display all lines that contain no adjacent duplicate lines. The lines must be adjacent in order to be detected. Two otherwise identical lines with a different number of lines at the end are not considered to be duplicates by **uniq**.

unloadname

Removes from the local Name Server object table the names and addresses of iRMX-NET servers listed in a specified file.

Syntax

```
unloadname [pathname]
```

Parameter

`pathname`

The name of the file containing the list of network servers. The default file is *:sd:net/data*. If you specify another file, it must use the format defined for the *net/data* file.

See also: *:sd:net/data* file, Chapter 11, *Network User's Guide and Reference*

Additional Information

The **unloadname** command deletes names from the object table that were previously entered by the **loadname** command. The list of objects is read from a file and the names are deleted from the object table. The format of the input file is the same as that of the **loadname** command.

See also: **listname** and **loadname** commands, in this chapter

If an error message contains the name of one of the objects specified in the input file, the error occurred just for that name. Other entries in the file are processed.

Error Messages

`<name>, illegal input file format`

The input format of the file is not correct.

`<name>, syntax error. TYPE not found`

The entry in the input file for this object does not contain the keyword `TYPE=`. The name is ignored and **unloadname** processes the next entry.

`<name>, property type too long`

The property type or the system type field for this object is not the correct format.

`<name>, not valid property type`

The system type field for this object does not contain a valid value for the property or system type.

`<name>, syntax error.  ADDRESS not found`

The entry for this object does not contain the keyword `ADDRESS`.

`<name>, value too long`
: The transport address for this object is too long.

`<name>, illegal property value`
: The transport address for this object contains invalid characters.

`<name>, name does not exist`
: The object name in the input file is not present in the local object table. However, the object may be present in another system.

`<name>, illegal name`
: The object name specified in the input file is more than 16 characters long.

unlock

Enables users whose terminals have been locked out of the system to log back on; cannot be used for virtual terminals.

Syntax

```
unlock [terminal_id_list|*]
```

Parameters

`terminal_id_list`
: One or more physical device names of the terminals to be unlocked. Multiple names must be separated with commas.

`*`
: All configured terminals are to be unlocked.

Additional Information

Only the Super user can invoke the **unlock** command. **Unlock** unlocks terminals that were locked out by either the **lock** or **shutdown** commands. When you invoke **unlock**, the HI initiates logon procedures for terminals where the user is logged off.

When a terminal is unlocked, this message is displayed on the terminal where **unlock** is invoked:

```
unlocked
<terminal_id>, unlocked
```

This message is displayed on the unlocked terminal:

```
Terminal is now unlocked and available for use.
```

See also: Loading and unlocking terminals, *System Configuration and Administration*, for information about enabling terminals defined by loadable device drivers

Error Messages

`not multi-user system`
: You entered more than one terminal number in a system that is not configured as a multi-user system.

`unlock not allowed to non-super users`
: You are not the system manager and are not entitled to issue this command.

`parameters required`
: You entered **unlock** with no parameters.

`<terminal_id>, not found`

The terminal you specified is not configured into the system.

`<terminal_id>, already unlocked`

The terminal you specified is not locked.

`<terminal_id>, terminal connected`

The terminal you specified has been connected with the **connect** command. Use the **disconnect** command to disconnect the terminal before unlocking it.

unxlate

Displays information about the format of a file that was translated with the **xlate** command. The **xlate** command translates OMF files into bootloadable (iNA 960) network files.

Syntax

```
unxlate pathname
```

Parameter

`pathname`
A file produced with the **xlate** command

Additional Information

This utility can be used to determine the format of an **xlate**-translated file. Such a file consists of multiple modules that contain a command field, a length, a load address, a starting address, and the actual data to be loaded. The output from **unxlate** shows information about each module. The information is listed in a table containing entries as shown below:

```
CMD=<cmd> LOADADDR=<base:offset> LENGTH=<len>
    STARTADDR=<base:offset>
```

Where:

`<cmd>` One of these values:

0	For the last module on the LAN controller; execution waits for a GO command.
1	For modules that will reside on the LAN controller and are not the last module.
2	For the last module on the LAN controller; execution starts immediately.
C	For the last module on the host.
D	For modules that will reside on the host; not the last module.

`<base:offset>`
Memory addresses in which to load the code. The base and offset for `STARTADDR` is only used if the module is the last to load and execution starts immediately afterward.

`<len>` The length of the module to load.

See also: **xlate** command, in this chapter

version

Displays the version number of one or more library files or object files, such as HI commands.

Syntax

```
version pathname_list [l]
```

Parameters

`pathname_list`
One or more pathnames, separated by commas, of files from which to display version numbers. Wildcards are permitted.

`l(ong)` Displays all the version numbers residing in the input file.

Additional Information

If there is a version number in the file, **version** displays it in this format:

```
<pathname>, <module_name> version is x.y
```

Where:

`<pathname>`
The file containing the command

`<module_name>`
Name of the specified command or library; Intel-supplied commands have names as listed in this manual.

`x.y` Version number of the command.

You can use **version** to determine the version number of any HI command. You can also use it to determine the version numbers of commands that you write. If the file is a library, the command shows the current and previous version numbers.

For **version** to work on your commands, you must include a literal string in the command's source code to specify the name of the command and its version. The string contains this information:

```
'program_version_number=xxxx',
'program_name=yyyy...yyy',0
```

Where:

`program_version_number=`
: Specify this exactly as shown (lower-case, underscore separating the words, no spaces).

`xxxx`
: Version number of the product; this can be any four characters, but it must be exactly four characters long.

`program_name=`
: This is optional, but if you want **version** to recognize and display the program name, you must specify this exactly as shown.

`yyyy...yyy`
: Name of the command; this can be any number of characters.

`0`
: The literal string must be terminated with a byte of binary 0.

Example

This is an example of a literal string:

```
DECLARE version (*)  BYTE
DATA('program_version_number=V8.5',
    'program_name=MYPROG',0);
```

If your program included this declaration, **version** would display:

```
<pathname>, MYPROG version is V8.5
```

This is an example of a literal string that does not include the program name:

```
DECLARE vers2(*)    BYTE
DATA('program_version_number=1986',0);
```

If your program included this declaration, **version** would display:

```
<pathname>, version is 1986
```

Error Messages

`<pathname>, does not contain a program version number.`
: The command you specified does not contain version number information.

`<pathname>, is not an object module.`
: The pathname you specified is not a file containing executable object code.

whoami

Lists your current user ID and access rights.

Syntax

```
whoami
```

Additional Information

The **whoami** command produces a display similar to:

```
User id: # 5
Access IDs:  5, WORLD
```

The access IDs are the IDs of other users who have granted you access to their files.

See also: **permit** command, in this chapter

xlate

Processes files in Object Module Format (OMF86/286/386) to produce an iNA 960 boot image file.

Syntax

```
xlate pathname to|over outpath [options]
```

Parameters

pathname
The name of the input OMF file.

to|over *outpath*
Writes the output to the specified file.

options
A list of options separated by a single space. These options may be used to translate any OMF file:

Option	Definition
Q	Quiet - Do not display information as translation is done
V	Verbose - Print information as translation is done
N	Not Last Module - Sets bit 0 of the command byte of the boot module structure to 1; other modules follow this one. If the complete boot module comprises more than one file, specify this option for all files except the last one. If this option is not specified, the translation assumes that the module is the last one and sets bit 0 of the command byte of the boot module structure to 0.

These additional options may be specified to translate OMF286 and OMF386 files:

Option	Definition
I	Information only - Do not translate, only display contents of file header.
T	No task information - Do not load any task information data. If this option is used, it must be the last option specified, because **xlate** assumes that anything following the T is an address.

T *address*	Load task information at the specified address (a hexadecimal number with the prefix 0x). Recognized address suffixes are "k" for kilo and "M" for Mega. If this option is not specified, the translation assumes the no task information option (T with no address).
O *address*	Address offset - Add the specified address (a hexadecimal number with the prefix 0x) as an offset to all output addresses. Recognized address suffixes are "k" for kilo and "M" for Mega.
H *size*	Output the result of the translation as hexadecimal records of the specified length (size).

These additional options may be specified to translate OMF86 files:

Option	Definition
G	Go - Start execution upon loading. Sets bit 1 of the command byte of the boot module structure to 1, and jumps to the execution address immediately when loading is completed. If the boot module consists of more than one file, specify this option only for the last file. If neither G nor W is specified, the translation assumes G.
W	Wait - Sets bit 1 of the boot module structure to 0; when loading is completed, saves the execution address and waits for the start instruction. If the boot module consists of more than one file, specify this option only for the last file.
A	Absolute addresses used in module - Sets bit 2 of the command byte of the boot module structure to 1. If this option is not specified, bit 2 is set to 0, which indicates that the load and execution addresses are pointers.

Option	**Definition**
R	Remote - File loaded into remote memory. Sets bit 3 of the command byte of the boot module structure to 1: the module is to be loaded into remote host memory (from the perspective of the NIA). If this option is not specified, bit 3 is set to 0, which indicates that the module is to be loaded into local memory. If this option is used with G, they must be specified in the order R G. If this option is specified without a W or G, W is assumed for the translation.
D	Data - Include data segments in the output file. If this option is not specified, only the code segments are translated and included in the output file.

Additional Information

After files are translated by **xlate**, they can be downloaded to a local network controller board with the **load** utility. The files can be loaded on a remote network controller by including their names in a *ccinfo* file produced with the **bcl** command.

See also: **bcl** and **load** commands, in this chapter
boot file format, *Network User's Guide and Reference*

If processor-dependent options are not specified, the **xlate** utility applies these defaults to the translation:

- Normal translation information display mode.
- Last module - Sets bit 0 of the command byte of the boot module structure to 0.
- Go - If this is an OMF86 file translation, sets bit 1 of the command byte of the boot module structure to 1 and jumps to the execution address immediately when loading is completed.
- Load in local memory - If this is an OMF86 file translation, sets bit 3 of the command byte of the boot module structure to 0; the module is to be loaded into local memory (from the perspective of the NIA).
- Pointer addresses used in module - If this is an OMF86 file translation, sets bit 2 of the command byte of the boot module structure to 0.
- Code segments only in the output file - If this is an OMF86 file translation, only the code segments are translated; data segments are ignored.
- Load task information at address 1050H.

See also: **unxlate** command, in this chapter

Examples

1. This example translates an OMF86 file including the data segments, and displays translation information in verbose mode. This example is for local loading:

   ```
   xlate file1.omf to file1.loc V D
   ```

   Because no other options are specified, the translation makes these assumptions:

   - Last module - Sets bit 0 of the command byte of the boot module structure to 0.
   - Go - Sets bit 1 of the command byte of the boot module structure to 1 and jumps to the execution address immediately when loading is completed.
   - Load in local memory - Sets bit 3 of the command byte of the boot module structure to 0; the module is to be loaded into local memory (from the perspective of the NIA).
   - Pointer addresses used in module - Sets bit 2 of the command byte of the boot module structure to 0.

   If the *file1.loc* file already exists, **xlate** halts without translating, leaving the file undisturbed.

2. This example translates two OMF86 files for downloading with a remote boot request to a host:

   ```
   xlate file1.omf over file1.loc N R A
   xlate file2.omf over file2.loc R A
   ```

   In this case, two files are created for loading into remote memory (option R). The files are to be loaded in this order: *file1.rem* (option N), then *file2.rem*. The loading order must match that in the *ccinfo* file.

   Because no other options are specified, these defaults are applied:

   - Go - Sets bit 1 of the command byte of the boot module structure to 1 and jumps to the execution address immediately when loading is completed.
   - Absolute pointer addresses (option A) used in module - Sets bit 2 of the command byte of both the boot module structures to 1.

   Any existing files named *file1.loc* or *file2.loc* are overwritten.

3. This example translates an OMF286 file, including data segments:

   ```
   xlate appcode.omf to appcode.out
   ```

   Because no options are specified, the translation makes these assumptions:

   - Normal translation information display mode.
   - Load task information data at address 1050H.

   If the *appcode.out* file already exists, **xlate** halts without translating, leaving the file undisturbed.

❑❑❑

Using Disk Mirroring A

iRMX disk mirroring is a hard disk configuration that maintains identical copies (mirrors) of data on two hard disks for increased reliability.

➡ **Note**
The disks must have the same formatted capacity, granularity and should be the same model type to ensure the same formatted disk capacity.

Disk mirroring is implemented for the Peripheral Controller Interface (PCI) family of controllers. Disk mirroring is available for:

- iRMX III systems using Multibus I and II
- DOSRMX and iRMX for PCs systems using Multibus II
- DOSRMX and iRMX for PCs systems using a PC bus with an Adaptec 1542/1742 host adapter

This appendix is for operators who need to configure a system for disk mirroring and for system developers who develop disk mirroring system applications.

This appendix contains this information about disk mirroring:

- Disk mirroring concepts
- Disk mirroring configurations
- Using disk mirroring, including a tutorial on using the **mirror** command and information about the **a_special** system call

See also: **mirror** command, in this manual, for syntax, parameters, and basic information
a_special call, *System Call Reference*

Introduction

Disk mirroring provides these benefits:

- Prevents system crashes due to hard disk and peripheral controller failure
- Increases data integrity by replicating write operations
- Increases data reliability and availability by allowing your system to continue operating after a hard disk or peripheral controller failure
- Improves read performance by providing data access from both hard disks of a mirror set
- Reduces downtime by supporting on-line repair and resynchronization of hard disks

Disk Mirroring Concepts

This section explains these concepts:

- Mirror sets
- Failure detection
- Rollover
- On-line and off-line repair
- On-line resynchronization
- Automatically enabling disk mirroring
- Event notification
- Disk mirroring operations

A *mirror set* consists of two hard disks that contain identical data: the *primary* and *secondary* hard disks. *Rollover* occurs when the primary disk of a mirror set fails, and the secondary disk continues to perform I/O operations. *On-line repair* allows a failed hard disk to be reformatted and reused without shutting down the system. *On-line resynchronization* copies data from one hard disk to the other as a background task. *Event notification* reports events such as rollover and resynchronization completion to the operator or a file.

Mirror Sets

Disk mirroring requires a pair of hard disks to use as a mirror set. Designate one hard disk in the set as the primary hard disk and the other as the secondary hard disk. The name of the primary hard disk serves as the name for the mirror set.

Once you enable disk mirroring on a mirror set, the hard disks are treated identically, as illustrated in Figure A-1. The secondary hard disk becomes transparent to application programs, I/O system calls to read and write take on different characteristics:

- Applications may only direct write operations to the primary hard disk of a mirror set. The device driver directs write operations to both the primary and the secondary hard disks. Each write operation causes identical copies of the data to be written to both members of the mirror set.
- Applications may only direct read operations to the primary hard disk of a mirror set. The device driver can obtain the requested data by issuing a read operation on either hard disk in the mirror set.

Figure A-1. Mirror Set Operations

Applications direct read operations to the primary disk, but you can set up the mirror set so that the device driver issues a read on the primary or secondary disks alternately. This operation is transparent to applications and improves read performance by overlapping read operations.

Failure Detection

The device driver detects a hard disk failure when a read or write operation returns a failed status or times out. The device driver keeps track of all transactions initiated to the primary and secondary disks. If a transaction on a hard disk does not complete within a fixed time period, the device driver marks that hard disk as failed. The device driver frees up all the pending transactions on the failed hard disk and retries them on the other hard disk of the mirror set.

Once a mirror set has encountered an error on one hard disk, read and write operations are issued to only the good hard disk.

Rollover

With disk mirroring enabled, if either a read operation or a write operation results in an I/O error, the device driver initiates an automatic rollover. The rollover feature allows the device driver to detect a fault or a failure on a mirror set, determine which hard disk failed, and direct I/O operations to the surviving hard disk of the mirror set. This allows system operations to continue. Rollover is transparent to the application requesting the I/O operation.

If an I/O operation on one hard disk of a mirror set results in an unrecoverable error, the device driver retries the operation on the other disk. If the retry succeeds, the I/O operation returns with no error. The device driver then updates its state to reflect that only one hard disk of the mirror set is operational, and the device driver redirects all succeeding read and write operations to the surviving hard disk. The disk that failed is marked failed and, if the application has requested notification, the operator or application is notified of the failure. Until a repair is performed, I/O operations continue on the surviving disk. In the absence of disk mirroring, a hard disk failure causes a system crash.

Once an I/O error has occurred, the device driver redirects all I/O to the surviving hard disk. You can direct operations other than **read** and **write** (typically **format**) to either hard disk, and they are performed on the hard disk to which they are directed.

Figure A-2. Rollover, Repair, and Resynchronization

Rollover on Different Hard Disk Controllers

When mirrored hard disks are connected to two different hard disk controllers, applications can recover from peripheral server and controller failures. The device driver can detect a controller or a PCI server crash and automatically roll over to the remaining server.

The peripheral server can support command queueing at the controller. If so, there might be commands pending at the hard disk which failed. After rollover, these commands can complete because the device driver will unconditionally retry all the queued commands on the surviving hard disk when they are returned by the server.

Rollover on peripheral server and controller failures includes automatic rollover to single disk operation on I/O errors.

On-line and Off-line Repair

When an I/O error occurs, the device driver redirects I/O operations to the surviving disk. Diagnostic programs can then reformat or reassign alternates for bad blocks in an attempt at on-line repair of the failed disk.

Because the device driver allows you to format the failed hard disk when it is in the rollover state, you can reformat a failed hard disk on-line, without ever powering down the system. If you set up the system for disk mirroring with resynchronization, normal operations can continue after the repair is completed.

You must shut down the system to physically replace a disk or for off-line repair. If the system crashes or is in rollover state at the time of shutdown, disk mirroring is not automatically enabled when you restart the system. You must resynchronize the new or repaired hard disk with the surviving hard disk when the system is brought on-line.

See also: On-line resynchronization, in this appendix

System Device Repair

The procedure for mirroring a system device is identical to that of a non-system device, but there are some issues that are unique to a system device in the event of a failure.

When the system device fails, you might need to reboot the system from the secondary hard disk. You must set the boot parameters so that the OS can be rebooted from either the standard system device or its secondary.

On-line Resynchronization

Resynchronizing a mirror set involves copying data from one hard disk of the mirror set to the other. You must explicitly resynchronize a mirror set; the device driver does not automatically perform this operation.

You need to resynchronize a mirror set any time you recreate it, such as after a rollover, when a new hard disk is added to an existing mirror set, or after off-line repair. You resynchronize a mirror set while it is on-line, as a background job. This minimizes system downtime after repair or on startup. I/O operations are allowed on a mirror set while resynchronization is in progress.

See also: Tutorial: Using the Mirror Command, in this appendix

If the device driver detects an error during resynchronization, the resynchronization operation is aborted and the surviving hard disk continues to respond to I/O requests.

Automatically Enabling Disk Mirroring

If you set up disk mirroring on your system, disk mirroring is automatically enabled whenever the I/O system attaches the mirror set's primary hard disk. The automatic enabling mechanism works as illustrated in Figure A-3.

Figure A-3. Automatically Enabling Disk Mirroring

The process shown in Figure A-3 includes these steps:

1. When you attach the primary hard disk or initialize the system, the device driver reads the volume label on the primary and secondary units before any read or write operations are issued. The device driver determines whether the system was shut down normally with the mirror sets left intact, or whether the system had crashed, possibly leaving the elements of mirror sets holding different data.

   If the state information indicates that the previous detach was not normal, mirroring is not enabled and I/O operations are performed only by the surviving disk in the mirror set.

   If the previous detach was normal, the mirror set is created and mirroring is enabled before any I/O operations occur. I/O operations are performed by both disks in the mirror set. As a precautionary measure, the device driver changes the state information on the disks to indicate an improper shutdown. Thus if a disk fails while attached, disk mirroring will not be enabled on the next reattachment.

2. When the primary hard disk is detached the device driver records, as state information on the mirror set hard disks, that a normal detach occurred. Normal detach information indicates that disk mirroring can be automatically enabled when the primary hard disk is attached next time.

In addition to the normal or improper detach information, the device driver records the device unit information block (DUIB) name of the secondary hard disk on the primary hard disk's volume label; it records the DUIB name of the primary hard disk on the secondary hard disk's volume label.

See also: Mirror state structure, in this appendix

The device driver also writes an *incarnation signature* pattern on both hard disks. This unique 32-bit number marks this particular instance of the mirror set. This prevents the device driver from accidentally enabling mirroring on the wrong instance of a hard disk.

Event Notification

You can request event notification to monitor disk mirroring events. You can get the disk mirroring status for these events:

- Rollover
- Resynchronization complete
- Resynchronization abort

When one of these events occurs, the device driver notifies the operator or application with a message. You can have the message sent to the screen or a file. Using the message, you can decide what actions to take in response to the event. For example, if rollover occurs, you can obtain detailed status on the error that caused the rollover.

After you receive notification of an event, you must request event notification again to be notified of the next event.

Disk Mirroring Configuration

This section describes hardware and software configuration for disk mirroring.

Hardware Configuration

Disk mirroring is implemented for the peripheral controller interface (PCI) family of controllers. This product family includes these boards:

- The SBC 386/12S and SBC 486/12S for Multibus I systems
- The SBC 386/258 and SBC 486/133SE for Multibus II systems

For Multibus I systems, one board includes both the PCI server and the iRMX host device driver.

There are several configuration options for Multibus II systems. The configuration examples shown in these illustrations use the SBC 386/258 board as the PCI server. The illustrations show:

- The primary and secondary hard disks can be on the same or on different SCSI busses.
- The hard disks in a mirror set may reside on the same PCI server or on different PCI servers.
- The iRMX device driver runs on one or more separate CPU boards or on the same board that hosts the PCI server.

Note

The disks in a mirror set must have the same formatted capacity and granularity, and must be the same model type to ensure the same formatted disk capacity.

Mirror Set on One PCI Server

In Figure A-4, the PCI Server runs on the SBC 386/258 board, which is connected to a single SCSI bus. The primary and the secondary hard disks are connected to the same single-ended SCSI bus.

Figure A-4. Mirror Set on One PCI Server

This configuration has two advantages:

- A cost effective solution, since the mirror set resides on one SBC 386/258 board
- Recovery from a primary or a secondary disk failure, as long as that failure does not hang the SCSI bus

The major disadvantage in this configuration is that there is no recovery from either a SCSI bus failure or an SBC 386/258 board failure.

Mirror Set Across SCSI Busses

In Figure A-5, the PCI Server runs on the SBC 386/258D (dual) board, which is connected to two SCSI busses. The primary hard disk is connected to the differential SCSI bus and the secondary hard disk is connected to the single-ended SCSI bus.

Figure A-5. Mirror Set Across a SCSI Bus

This configuration has two advantages:

- A cost effective solution using a single SBC 386/258D board
- Recovery from any single SCSI bus failure that does not cause the SBC 386/258D board to fail

The major disadvantage to this configuration is that there is no recovery from an SBC 386/258D board failure.

Mirror Set Across Two PCI Servers

In Figure A-6, the mirror set includes two SBC 386/258 boards. The PCI Server runs on the SBC 386/258 boards, each of which is connected to a single-ended SCSI bus. The primary hard disk is connected to one SCSI bus on one of the SBC 386/258 boards and the secondary hard disk is connected to a different SCSI bus on the other SBC 386/258 board.

Figure A-6. Mirror Set Across Two PCI Servers

This configuration has two advantages:

- Recovery from
  - A single hard disk failure on either board
  - A SCSI bus failure on either board
  - An SBC 386/258 board failure
- Better performance because there are two paths to the disks using the two SBC 386/258 boards

Mirror Set on Multiple Multibus II Systems

In Figure A-7, there are two individual Multibus II systems. Each system has its own mirror set across the single-ended and differential SCSI busses of its SBC 386/258D board. A PCI Server runs on each SBC 386/258D board. The systems are connected by a shared differential SCSI bus on the two SBC 386/258D boards.

Using two SBC 386/258D boards has two advantages:

- If either system fails, the primary hard disk of the failed system can still be accessed from the surviving system because of the shared SCSI bus.
- Recovery is possible from any single SCSI bus failure that does not cause the SBC 386/258D board to fail.

This redundant system configuration also provides better performance.

Figure A-7. Mirror Set on Multiple Multibus II Systems

Software Configuration

There are two aspects of software configuration: setting up the mirror set with the **mirror** command, and setting the number of maximum outstanding commands. The transaction timeout period is fixed in the device driver and is not set by the user.

See also:	Disk mirroring tutorial, in this appendix
	mirror command, Chapter 2

Setting the Maximum Outstanding Commands

You must equally divide the number of outstanding messages at each PCI server among all the PCI drivers in the system. For example, if a PCI server supports 100 messages and there are 5 iRMX hosts with 2 PCI driver instances on each host, you must configure each PCI driver to have at most 10 messages (100 / (5*2)) outstanding.

Set the Maximum Outstanding Commands (MOC) option in the PCI Driver Screen. You do not need to change the defaults used in the standard definition files. This is the formula for setting the MOC:

```
MOC = total outstanding messages / (number of hosts * number of
    device driver instances on each host)
```

After you configure and regenerate the OS with the new driver, use the **mirror** command to set up the mirror sets.

See also: Using the **mirror** command, in this appendix
How to Use the Peripheral Controller Interface (PCI) Server

Using Disk Mirroring

These topics are described in this section:

- Summary of disk mirroring operations
- Tutorial on using the **mirror** command
- Handling events
- Handling failures
  - Secondary hard disk failures
  - Primary hard disk failures
- Protecting hard disks
- Using the **a_special** system call

Summary of Disk Mirroring Operations

You perform disk mirroring operations using both a command interface and a system call subfunction. The **mirror** command lets you change and monitor disk operations from the command line while the system is running. The disk mirroring subfunction of the BIOS **a_special** system call lets you develop disk mirroring applications.

The **mirror** command and the disk mirroring subfunction of the BIOS **a_special** system call provide these operations:

Create mirror set	Requests the device driver to create a mirror set of two specified hard disks. You specify one hard disk as primary and the other hard disk as secondary. The primary hard disk's name becomes the mirror set's name.
Enable mirroring with resynchronization	Enables disk mirroring by resynchronizing the primary and secondary hard disks on-line. Resynchronizing a mirror set involves copying data from one hard disk of the mirror set to the other. You explicitly specify the source hard disk and destination hard disk for the data copy.
Disable mirroring	Requests the device driver to disable and discontinue mirroring operations on a specified mirror set.
Request mirror event notification	Requests notification when certain events occur on a mirror set. These events include rollover, resynchronization completion, and resynchronization abort. You can have the status message sent to the screen or to a file.
Get mirror status	Reports disk mirroring status for a mirror set. For example, the status information includes whether a rollover has occurred and whether resynchronization is in progress on a mirror set.
Get mirror attach status	Reports attach status for a hard disk after it is attached to the system. The status report contains such information as the name of the hard disk's mirror set and the state of the disk when it was last detached.
Set mirror options	Sets or changes the read policy for a mirror set.

See also: **mirror** command, in this manual
a_special system call, *System Call Reference*

Tutorial: Using the Mirror Command

To set up the mirror set, use the **mirror** command as illustrated in this example. The PCI mirroring driver and the **mirror** command must be installed and the OS must be rebuilt. Assume that the primary and the secondary disks are Maxtor 4380 with SCSI units 2 and 3, and that the system was properly configured and generated with the ICU. The DUIB names for the two disks are M4380_2 and M4380_3 respectively.

Follow these steps to set up a mirror set on a new system.

1. Attach and format the primary and secondary disks:

   ```
   ad m4380_2 as :w:
   ad m4380_3 as :w1:
   format :w: <format command options>
   format :w1: <format command options>
   ```

   Formatting will take 15 to 30 minutes for each disk, depending on the disk.

2. Detach the secondary hard disk by entering:

   ```
   dd :w1:
   ```

3. Create the mirror set by entering:

   ```
   mirror create :w: m4380_3
   ```

4. Get the status of the mirror set by entering:

   ```
   mirror getstat :w:
   ```

   This information is displayed on the screen:

   ```
   State                     = Mirror Set Created
   Primary Unit              = M4380_2
   Secondary Unit            = M4380_3
   Read Policy               = Alternate Read
   ```

5. Resynchronize the primary hard disk with the secondary hard disk by entering:

   ```
   mirror resync :w: p2s
   ```

   The resync function has started when the hard disk lights start flashing. Resynchronization takes 15 to 30 minutes, depending on the disk.

6. You can check on the progress of the resynchronization by entering:

   ```
   mirror getstat :w:
   ```

This information is displayed on the screen:

```
State                         = Resync In Progress
Primary Unit                  = M4380_2
Secondary Unit                = M4380_3
Resync Source Unit            = M4380_2
Resync Percent Complete       = xy%
Read Policy                   = Alternate Read
```

7. Obtain notification of the resynchronization completion by entering:

```
bk mirror waitevent :w: > :config:mirror.log
```

   This causes a task to wait in the background for the resynchronization to complete. The status of the resynchronization is written into *:config:mirror.log*.

   When the resynchronization is finished, the background job waiting for an event will complete, and send a message to the screen. Examine *:config: mirror.log* to see if the resynchronization completed normally. The Mirror Set Event message should read `Resync complete`.

8. To verify that mirroring is now enabled, use the `getstat` parameter. All read commands now alternate between both disks and all write commands are duplicated on both disks. This information is displayed on the screen:

```
State                = Mirroring Enabled
Primary Unit         = M4380_2
Secondary Unit       = M4380_3
Read Policy          = Alternate Read
```

9. To verify that mirroring gets automatically enabled after a normal detach, detach the primary hard disk M4380_2:

```
dd :w:
```

10. Attach the primary hard disk again, then enter:

```
mirror attstat :w:
```

   The mirror state information that was written on the disk during the detach will be displayed on the screen. The incarnation number is a unique 9-digit number assigned at shutdown time.

```
Mirror Attach Status          = Mirror Set Valid
Other Unit Name               = M4380_3
Incarnation Number            = XXXXXXXXX
Disk Status                   = Marked Good
```

   The `attstat` parameter is also useful for troubleshooting in certain situations. For instance, if you expect mirroring to be enabled automatically when a hard disk is attached, you can use the `attstat` parameter to check this. It might not be enabled if the secondary hard disk is accidentally attached instead of the primary.

11. To verify that mirroring has been automatically enabled, use the `getstat` parameter.

    This information is displayed on the screen:

    ```
    State                         = Mirroring Enabled
    Primary Unit                  = M4380_2
    Secondary Unit                = M4380_3
    Read Policy                   = Alternate Read
    ```

Now you can start normal operations.

If there are multiple mirror sets, the preceding steps must be repeated for each mirror set.

Handling Events

To receive notification of important events, such as rollover or resynchronization completion, you must always keep a **mirror** command with the `waitevent` parameter operating in the background. When an event occurs, the command prints the event that occurred. You can redirect the output to a log file. Once an event has been reported, use the **mirror** command with the `getstat` parameter to get more details about the event. You can use a submit file for this purpose. This file has two lines:

```
mirror waitevent :w:
mirror getstat :w:
```

To wait for an event, type:

```
bk <submit file name> > :config:mirror.log
```

Once an event has been reported, you must again invoke the submit file to obtain further notification of events.

Handling Failures

This section discusses options for handling primary and secondary failures. A failure may be a hard disk failure, a SCSI bus failure, a disk controller failure, or a PCI Server failure.

When a failure occurs, two possibilities exist:

Off-line repair	Keep the system running on the surviving disk until the next scheduled shutdown and fix the failure while the system is shut down. Re-introduce the fixed disk into the mirror set when the system is rebooted.
On-line repair	Try to fix the failure and restart the failed entity without shutting the system down. A failed hard disk may be fixed by attempting to format it. For example, the **reboot** command can be used to restart a failed SCSI controller, and the SCSI bus may be fixed by resetting it. (The PCI server has an option to reset the SCSI bus on startup.)

The next two sections describe how to handle secondary and primary hard disk failures.

Handling Secondary Hard Disk Failure

Assume the primary hard disk is M4380_2 and the secondary hard disk is M4380_3. Hard disk M4380_3 crashed and the system is running on its primary hard disk, M4380_2.

Off-line Repair of Secondary Hard Disk

To perform an off-line repair, take these steps.

1. Shut the system down and replace the secondary hard disk.
2. Attach the primary hard disk M4380_2 and get the system started while formatting the new secondary hard disk:

   ```
   ad m4380_2 as :w:
   <perform normal operations on :w:>
   ad m4380_3 as :w1:
   format :w1: <format parameters>
   ```

   Formatting will take 15 to 30 minutes, depending on the disk.

3. When the format is finished, detach the new secondary hard disk:

   ```
   dd :w1:
   ```

4. Create the mirror set and resynchronize the new secondary hard disk:

   ```
   mirror create :w: m4380_3
   mirror resync :w: p2s
   ```

   Resynchronization takes 15 to 30 minutes, depending on the disk.

5. You can check on the progress of the resynchronization by entering:

   ```
   mirror getstat :w:
   ```

6. Get the resynchronization notification by invoking the **mirror** command to wait for an event in the background:

   ```
   bk mirror waitevent :w: > :config:mirror.log
   ```

   When the resynchronization is complete, you receive a notification. The two disks are now identical.

On-line Repair of Secondary Hard Disk

To attempt to fix the secondary hard disk by formatting it on-line, take these steps.

1. Attach and format the secondary hard disk, M4380_3:

   ```
   ad m4380_3 as :w1:
   format :w1: <format options>
   ```

   Formatting will take 15 to 30 minutes, depending on the disk.

   If the format is not successful, the hard disk may have to be repaired off-line.

2. After the format is complete, detach the secondary hard disk:

   ```
   dd :w1:
   ```

3. Resynchronize the primary hard disk with the secondary:

   ```
   mirror resync :w: p2s
   ```

   Resynchronization takes 15 to 30 minutes, depending on the disk.

4. You can check on the progress of the resynchronization by entering:

```
mirror getstat :w:
```

5. Wait for the resynchronization to complete:

```
bk mirror waitevent :w: > :config:mirror.log
```

   When the resynchronization is complete, you receive a notification. The two disks are now identical.

Handling Primary Hard Disk Failure

Assume that the hard disk M4380_2 crashed and the system is running on its secondary, M4380_3.

Off-line Repair of Primary Hard Disk

When the primary hard disk fails, you have the option of either replacing the disk or attaching the secondary disk as the primary and trying to reformat the former primary disk. Both options require shutting the system down.

To perform an off-line repair, take these steps.

1. Shut the system down and replace the primary hard disk if necessary.
2. Attach the secondary hard disk M4380_3 as the primary hard disk and get the system started while formatting the new (or former primary) hard disk:

```
ad m4380_3 as :w:
<Perform normal operations on :w:>
ad m4380_2 as :w1:
format :w1: <format parameters>
```

   Formatting takes 15 to 30 minutes, depending on the disk.

3. When the format is finished, detach the new hard disk:

```
dd :w1:
```

4. Create the mirror set and resynchronize the new hard disk:

```
mirror create :w: m4380_2
mirror resync :w: p2s
```

   Resynchronization takes 15 to 30 minutes, depending on the disk.

5. You can check on the progress of the resynchronization by entering:

```
mirror getstat :w:
```

6. Wait for the resynchronization notification by invoking the **mirror** command to wait for an event in the background:

```
bk mirror waitevent :w: > :config:mirror.log
```

   When the resynchronization is complete, you receive a notification. The two disks are now identical.

On-line Repair of Primary Hard Disk

On-line repair using the iRMX **format** command is not possible when the primary disk has failed, since the OS does not allow a hard disk to be reformatted when it is in use. Even though the device driver redirects all I/O to the secondary hard disk, the I/O System is not aware of this and assumes that all I/O is being performed on the primary hard disk.

Utility programs that directly communicate with the PCI server may be used to format the primary hard disk in an attempt to fix it. If these are available, take these steps:

1. Attempt to fix the primary disk by formatting it. If the format is not successful, you must repair the hard disk off-line.
2. If the format is successful, resynchronize the primary with the secondary. The resynchronization direction is from secondary to primary:

```
mirror resync :w: s2p
```

   Resynchronization takes 15 to 30 minutes, depending on the disk.

3. You can check on the progress of the resynchronization by entering:

```
mirror getstat :w:
```

4. Wait for the resynchronization to complete:

```
bk mirror waitevent :w: > :config:mirror.log
```

   When the resynchronization is complete, you receive a notification. The two disks are now identical.

See also: *How to Use the Peripheral Controller Interface (PCI) Server*, for more information

Protecting Hard Disks

The PCI device driver reserves both the primary hard disk that is being attached and the secondary hard disk in a mirror set. If a hard disk is reserved and an attempt is made to reserve it again, the driver returns a Write Protect Error. This protects a hard disk from being used by two instances of the device driver at the same time. This can happen when a hard disk is attached and another driver tries to use it as a secondary hard disk of a mirror set.

Using A_special for Disk Mirroring

Function code 19 of the **a_special** system call performs disk mirroring operations on the primary hard disk of the mirror set and is valid for physical and named drivers. The iRMX PCI device driver implements the actual mirroring, error detection and rollover, and on-line resynchronization. Refer to the *mirror.lit* and *mirror.h* files for the literal definitions for the disk mirroring subfunction.

See also: Function 19 and error messages for **a_special**, *System Call Reference*

Mirror State Structure

Each mirrored disk contains a `mirr_state_struct` structure, located in the Volume Label at a byte offset of 896 decimal. When the first attach is performed on a hard disk, the device driver uses this structure to detect whether this hard disk was part of a mirror set and, if it was, to identify the name of the secondary disk. The format of this structure in PL/M is:

```
DECLARE mirr_state_struct STRUCTURE(
   other_name(14)         BYTE,
   valid_flg              WORD32,
   incarnation            WORD32,
   prim_flg               BYTE,
   good_flg               BYTE);
```

The format of the structure in C is:

```
typedef struct {
   UINT_8                 other_name(14);
   UINT_32                valid_flg;
   UINT_32                incarnation;
   UINT_8                 prim_flg;
   UINT_8                 good_flg;
} MIRR_STATE_STRUCT;
```

Where:

`other_name`
: Specifies the DUIB name of the other hard disk of the mirror set. The DUIB name must be in capital letters, be null-terminated, and be a maximum of 14 characters not including the null.

`valid_flg` Specifies if the mirror set is valid. A valid set has the pattern `600ddi5c` (looks like `gooddisc`) on both disks; an invalid set has the pattern `deadbeef`. If the mirror set is valid, the device driver automatically re-enables mirroring. The valid flag is set at the end of a normal detach if no I/O errors have occurred. The device driver clears the flag on each disk when it reads the disk so that mirroring is not automatically enabled if the system crashes.

`incarnation`
: Is a pattern that is written on the disks to uniquely identify the correct instance of a mirror set.

`prim_flg` Specifies if this hard disk is the primary or secondary unit of a mirror set:

1	primary unit
2	secondary unit

`good_flg` Specifies whether this disk was good when it was detached:

0AAH	good
055H	not good

❑❑❑

Using Diskverify in Interactive Mode B

You can use **diskverify** in one of two ways:

- In interactive mode, which requires an understanding of the iRMX file structures. This appendix describes using **diskverify** in interactive mode.
- As a single Human Interface command, which does not require as much understanding of the iRMX file structures

See also: **diskverify** as a single command, Chapter 2
named volume structure, Appendix C

Introduction

The Disk Verification Utility (DVU) inspects, verifies, and corrects the data structures of iRMX named or physical volumes after such occurrences as power irregularities or accidental reset. **Diskverify** can be used on named and physical volumes; it cannot be used on remote, NFS, or DOS volumes. In DOSRMX, use this command only for an iRMX partition, not for a DOS drive or a partition containing the DOS file system.

The DVU can reconstruct the file descriptor node (fnode) file, the volume label, the fnode map, the volume free space map, and the bad blocks map of the volume. In addition, with **diskverify** you can view bad track information, and manipulate fnodes and the actual data on the volumes. The DVU also supports auto-volume recognition, which means you can verify any iRMX named volume without detaching and reattaching the device with the correct DUIB. These processes usually involve reading a portion of the volume into a buffer, modifying that buffer, and writing the information back to the volume.

This appendix includes:

- Invocation instructions and invocation error messages
- Information about using commands and parameters
- **Diskverify** error messages
- Instructions for using **diskverify** to back up and restore volume labels and fnodes
- A command summary table
- Descriptions of the 36 Disk Verification Utility commands

You must be familiar with volume structure to use the full capabilities of the Disk Verification Utility. You should also understand the OS, and particularly the BIOS and Human Interface layers.

See also: Volume structure, Appendix C
I/O Systems, *Introducing the iRMX Operating Systems* for general information
System Concepts for information on the BIOS and for information on the HI

CAUTION

Do not use the **diskverify** commands in an interactive program unless you understand the iRMX volume structure. Some commands, if not used correctly, can render your volumes unusable.

It is recommended that you first try using **diskverify** on an expendable diskette. Format a spare diskette and create a simple file structure on it. Include some data files in the directories.

See also: **format** command, Chapter 2

Invoking Diskverify

Unless you are the Super user, you may only invoke **diskverify** for devices attached by you or the World user. The **diskverify** utility reattaches the device as a physical device before verifying it. When the utility finishes, it reattaches the device as it was before you invoked the utility.

If you verify the system device (*:sd:*), the OS deletes all connections to the device. You must either use the **attachfile** command with the `system` option or reboot the system to restore the system logical names before you can enter more commands. **Attachfile** can also be used to restore your *:home:* directory.

See also: **attachfile** in Chapter 2

To invoke **diskverify** in interactive mode, enter:

```
diskverify :logical_name: [to|over|after outpath]
```

Where:

:*`logical_name`*:
Logical name of the secondary storage device containing the volume to be verified. The colons are not required.

`to|over|after`
`To` writes the output of the DVU to the specified file, `over` copies the output over the specified file, and `after` appends the output to the end of the specified file; if the file does not exist, it is created.

`outpath`
Pathname of the file to receive the output from the DVU. You cannot direct the output to a file on the volume being verified. If you attempt this, the utility returns an error message.

If you omit the *`outpath`* parameter and/or the preposition, output is directed to the console screen (*:co:*) by default.

When you invoke **diskverify**, the utility displays a header message (where `V`*`x.y`* is the version number of the utility) and the utility prompt (*), as follows:

```
iRMX Disk Verify Utility, Vx.y
Copyright <year> Intel Corporation
All Rights Reserved
*
```

You can then enter any of the **diskverify** commands. If you enter anything else, the utility displays an error message.

Invocation Error Messages

These error messages can be generated when you invoke the DVU:

`argument error`

The option specified is not valid.

`<logical_name>, invalid logical name`

The logical name does not exist, was longer than 12 characters, contained invalid characters, or was missing a matching colon.

`0045 : E_LOG_NAME_NEXIST or <logical_name>, logical name does not exist`

A nonexistent logical name was specified in either the *`:logical_name:`* or *`outpath`* parameter.

`<outpath>, 0038 : E_ALREADY_ATTACHED`

The output was directed to a file on the volume being verified.

`command syntax error`

You made an error when entering the command.

`<logical_name>, outstanding connections to the device have been deleted.`

This warning is not fatal, and will occur every time you try to verify the system device or any other volume on which files have been attached.

`<logical_name> or <outpath>, invalid wildcard specification`

The logical name or output pathname contained a wildcard character.

`<logical_name>, can't attach device`

The device cannot be attached and read.

```
device size inconsistent
size in volume label = <value1> : computed size = <value2>
```

When the DVU computed the size of the volume, the size it computed did not match the information recorded in the iRMX volume label. The volume label may contain invalid or corrupted information. This is not a fatal error, but it is an indication that further error conditions may result during the verification session. You may have to reformat the volume or use the DVU to restore the volume label.

`<partial logical_name>, 0081: E_STRING_BUFFER`

The logical name was longer than 12 characters, not including colons.

`<logical_name>, device does not belong to you`

An attempt was made to verify a device that was attached by another user. For example, the system device is *:sd:* and the user is not the Super user.

`<logical_name>, device size is zero`

The logical name entered does not define a mass storage device. For example, you cannot perform **diskverify** on a line printer.

Using Diskverify Commands

This section provides information about:

- Abbreviating command names
- Using parameters
- Input radices
- Aborting **diskverify** commands

The notation used for **diskverify** command syntax is the same as for other commands in this manual.

See also: Command Syntax, Chapter 2

Abbreviating Command Names

When you enter a **diskverify** command, you can enter the command name, its abbreviation, or any unique portion of the command name. For example, when specifying the **displayfnode** command, you can enter any of these:

```
displayfnode fnodenumber
df fnodenumber
displayf fnodenumber
```

You can also enter any other partial form of the word **displayfnode** that contains at least the characters **displayf**.

Command name abbreviations are provided in the Command Summary Table (in parentheses after the command name) and in the syntax description for each command. The syntax descriptions give any standard abbreviations or substitutes with the full name as options. For example:

```
d|db|displaybyte
```

means that **d** or **db** may be used for **displaybyte**

```
>|<CR>|dnb|displaynextblock
```

means that a right angle bracket (>), carriage return, or **dnb** may be used for **displaynextblock**

Using Parameters

Several **diskverify** commands have parameters in this form:

```
keyword = value
```

You can also enter these parameters in this form:

```
keyword (value)
```

For example, both of these specify a **free** command:

```
free fnode = 10

free fnode (10)
```

The use of the `to`, `over`, and `after` parameters is the same as for other commands in this manual.

See also: Using the to, over, and after parameters, Chapter 1

Abbreviating Parameters

These parameters, used with the **verify** and **fix** commands, have standard abbreviations:

Parameter	**Abbreviation**
named	n
named1	n1
named2	n2

Both the full name and the abbreviation are listed in the individual commands' parameter descriptions.

Specifying Input Radices

Diskverify always produces numerical output in hexadecimal format. You can provide input to **diskverify** in any one of these three radices by including a radix character immediately after the number. The valid radix characters are:

Radix	**Character**	**Example**
hexadecimal	h or H	16h, 7CH
decimal	t or T	23t, 100T
octal	o, O, q, or Q	27o, 33Q

If you omit the radix character, **diskverify** assumes the number is hexadecimal.

Aborting Diskverify Commands

You can abort some **diskverify** commands by typing <Ctrl-C>. This terminates the command and returns control to the DVU, not the HI command level. These commands are:

disk
displaybyte
displaydirectory
displayfnode
displaynextblock
displaypreviousblock
displayword
editfnode
editsavefnode
fix
getbadtrackinfo
listbadblocks
substitutebyte
substituteword
verify

Diskverify Error Messages

Each **diskverify** command can generate a number of error messages, which indicate errors in the way you specified the command, or problems with the volume itself. Individual command descriptions list the error messages generated by the particular command.

These messages can be generated by many of the commands:

`block I/O error`

The utility attempted to read or write a block on the volume, found that the block was physically damaged, and therefore could not complete the requested command. Or, the utility tried to write a block to a disk volume that is write-protected. The error message states whether read or write was performed, and the number of the block causing the error.

`command syntax error`

A syntax error was made in a command.

`illegal command`

The command specified is not a valid **diskverify** command.

`fnode file/space map file inconsistent`

One of the files, *r?save* (the fnode backup file) or *r?fnodemap* (the map of file descriptor nodes), is damaged and **diskverify** cannot perform further verification.

`argument error`

The command was missing a required argument, the argument was illegally specified, or an argument was entered for a command that does not accept one.

`not a named disk`

Either the device is not a named volume, or the iRMX volume label, obtained when **diskverify** begins processing, contains invalid information. The latter may cause the DVU to assume that a named volume is a physical volume. In this case, the commands that apply to named volumes only (such as **displayfnode**, **displaydirectory**, and **verify named**) issue this message. If you are sure the volume is a named volume, this message may indicate that the iRMX volume label is corrupted.

If the file was formatted with the `reserve` option of the **format** command, **diskverify** issues this message only if both volume labels are corrupted. When only the volume label is invalid, the duplicate in the `save` area is used.

`seek error`

The utility unsuccessfully attempted to seek to a location on the volume. This error normally results from invalid information in the iRMX volume label or the fnodes, from inserting a new volume after **diskverify** is invoked, or from a defective disk.

Tutorial: Backing Up and Restoring Fnodes

To access data on a named volume (such as a disk), the iRMX OSs create and maintain an index of pointers to the location of every file on the disk.

This index consists of the iRMX volume label and a file descriptor node (fnode) file. The volume label is the initial entry point into the device. The fnode file contains a pointer and other vital information for each file on the disk. Since both contain information essential to accessing and maintaining the volume and files, if either one is damaged or destroyed it is very difficult to locate files and recover the data on the disk.

The backup and restore fnodes feature enables some recovery of data lost as a result of damage to the volume label or the fnode file. This feature is not intended to provide comprehensive protection from the loss of data associated with damaged iRMX volume labels or fnode files. Rather, it offers a tool that, when properly applied, can be useful in maintaining volume integrity in certain situations. For comprehensive protection against loss of data use the HI **backup** command.

See also:	**backup** command, Chapter 2

To use this feature, you must create and maintain a backup version of the volume label and the fnode file, as detailed later in this section. You can then:

- Examine the contents of the backup file, *r?save*
- Restore damaged fnodes
- Restore the volume label
- Edit fnodes or save fnodes

This section provides a description of each operation, followed by one or more examples of a typical implementation.

Structure of the Volume Label and Fnode File

The organization of the volume label and the fnode file reflects the hierarchical file structure. The iRMX volume label contains a pointer to the fnode of the file structure's root directory, the starting address for any file or directory on the volume. The fnode file begins with the root directory and continues down through the directory and file levels. Each file or directory is represented by an fnode. The pointers and fnodes are adjusted each time a file is created, deleted, or changes size.

The fnode, in addition to other data describing the file or directory, contains pointers to blocks on the volume. If the fnode describes a short file, these blocks contain the actual file data. If the fnode describes a long file, these blocks contain pointers to other blocks containing the actual data. If the fnode describes a directory, these blocks contain entries which describe the contents of the directory. Each entry lists the fnode number and name of the associated file or directory.

See also: Short and long files, Appendix C

The number of unallocated fnodes in the fnode file is controlled by the `files` parameter of the **format** command. In addition to the unallocated fnodes, seven (with an option of nine) allocated fnodes are established when the fnode file is created. These allocated fnodes represent:

- The fnode file
- The volume label file, *r?volumelabel*
- The volume free space map file, *r?spacemap*
- The free fnodes map file, *r?fnodemap*
- The bad blocks file, *r?badblockmap*
- The root directory
- The space accounting file
- Optionally, the duplicate volume label file, *r?save*

See also: **format** command, Chapter 2

Creating the Backup Volume Label and Fnode File

Use the optional `reserve` parameter of the **format** command to create a file named *r?save*. **Format** places a copy of the iRMX volume label in the front (that is, the physical end) of the file, and copies the fnode file into *r?save*.

The *r?save* file is stored in one of the innermost tracks of the disk where the chance of accidental loss of data is minimal. (In normal use, the disk heads do not extend to the innermost tracks.)

⚠ **CAUTION**

The **format** command overwrites all of the data currently on the disk. Therefore, before invoking format, use the HI **backup** command to make a backup copy of any files you wish to save. Or, use a blank disk to experiment with these procedures.

Example

Assume that you have booted your system from a diskette to format the system disk. The command below uses the **format** command, specifying the `reserve` parameter. This will format the disk, create the *r?save* backup file, and copy the volume label and initialized fnode file into *r?save*.

```
-attachdevice cmbo as :mydisk: <CR>
-format :mydisk: il = 4 files = 3000 reserve <CR>
```

The HI responds:

```
volume ( ) will be formatted as a named volume
       granularity        =  1,024 map start   = 7,859
       interleave         =     4
       files              =  3000
       extensionsize      =     3
       save area reserved =    yes
       bad track/sector information written = no

TTTTTTTTTTTTTTTTT
volume formatted
```

⟹ **Note**
The map start value may change if *r?save* is present.

The disk has now been formatted. If you use the DVU command **displaydirectory** on the volume root fnode (fnode 6) or the HI **dir** command with the invisible (`I`) option on the volume root directory, you will find an fnode listed for *r?save*. *R?save* contains a duplicate copy of the fnodes in the fnode file: eight allocated fnodes (*r?save*, *r?spacemap*, *r?fnodemap*, etc.) and 2,999 unallocated fnodes. (The *r?save* fnode is allocated out of the 3,000 fnodes specified through the `files` parameter.)

Maintaining the Backup Fnode File

The **format** command creates a backup of the fnode file in its initialized state. *R?save* is not automatically updated as files are created, written to, or deleted from the volume. Therefore, it is very important to back up the fnode file at regular intervals, such as once a day, or before each system shutdown. Otherwise the backup fnode file will contain incorrect information and be useless for data recovery.

There are two ways to back up the fnode file on a volume:

- Use the HI **shutdown** command with the `backup` option.
- Use the `backupfnodes` option of **diskverify**.

In both cases, you must reboot the system after backing up the fnodes on the volume.

Examples

1. This example uses **shutdown** with the `backup` option to copy the volume fnode file to its duplicate file, *r?save*, on any attached volume:

```
super-shutdown  B  <CR>
***SYSTEM WILL BE SHUTDOWN IN 10 MINUTE(S)
:SD:, outstanding connections to device have been deleted
***SHUTDOWN COMPLETED  ***
```

2. This example uses the **diskverify** command **backupfnodes** to copy all fnodes in the system disk (*:sd:*, attached as a logical device) fnode file into the *r?save* file:

```
super- diskverify :sd: <CR>
iRMX Disk Verify Utility, Vx.x
Copyright <year> Intel Corporation
All Rights Reserved
:sd:, outstanding connections to device have been deleted
*backupfnodes <CR>  or  bf <CR>
fnode file backed up to save area
*
```

Restoring Fnodes

If the volume label or the fnode file become damaged, you can attempt to recover files on the volume by using the DVU commands **restorefnode** and **restorevolumelabel** to rebuild the index. To assist in this process, you can use the **displaysavefnode** DVU command to look at individual fnodes stored in the *r?save* file.

⚠ **CAUTION**

The system changes the fnode file each time a volume is modified. If you do not back up the fnodes after each modification, some fnodes in *r?save* may not be associated with the same files as the corresponding fnodes in the fnode file. Attempting to recover fnodes under these conditions is dangerous because the **restorefnode** command could overwrite valid information with invalid information.

Examples

1. This example uses the **verify** command to examine the fnode file on the volume *:sd:*(attached as a logical device):

```
super- diskverify :sd: <CR>
iRMX Disk Verify Utility, Vx.x
Copyright <year> Intel Corporation
All Rights Reserved
:sd:, outstanding connections to device have been
  deleted
*verify
```

After examining the structure of the disk, you find that fnodes 09H through 0CH have probably been destroyed. You then use the **restorefnode** command to recover these fnodes; the DVU prompts you to confirm each fnode:

```
*restorefnode 9, 0C <CR>    or   rf 9, 0C <CR>
restore fnode     9?  Y <CR>
restored fnode number:    9
restore fnode    0A?  Y <CR>
restored fnode number:   0A
restore fnode    0B?  Y <CR>
restored fnode number:   0B
restore fnode    0C?  Y <CR>
restored fnode number:   0C
```

The DVU has now copied fnodes 09H through 0CH in the *r?save* file into fnode 09H through 0CH in the fnode file. You should now be able to recover the data on the disk.

2. Assume the same situation as in Example 1 except that two files, at fnodes 0AH and 0BH, have been modified since the last time the fnodes were backed up. You do not wish to restore them, since you might be replacing valid data with invalid data.

   To pass over the restoration of these two fnodes, respond to the confirmation prompt with some character other than `Y`, as shown. The DVU returns the message: `allocation bit not set for saved fnode`.

   ```
   *restorefnode 9, 0C <CR>     or    rf 9, 0C <CR>
   restore fnode     9?  Y <CR>
   restored fnode number:    9
   restore fnode    0A?  <CR>
   allocation bit not set for saved fnode
   restore fnode    0B?  <CR>
   allocation bit not set for saved fnode
   restore fnode    0C?  Y <CR>
   restored fnode number:   0C
   ```

   The *r?save* fnodes 09H and 0CH have now been copied into the fnode file; 0AH and 0BH were not restored.

Restoring the Volume Label

Since the contents of the iRMX volume label do not change, the copy of the volume label in *r?save* does not need updating to remain valid.

When the DVU encounters a damaged volume label, it automatically uses the backup volume label if the *r?save* file is present. However, it does not restore unless explicitly instructed to do so.

When the backup label is used, the DVU issues the message: `duplicate volume label used`. If this message appears when the DVU is activated, then the volume label is damaged. It can be restored by being overwritten with the volume label copy from *r?save*.

Example

When you attempt to access files on *:sd:* (the logical name of the current volume) the system returns an `E_ILLEGAL_VOLUME` message. Invoke the DVU to check the possibility that the volume label is damaged:

```
super- diskverify :sd: <CR>
iRMX Disk Verify Utility, Vx.x
Copyright <year> Intel Corporation
All Rights Reserved
:sd:, outstanding connections to device have been deleted
duplicate volume label used
*
```

The message `duplicate volume label used` confirms that the volume label has been damaged. Restore the volume label using the **restorevolumelabel** command:

```
*restorevolumelabel <CR>  or  rvl <CR>
```

The DVU responds:

```
volume label restored
*
```

The original volume label has been overwritten with the duplicate copy from the *r?save* file. Attempts to access files on volume *:sd:* should now be successful.

Displaying R?save Fnodes

If you cannot access a file, it may be because the fnode file is damaged. You can use the DVU to display the file's directory and identify the file's fnode, and then display the fnode.

Any fnode (both allocated and unallocated) in the *r?save* file can be examined by using the DVU **displaysavefnode** command with the fnode's hexadecimal number. The DVU will display vital information about the fnode (total blocks, total size, block pointers, parent node, etc.). The fnode is displayed in the same format used by the **displayfnode** command.

Example

Assume that you cannot access a file at fnode 3C8H on a disk attached as *:sd:*. You use **displayfnode** to display fnode 3C8H, but you are not confident of the data you see. Since the fnode for the file has been backed up since the file was last modified, you decide to compare the data in the *r?save* fnode. To do so, invoke **diskverify**, then enter this command to display the data for fnode 3C8H in *r?save*:

```
*displaysavefnode 3C8 <CR>    or   dsf 3C8 <CR>
```

The DVU responds:

```
      Fnode number = 3C8 (saved)
      path name: /USER/MYFILE
                         flags : 0025  =>  short file
                          type : 08  =>  data file
            file gran/vol gran : 01
                         owner : 0001
       create,access,mod times : 00000000, 00000000, 00000000
       total size,total blocks : 00002D01, 0000000C
             block pointer (1) : 000C, 004910
             block pointer (2) : 0000, 000000
             block pointer (3) : 0000, 000000
             block pointer (4) : 0000, 000000
             block pointer (5) : 0000, 000000
             block pointer (6) : 0000, 000000
             block pointer (7) : 0000, 000000
             block pointer (8) : 0000, 000000
                     this size : 00003000
                      id count : 0001
                  accessor (1) : 0F, 0001
                  accessor (2) : 00, 0000
                  accessor (3) : 00, 0000
              parent, checksum : 03C4, 56CA
                       aux (*) : 000000
*
```

You can modify the contents of the both the original fnode file and the saved fnode file by using either the **editfnode** or **editsavefnode** commands.

Diskverify Command Descriptions

This section provides a command summary followed by a complete description of each command.

In the descriptions, the commands are presented in alphabetical order except when two commands are similar, such as **displaybyte** and **displayword**. In this case, the first command is in its alphabetical order, and the second command follows it with only the differences described.

Command Summary

The command summary below lists the name, name abbreviation, and a brief description of each **diskverify** command.

Table B-1. Diskverify Command Summary

Command	Description
allocate	Marks a particular fnode or volume block as allocated
arithmetic commands	Perform arithmetic functions: add (+), sub (-), div (/), mul (*), and mod (finds the remainder of a division process)
backupfnodes (bf)	Copies current fnode file into a backup file named *r?save*
conversion commands	Perform conversion functions: address and block convert between block numbers and absolute addresses; **dec** and **hex** convert between decimal and hexadecimal numbers
disk	Displays the attributes of the volume being verified
displaybyte (db or d)	Displays the working buffer in byte format
displayword (dw)	Displays the working buffer in word format
displaydirectory (dd)	Displays directory contents
displayfnode (df)	Displays the specified fnode information
displaysavefnode (dsf)	Displays the fields of a single fnode in the *r?save* file
displaynextblock (dnb or > or <CR>)	Displays the next volume block

continued

Table B-1. Command Summary (continued)

Command	Description
displaypreviousblock (dpb or <)	Displays the previous volume block
editfnode (ef)	Edits the specified fnode
editsavefnode (esf)	Edits the specified saved fnode
exit (e)	Exits the Disk Verification Utility
fix	Verifies the disk and fixes inconsistencies
free	Marks a particular fnode or volume block as free
getbadtrackinfo (gb)	Displays the bad track information
help (h)	Lists the diskverify commands
listbadblocks (lbb)	Displays all the bad blocks on the volume
quit (q)	Exits the Disk Verification Utility
read (r)	Reads a volume block into the working buffer
restorefnode (rf)	Copies one fnode (or range of fnodes) from the *r?save* file to the fnode file
restorevolumelabel (rvl)	Copies the duplicate volume label to the volume label offset on track 0
save	Writes the updated fnode map, free space map, and bad block map to the volume
substitutebyte (sb or s)	Modifies the contents of the working buffer in byte format
substituteword (sw)	Modifies the contents of the working buffer in word format
verify (v)	Verifies the volume
write (w)	Writes the working buffer to the volume

allocate

Designates fnodes or volume blocks as allocated. You can also use this command to designate one or a range of volume blocks as bad.

Syntax

```
allocate fnode=fnodenum[,fnodenum]|
      block=blocknum[,blocknum]|
      badblock=blocknum[,blocknum]
```

Parameters

fnodenum
: Number of the fnode to allocate. This number can range from 0 through (max fnodes - 1), where max fnodes is the number of fnodes defined when the volume was originally formatted. Two fnode values separated by a comma signify a range of fnodes.

blocknum
: Number of the volume block to allocate. This number can range from 0 through (max blocks - 1), where max blocks is the number of volume blocks in the volume. Two block numbers separated by a comma signify a range of block numbers.

Output

Allocate returns one of these messages, depending on whether you specify fnodes, blocks, or badblocks:

```
<fnodenum>, fnode marked allocated
<blocknum>, block marked allocated
<blocknum>, block marked bad
```

Where:

`<fnodenum>`
: Is the number of the fnode that the utility designated as allocated.

`<blocknum>`
: Is the number of the volume block that the utility designated as allocated or bad.

If a block is not allocated before you designate it as bad, **allocate** also displays:

```
<blocknum>, block marked allocated
```

Allocate checks the allocation status of fnodes or blocks before allocating them. Therefore, if you specify **allocate** for a block or fnode already allocated, **allocate** returns one of these messages:

```
<fnodenum>, fnode already marked allocated
<blocknum>, block already marked allocated
<blocknum>, block already marked bad
```

Additional Information

When you discover an inconsistency between allocated fnodes or volume blocks and referenced fnodes or volume blocks (most often as a result of using the **verify** command), you can use **allocate** and to help correct the errors.

Fnodes are data structures that describe the files on the volume. They are created when the volume is formatted. An allocated fnode is one that represents an actual file. **Allocate** designates fnodes as allocated by updating the `flags` field of the fnode and free fnodes map file.

An allocated volume block is a block of data storage that is part of a file; it is not available to be assigned to a new file. **Allocate** designates volume blocks as allocated by updating the volume free space map with this information.

When you use **allocate** to designate bad blocks, it updates the volume free space map and marks an associated bit as bad in the bad blocks file.

Error Messages

`argument error`
: A syntax error was made in the command, or a nonnumeric character was specified in the *`blocknum`* or *`fnodenum`* parameter.

`<blocknum>, block out of range`
: The block number specified was larger than the largest block number in the volume.

`<fnodenum>, fnode out of range`
: The fnode number specified was larger than the largest fnode number in the volume.

`no badblocks file`
: The volume does not have a bad blocks file. This message could appear if you used an earlier version of the **format** command to format the disk.

arithmetic commands

Perform arithmetic operations within the DVU: **add** adds two numbers together, **sub** subtracts one number from another, **div** divides one number by another, **mul** multiples one number by another, and **mod** finds the remainder of one number divided by another.

Syntax

```
+|add arg1, arg2
-|sub arg1, arg2
/|div arg1, arg2
*|mul arg1, arg2
mod arg1, arg2
```

Where:

arg1 and *arg2*

Numbers on which the command operates. The value of each argument cannot be greater than 2^{32}-1. **Sub** subtracts *arg2* from *arg1*; **div** divides *arg1* by *arg2*; **mod** performs the operation *arg1* modulo *arg2*.

Output

The commands perform their operations on unsigned numbers only and do not report any overflow conditions. The number is displayed in hexadecimal format first, followed by the decimal number in parentheses. For example:

```
13 (  19T)
```

Examples

In all the examples below, the beginning asterisk is the DVU prompt. In the first example, the second asterisk is the multiply operator.

```
** 134T, 13T <CR>    or    *MUL 134T, 13T <CR>
 6CE ( 1742T)

*+ 8, 4  <CR>
 0C  (   12T)

*SUB 8884, 256 <CR>
 862E (34350T)

*MOD 1225, 256T <CR>
 25 (   37T)
```

Error Messages

This error message may be returned by any of the arithmetic commands:

`argument error`

A syntax error was made in the command, a nonnumeric value was specified for one of the arguments, or a value was specified for a block number parameter that was not a valid block number.

backupfnodes

Copies the current fnode file into a designated fnode backup file named *r?save*.

Syntax

```
bf|backupfnodes
```

Output

```
        fnode file backed up to save area
```

Additional Information

The **backupfnodes** command ensures against data loss that occurs when the fnode file is damaged or destroyed. Be sure that the current fnode file is valid before executing the **backupfnode** command (using `named` verification).

To use this command, you must have formatted the volume using the `reserve` option in the **format** command (V1.1 or later) to create a special reserve area (*r?save*). If not, the **backupfnodes** command will be unable to copy the fnode file to *r?save*, and will return an error message.

The **format** command writes the initialized copy of the fnode file into *r?save*. Therefore, you do not have to use **backupfnodes** on a newly formatted volume. Subsequently, you can routinely (for example, once a day) back up fnodes to assure that the data in *r?save* matches the data in the fnode file. You can do this by using either the **backupfnodes** command or the HI **shutdown** command with the `backup` option.

See also: **shutdown** command, in this chapter

Error Messages

`argument error`

Backupfnodes does not accept an argument.

`no save area was reserved when volume was formatted`

To support fnode backup, use the **backup** command to save the data on the volume, reformat the volume using the `reserve` option of the **format** command, and then restore the volume data.

`not a named disk`

The volume specified when the DVU was invoked is a physical volume, not a named volume.

Example

```
super- diskverify :sd: <CR>
iRMX Disk Verify Utility, Vx.x
Copyright <year> Intel Corporation
All Rights Reserved
:sd:, outstanding connections to device have been deleted
*verify named <CR>
                    .
                    .
                    .
   BIT MAPS O.K.
*backupfnodes <CR>   or bf <CR>
fnode file backed up to save area
*
```

conversion commands

Perform conversion operations within the Disk Verification Utility: **address** and **block** convert between block numbers and absolute addresses; **dec** and **hex** convert between decimal and hexadecimal numbers.

address

Converts a block number into an absolute address on the volume; the inverse of the **block** command.

Syntax

```
address blocknum
```

Where:

blocknum
Volume block number that **address** converts into an absolute address in hexadecimal. This parameter can range from 0 through (max blocks - 1), where max blocks is the number of volume blocks in the volume.

Output

In response, **address** displays:

```
absolute address = <addr>
```

Where:

`<addr>`	Absolute address in hexadecimal that corresponds to the specified block number. This address represents the number of the byte that begins the block and can range from 0 through (volume size - 1), where volume size is the size, in bytes, of the volume.

Additional Information

All memory in a volume is divided into volume blocks, which are areas of memory the same size as the volume granularity. Volume blocks are numbered sequentially in the volume, starting with the block containing the smallest addresses (block 0).

block

Converts an absolute address into a volume block number; the inverse of the **address** command.

Syntax

```
block address
```

Where:

address

32-bit absolute address, in hexadecimal, that **block** converts into a block number. This parameter can range from 0 through (volume size - 1), where volume size is the size, in bytes, of the volume.

Output

In response, **block** displays:

```
block number = <blocknum>
```

Where:

`<blocknum>`

Number of the volume block that contains the specified absolute address in hexadecimal. The **block** command determines this value by dividing the absolute address by the volume block size and truncating the result.

dec

Finds the decimal equivalent of a number.

Syntax

```
dec arg
```

Where:

arg	Number for which **dec** finds the decimal equivalent. The value of the argument cannot be greater than 2^{32}-1. The default base is in hexadecimal.

Output

Dec displays the decimal equivalent of the specified number.

hex

Finds the hexadecimal equivalent of a number.

Syntax

```
hex arg
```

Where:

arg Number for which the command finds the hexadecimal equivalent. To specify a decimal number, follow it with a T. The value of the argument cannot be greater than 2^{32}-1.

Output

Hex displays the hexadecimal equivalent of the specified number.

Examples

```
*HEX 155T <CR>
 9B

*ADDRESS 15 <CR>
absolute address = 0A80

*BLOCK 2236 <CR>
block number = 44
```

Error Messages

This error message may be returned by any of the conversion commands:

`argument error`
A syntax error was made in the command, a nonnumeric value was specified for one of the arguments, or a value was specified for a block number parameter that was not a valid block number.

This error message may be returned by the **address** command:

`<blocknum>, block out of range`

If the command was an **address** command, the block number entered was greater than the number of blocks in the volume.

This error message may be returned by the **block** command:

`<address>, address not on the disk`

If the command was a **block** command, **block** converted the address to a volume block number, but the block number was greater than the number of blocks in the volume.

disk

Displays the attributes of the volume being verified.

Syntax

```
disk
```

Output

The output of the **disk** command depends on whether the volume is formatted as a physical or named volume. For a physical volume:

```
        device name  = <devname>
      physical disk
 device granularity  = <devgran>
         block size  = <devgran>
   number of blocks  = <numblocks>
        volume size  = <size>
```

Where:

`<devname>`	Physical name of the device containing the volume. This is the physical name of the device, as specified in the **attachdevice** HI command.
`<devgran>`	Granularity of the device, as defined in the Device Unit Information Block (DUIB). For physical devices, this is also the volume block size. See also: DUIBs, *Driver Programming Concepts*
`<numblocks>`	Number of volume blocks in the volume.
`<size>`	Size of the volume, in bytes.

Output for a named volume:

```
                 device name = <devname>
     named disk, volume name = <volname>
          device granularity = <devgran>
                  block size = <volgran>
            number of blocks = <numblocks>
       number of free blocks = <numfreeblocks>
                 volume size = <size>
                  interleave = <inleave>
              extension size = <xsize>
            number of fnodes = <numfnodes>
       number of free fnodes = <numfreefnodes>
                  root fnode = <rootfnode>
          save area reserved = (yes/no)
```

The `<devname>`, `<devgran>`, `<numblocks>`, and `<size>` fields are the same as for physical files. The remaining fields are:

`<volname>` Name of the volume, as specified when the volume was formatted.

`<volgran>` Volume granularity, as specified when the volume was formatted.

`<numfreeblocks>`
Number of available volume blocks in the volume.

`<inleave>` The interleave factor for a named volume.

`<xsize>` Size, in bytes, of the extension data portion of each fnode.

`<numfnodes>`
Number of fnodes in the volume. The fnodes were created when the volume was formatted.

`<numfreefnodes>`
Number of available fnodes in the named volume.

`<rootfnode>`
The number of the fnode that contains the volume's root directory.

`save area reserved`
Indicates whether the *r?save* file is reserved for volume label and fnode file backups.

See also: Named disk fields, in this appendix
format command, Chapter 2

Additional Information

You can abort this command by typing <Ctrl-C>.

Example

This example shows the output of the **disk** command for a 5.25-inch diskette:

```
super- diskverify :f0: <CR>
iRMX Disk Verify Utility, Vx.x
Copyright <year> Intel Corporation
All Rights Reserved

*disk  <CR>

                  device name =wmf0
      named disk, volume name =rmx286
           device granularity =0200
                   block size =0200
             number of blocks =0000027C
        number of free blocks =000001E9
     volume size =       0004F800
      interleave =           0005
        extension size =       03
             number of fnodes =00CF
        number of free fnodes =00BE
                   root fnode =0006
           save area reserved = no
```

displaybyte

Displays the specified portion of the working buffer in 16-byte rows.

Syntax

d|db|displaybyte [*startoffset* [,*endoffset*]]

Parameters

startoffset

Number of the byte at which you want the display to begin. With this parameter, **displaybyte** starts with the row containing the specified offset; if you omit this parameter, **displaybyte** starts at the beginning of the working buffer.

endoffset

Number of the byte, relative to the start of the buffer, at which you want the display to begin. If you omit this parameter, **displaybyte** shows only the row indicated by `startoffset`. However, if you omit both `startoffset` and `endoffset`, **displaybyte** displays the entire working buffer.

Output

Displaybyte begins by listing the block number where data resides in the working buffer. It then lists the specified portion of the buffer, providing the column numbers as a header and beginning each row with the relative address of the first byte in the row. It also includes, at the right of the listing, the ASCII equivalents of the bytes, if the ASCII equivalents are printable characters. If a byte is not a printable character, **displaybyte** displays a period in the corresponding position. For example:

```
*displaybyte 7,13 <CR>

BLOCK NUMBER = blocknum

offset  0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F   ASCII STRING
 0000  00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F   ............
 0010  61 6E 20 65 78 61 6D 70 6C 65 20 20 20 20 20 20   an example
```

Additional Information

Diskverify maintains a working buffer for **read** and **write** commands. The size of the buffer is equal to the volume's granularity value. After you read a volume block of memory into the working buffer with the **read** command, you can display part or all of that buffer, in BYTE format, by entering the **displaybyte** command. **Displaybyte** displays the hexadecimal value for each byte in the specified portion of the buffer. You can also use **substitutebyte** and **substituteword** to change the data in the block. Finally, you can use the **write** command to write the modified block back out to the volume.

You can abort this command by typing <Ctrl-C>.

Error Messages

`argument error`

A syntax error was made in the command, or a nonnumeric character was specified in one of the offset parameters.

`<offset>, invalid offset`

Either a larger value was specified for `startoffset` than for `endoffset`, or an offset value larger than the number of bytes in the block was specified.

displayword

Is the same as the **displaybyte** command, except that it displays the working buffer in eight words per row.

Syntax

```
dw|displayword [startoffset [,endoffset]]
```

Examples

Assuming that the volume granularity is 128 bytes and that you have read block 20H into the working buffer with the **read** command, this command displays that block:

```
*displayword   <CR>

BLOCK NUMBER = 20

offset     0     2     4     6     8     A     C     E
 0000    0000  0000  0000  0000  0000  0000  0000  0000
 0010    0000  0080  0000  0000  0000  0001  FF0F  00FF
 0020    0000  0000  0500  0000  0000  0025  0108  FFFF
 0030    1F25  0000  002E  0000  1F25  0000  002B  0000
 0040    0001  0000  0001  0080  0000  0000  0000  0000
 0050    0000  0000  0000  0000  0000  0000  0000  0000
 0060    0000  0000  0000  0000  0000  0000  0080  0000
 0070    0000  0000  0001  FF0F  00FF  0000  0000  0500
*
```

This command displays the portion of the block that contains the offsets 31H through 45H (words beginning at odd addresses):

```
*dw 31, 45  <CR>
BLOCK NUMBER = 20

offset     0     2     4     6     8     A     C     E
 0031    001F  2E00  0000  2500  001F  2B00  0000  0100
 0041    0000  0100  8000  0000  0000  0000  0000  0000
*
```

This command displays the portion of the block that contains the offsets 30H through 45H (words beginning at even addresses). Notice how the output differs from the previous example:

```
*displayword 30, 45 <CR>
BLOCK NUMBER = 20

offset     0     2     4     6     8     A     C     E
 0030    1F25  0000  002E  0000  1F25  0000  002B  0000
 0040    0001  0000  0001  0080  0000  0000  0000  0000
*
```

displaydirectory

Lists all the files contained in a directory, with their fnode numbers and types.

Syntax

```
dd|displaydirectory fnodenum
```

Parameter

fnodenum

Number of the fnode that corresponds to a directory file. This number can range from 0 through (max fnodes - 1), where max fnodes is the number of fnodes defined when the volume was originally formatted. **Displaydirectory** lists all files or directories contained in this directory.

Output

The format of the display is:

```
FILE NAME  FNODE   TYPE   FILE NAME  FNODE   TYPE   FILE NAME  FNODE   TYPE

<filenam> <fnode> <type>  <filenam> <fnode> <type>  <filenam> <fnode> <type>
<filenam> <fnode> <type>  <filenam> <fnode> <type>  <filenam> <fnode> <type>
          .                         .                         .
          .                         .                         .
          .                         .                         .
```

Where:

`<filename>`
Name of the file or directory contained in the directory.

`<fnode>` Number of the fnode that describes the file.

`<type>` Type of the file, as follows:

Type of file	**Description**
data	data files
dir	directory files
smap	volume free space map
fmap	free fnodes map
bmap	bad blocks map
vlab	volume label file
****	indicates an illegal fnode type

Additional Information

You can abort this command by typing <Ctrl-C>.

Example

This command lists the files contained in the directory with fnode 6:

```
*displaydirectory 6  <CR>

     FILE NAME  FNODE TYPE  FILE NAME  FNODE TYPE     FILE NAME  FNODE TYPE
    R?SPACEMAP   0001 SMAP R?FNODEMAP   0002 FMAP R?BADBLOCKMAP   0004 BMAP
 R?VOLUMELABEL   0005 VLAB     R?SAVE   0007 DATA        RMX286   0008 DIR
        MYFILE   0009 DATA   YOURFILE   000A DATA       ONEFILE   000B DATA
*
```

Error Messages

`argument error`
: A nonnumeric character was specified in the `fnodenum` parameter.

`<fnodenum>, fnode not allocated`
: The number specified for the *`fnodenum`* parameter does not correspond to an allocated fnode. This fnode does not represent an actual file.

`<fnodenum>, not a directory fnode`
: The number specified for the *`fnodenum`* parameter is not an fnode for a directory file.

`<fnodenum>, fnode out of range`
: The number specified for the *`fnodenum`* parameter is larger than the largest fnode number on the volume.

displayfnode

Displays the fields associated with an fnode.

Syntax

```
df|displayfnode fnodenum
```

Parameter

fnodenum

Number of the fnode to be displayed. This number can range from 0 through (max fnodes - 1), where max fnodes is the number of fnodes defined when the volume was originally formatted.

Output

Displayfnode displays the fields of the specified fnode in this format:

```
Fnode number = <fnodenum>
path name: <pathname>
                  flags : <flgs>
                   type : <typ>
      file gran/vol gran : <gran>
                  owner : <own>
 create,access,mod times : <crtime>, <acctime>, <modtime>
   total size,total blks : <totsize>, <totblks>
       block pointer (1) : <blks>, <blkptr>
       block pointer (2) : <blks>, <blkptr>
       block pointer (3) : <blks>, <blkptr>
       block pointer (4) : <blks>, <blkptr>
       block pointer (5) : <blks>, <blkptr>
       block pointer (6) : <blks>, <blkptr>
       block pointer (7) : <blks>, <blkptr>
       block pointer (8) : <blks>, <blkptr>
               this size : <thissize>
                id count : <count>
            accessor (1) : <access>, <id>
            accessor (2) : <access>, <id>
            accessor (3) : <access>, <id>
       parent, checksum  : <prnt>, <checksum>
                  aux(*) : <auxbytes>
```

Where:

`<fnodenum>`

Number of the fnode being displayed. If the fnode does not describe an actual file (that is, if it is not allocated), this message appears next to this field:

```
*** ALLOCATION STATUS BIT IN THIS FNODE NOT SET ***
```

In this case, the fnode fields are normally set to 0.

`<pathname>`

Full pathname of the file described by the fnode. This field is not displayed if the fnode does not describe a file.

`<flgs>` A word defining the attributes of the file. Significant bits of this word are:

Bit	**Attribute**	**Setting**
6	deletion	1 to indicate a temporary file or a file to be deleted
5	modification	1 whenever a file is modified
1	long or short file	1 for long files 0 for short files
0	allocation status	1 for allocated fnodes 0 for free fnodes

The **displayfnode** command displays a message next to this field that indicates whether the file is a long or short file.

`<typ>` Type of file. This field contains a value, and a description which is displayed next to the value. The possible values and descriptions are as follows:

Value	**Descriptions**
00	fnode file
01	volume map file
02	fnode map file
03	account file
04	bad block file
06	directory file
08	data file
09	volume label file
any other value	illegal value

`<gran>` File granularity, specified as a multiple of the volume granularity.

`<own>` User ID of the owner of the file.

`<crtime>` `<acctime>` `<modtime>` Time and date of file creation, last access, and last modification. These values are expressed as the time, in seconds, since midnight (00:00) on January 1, 1978.

`<totsize>` Total size, in bytes, of the actual data in the file.

`<totblks>` Total number of volume blocks used by the file, including indirect block overhead.

`<blks>`, `<blkptr>`
Values that identify the data blocks of the file. For short files, each `<blks>` parameter indicates the number of volume blocks in the data block, and each `<blkptr>` is the number of the first such volume block. For long files, each `<blks>` parameter indicates the number of volume blocks pointed to by an indirect block, and each `<blkptr>` is the block number of the indirect block.

`<thissize>`
Size in bytes of the total data space allocated to the file, minus any space used for indirect blocks.

`<count>` Number of user IDs associated with the file.

`<access>`, `<id>`
Each pair of fields indicates the access rights for the file and the ID of the user who has that access ID. Bits in the `<access>` field are set to indicate these access rights:

Bit	**Data File**	**Directory File**
3	update	change entry
2	append	add entry
1	read	list
0	delete	delete

The first ID listed is the owner's ID.

`<prnt>` Fnode number of the directory that contains the file.

`<checksum>`
Checksum of the fnode.

`<auxbytes>`
Auxiliary bytes associated with the file.

Additional Information

Each time a file is created on the volume, the BIOS allocates an fnode for the file and fills in the fnode fields to describe the file. The **displayfnode** command enables you to examine these fnodes and determine where the data for each file resides.

You can abort this command by typing <Ctrl-C>.

Example

This example displays fnode 10 of a volume, which represents a directory:

```
*displayfnode 10   <CR>

Fnode number = 10
path name : /MYDIR
                   flags : 0025 =>short file
                    type : 06 =>directory file
      file gran/vol gran : 01
                   owner : FFFF => world
 create,access,mod times : 10219017, 10219E58, 10219E58
 total size,total blocks : 00000360, 00000001
       block pointer (1) : 0001, 000050
       block pointer (2) : 0000, 000000
       block pointer (3) : 0000, 000000
       block pointer (4) : 0000, 000000
       block pointer (5) : 0000, 000000
       block pointer (6) : 0000, 000000
       block pointer (7) : 0000, 000000
       block pointer (8) : 0000, 000000
               this size : 00000400
                id count : 0001
            accessor (1) : 0F, FFFF
            accessor (2) : 00, 0000
            accessor (3) : 00, 0000
        parent, checksum : 0006, 796D
                  aux(*) : 000000
*
```

Error Messages

`argument error`

The value entered for the *`fnodenum`* parameter was not a legitimate fnode number.

`<fnodenum>, fnode out of range`

The number specified for the *`fnodenum`* parameter is larger than the largest fnode number on the volume.

`Unable to get pathname - <reason>`

The pathname specified could not be retrieved. Possible causes of this error are seek error, I/O error, invalid parent, or insufficient memory.

displaysavefnode

Is identical to **displayfnode**, except **displaysavefnode** takes the fnode information from the *r?save* file, and displays the fnode as saved.

Syntax

```
dsf|displaysavefnode fnodenum
```

Output

The output is identical to **displayfnode** except for the first line, which indicates that the fnode is saved. The format of the first line is:

```
Fnode number = <fnodenum> (saved)
```

Error Messages

`argument error`
: When the command was entered, no argument was supplied. **Displaysavefnode** requires a designation of the fnode number.

`<fnodenum>, fnode out of range`
: The number specified for the `fnodenum` parameter is larger than the largest fnode number on the volume.

`no save area was reserved when volume was formatted`
: To support fnode backup, use the **backup** command to save the data on the volume, reformat the volume using the `reserve` option of the **format** command, and then restore the volume data.

`Unable to get pathname - <reason>`
: The pathname specified could not be retrieved. Possible causes of this error are seek error, I/O error, invalid parent, or insufficient memory.

displaynextblock

Displays the next volume block: the block immediately following the block currently in the working buffer. The display format can be either word or byte.

Syntax

```
dnb|>|<CR>|displaynextblock
```

Additional Information

Displaynextblock copies the next volume block from the volume to the working buffer and displays it at your terminal. If you specify **displaynextblock** at the end of the volume, the utility wraps around and displays the first block in the volume. It destroys any data currently in the working buffer.

The utility remembers the mode (word if you used **displayword**, or byte if you used **displaybyte**) in which you displayed the volume block currently in the working buffer, and it displays the next block in that format. **Displaynextblock** uses the byte format as a default if you have not yet displayed a volume block.

Once the block is in the working buffer, you can use **substitutebyte** and **substituteword** to change the data in the block. Finally, you can use the **write** DVU command to write the modified block back out to the volume.

You can abort this command by typing <Ctrl-C>.

displaypreviousblock

Is identical to **displaynextblock**, except that it displays the volume block preceding the current block in the working buffer.

Syntax

```
dpb|<|displaypreviousblock
```

editfnode

Allows you to edit values within a specified fnode.

Syntax

```
ef|editfnode fnodenum
```

Parameter

fnodenum

Number of the fnode to edit. This number can be in the range of 0 through (max fnodes - 1), where max fnodes is the number of fnodes defined when the volume was originally formatted.

Output

```
Fnode number = nnnn
```

Where:

`nnnn`	is the number of the fnode you want to edit.

The first field of the fnode, `flags`, is displayed with its current value:

```
flags(xxxx):
```

Where:

`xxxx`	is the current value of the `flags` field.

From this point on, you can edit the fnode fields, one at a time. After you have edited the last fnode field or entered a `Q` while in edit mode, this query appears on the screen and the modified fnode is displayed:

```
Write back?
```

A response of `Yes` causes the fnode with the modified values to be written on the volume and this message to be displayed:

```
Fnode has been updated
```

Any other response causes the fnode to remain unchanged, and this message is displayed:

```
Fnode not changed
```

Additional Information

The current value of each field is displayed followed by a colon. **Editfnode** then waits for one of these responses from the terminal:

Response	**Meaning**
`<CR>`	No modification to the field.
`numerical value` `<CR>`	The new value to be assigned. This value is always interpreted as hexadecimal.
`QUIT or Q or q <CR>`	Skip the remaining fields and display the query.

Any response other than those listed above causes the field to remain unchanged, and the next field to be displayed.

Once the fnode has been updated, you can use **displayfnode** to examine the contents of the fnode and the changes you made. Changing the contents of an fnode causes it to have a bad checksum; use **fix** with the `named1` option to correct it.

See also: **displayfnode** and **fix** commands, in this appendix

This command can be aborted by typing <Ctrl-C>.

Example

This example illustrates using **editfnode** to edit fnode 10:

```
*editfnode 10 <CR>
fnode number = 10
flags(0025):<CR>
type(0006):<CR>
file gran/vol gran(01): <CR>
owner(0FFFF):  0 <CR>
create time(10219CB2): q <CR>
```

The only edit is the `owner` field. Entering `q` causes the modified fnode to be displayed, with the new `owner` value:

```
                   flags : 0025 =>short file
                    type : 06 =>directory file
         file gran/vol gran : 01
                   owner : 0000
 create,access,mod times : 10219CB2, 10219CC8, 10219CC8
 total size,total blocks : 00000360, 00000001
       block pointer (1) : 0001, 000050
       block pointer (2) : 0000, 000000
       block pointer (3) : 0000, 000000
       block pointer (4) : 0000, 000000
       block pointer (5) : 0000, 000000
       block pointer (6) : 0000, 000000
       block pointer (7) : 0000, 000000
       block pointer (8) : 0000, 000000
               this size : 00000400
                id count : 0001
            accessor (1) : 0F, FFFF
            accessor (2) : 00, 0000
            accessor (3) : 00, 0000
        parent, checksum : 0006, 0000
                  aux(*) : 000000
Write back? yes  <CR>
Fnode has been updated
*
```

Error Messages

`argument error`
: The option specified is not valid.

`<fnode num>, fnode out of range`
: The fnode number specified was larger than the largest fnode number on the volume.

`Error in Input`
: Invalid input was entered while editing an entry.

editsavefnode

Is identical to **editfnode**, except that you can edit an fnode from the *r?save* file. In addition, it designates the fnode as saved when displaying the fnode number.

Syntax

```
esf|editsavefnode fnodenum
```

Error Messages

The error messages are the same as in **editfnode**, with the addition of this message:

`no save area was reserved when volume was formatted`

To support fnode backup, use the **backup** command to save the data on the volume, reformat the volume using the `reserve` option of the **format** command, and then restore the volume data.

exit

Exits the DVU and returns control to the HI command level; identical to the **quit** command.

Syntax

```
e|exit
```

Additional Information

Although you can use **diskverify** to verify the system device (*:sd:*), all connections to this device are deleted by the OS. After exiting, you must reboot or warm start the system.

See also: Warm start feature, *System Debugger*

fix

Verifies the volume in the same way as the **verify** command; also fixes various kinds of inconsistencies discovered during verification.

Syntax

```
fix [[all|named1|named] [,list]] [named2|physical]
```

Parameters

`all` Performs all operations appropriate to the volume. For named volumes, this option performs both the `named` and `physical` verification functions. For physical volumes, this option performs only the `physical` verification function. For both `named` and `physical` volumes, `all` performs the fixes for the relevant verifications.

`named1` or `n1`
Performs `named1` verification and fixes these inconsistencies:

- Fixes bad checksums
- Attaches orphan fnodes to their parents. An orphan fnode is an fnode contained within a directory, whose parent field does not point back to this directory. If the parent field of the specified fnode points to a second valid directory, and the second directory also points to the fnode, no fix is performed since the specified fnode belongs to an existing directory. This is a case of multiple references (discussed in `named2` below).
- If the parent field does not point to a valid parent, the parent field is fixed to point to the directory that contains this fnode in its file list.

`named` or `n`
Performs both the `named1` and `named2` verification functions on a named volume and fixes the inconsistencies defined for these options.

`list` Lists the file information displayed in the **verify** command description later in this appendix, for any verification that includes `named1`.

`named2` or `n2`

Performs `named2` verification and fixes these inconsistencies:

- Removes fnodes from their illegal parents. If there is a multiple reference to an fnode, the fnode is removed from the directories that it does not point to (if `fix` was performed with `named1`, the fnode should now point to one valid parent).
- Saves fnode and block bit maps on completion of `named2`.

`physical`

Performs `physical` verification and saves the bad block bit map.

See also: **verify** command, in this appendix

Output

Fix produces the same output as the **verify** command (see examples there) with additional messages displayed when an inconsistency is fixed. `Named1` output includes these messages:

```
Checksum Fixed
fnode nnnn was attached to parent nnnn
```

The first message appears after a bad checksum is fixed. The second message is displayed when the parent field of an fnode is modified to point to a valid parent.

`Named2` displays this message when an fnode with multiple references is removed from the directory:

```
fnode removed from this directory
```

If an fnode exists on a disk and is marked allocated, but has not been referenced, **fix** issues a warning message and asks if you want to save the bit maps. This prevents **save** from freeing this fnode and its blocks, possibly causing a file to be lost.

Additional Information

Because **fix** and **verify** perform the same verification functions and generate the same error messages, the command description given here describes only the additional functions of **fix**.

See also: **verify** command, in this appendix

You can abort this command by typing <Ctrl-C>. <Ctrl-C> is ignored when **fix** is writing to the volume in order to prevent inconsistencies on the volume.

free

Designates fnodes and volume blocks as free (unallocated); also removes volume blocks from the bad blocks file.

Syntax

```
free fnode=fnodenum[,fnodenum]|
      block=blocknum[,blocknum]|
      badblock=blocknum[,blocknum]
```

Parameters

fnodenum

Number of the fnode to free. This number can range from 0 through (max fnodes - 1), where max fnodes is the number of fnodes defined when the volume was originally formatted. Two fnode values separated by a comma signify a range of fnodes.

blocknum

Number of the volume block to free. This number can range from 0 through (max blocks - 1), where max blocks is the number of volume blocks in the volume. Two block numbers separated by a comma signify a range of block numbers.

Output

Free returns one of these messages, depending on whether you specify fnodes, blocks, or badblocks:

```
<fnodenum>, fnode marked free
<blocknum>, block marked free
<blocknum>, block marked good
```

Where:

`<fnodenum>`

is the number of the fnode that the utility designated as free.

`<blocknum>`

is the number of the volume block that the utility designated as free or good.

Free checks the allocation status of fnodes or blocks before freeing them. Therefore, if you specify **free** for a block or fnode that is already unallocated, **free** returns one of these messages:

```
<fnodenum>, fnode already marked free
<blocknum>, block already marked free
<blocknum>, block already marked good
```

Additional Information

When you discover an inconsistency between allocated fnodes or volume blocks and referenced fnodes or volume blocks (most often as a result of using the **verify** command), you can use **free** and to help correct the errors. You can also use **free** to correct inconsistencies in good block and bad block information.

Free fnodes are fnodes for which no actual files exist. **Free** designates fnodes as free by updating both the `flags` field of the fnode and the free fnodes map file.

Free volume blocks are blocks that are not part of any file; they are available to be assigned to any new or current file. **Free** designates volume blocks as free by updating the volume free space map.

When you use the **free** command to designate one or more bad blocks as good, it removes the block number from the bad blocks file. However, **free badblock** does not designate the blocks as free. To update the volume free space map and designate these blocks as free, use the **free block** command.

Error Messages

`argument error`
: A syntax error was made in the command, or a nonnumeric character was specified in the *`blocknum`* or *`fnodenum`* parameter.

`<blocknum>, block out of range`
: The block number specified was larger than the largest block number in the volume.

`<fnodenum>, fnode out of range`
: The fnode number specified was larger than the largest fnode number in the volume.

`no badblocks file`
: The volume does not have a bad blocks file. This message could appear if you used an earlier version of the **format** command to format the disk.

`not a named disk`
: **Free** was performed on a physical volume.

getbadtrackinfo

Displays the volume's bad track information as written by the manufacturer or the HI **format** command.

Syntax

```
gb|getbadtrackinfo
```

Output

```
Bad track information:
cyl   head  sector
cccc  hh    ss
cccc  hh    ss
.     .     .
.     .     .
```

Where:

`cccc`	is the cylinder number
`hh`	is the head number
`ss`	is the sector number (always 0 for all devices supported in this release of the OS)

Additional Information

The output displayed by the **getbadtrackinfo** command is compatible with the format required by the HI **format** command when writing bad track information on the disk. To use the output as input to **format**, exit **diskverify** and reboot the system. Then edit *`:w:bad.lst`* and remove the header lines. The file can then be used as input to the bad track information file created by the **format** command.

The example below shows how to use **getbadtrackinfo** this way:

```
-attachdevice wmf0 as :w: <CR>
-diskverify :sd: to :w:bad.list <CR>
*getbadtrackinfo <CR>
*exit <CR>
```

Getbadtrackinfo can be aborted by typing <Ctrl-C>.

Error Messages

`I/O error while trying to read bad track information`
An I/O error occurred while reading the bad track information.

`No valid bad track info found`
Bad track information is not valid and cannot be displayed.

`No bad track info found`
The area designated for bad track information is empty.

help

Lists all available Disk Verification Utility commands and provides a short description of each command.

Syntax

```
h|help
```

Output

```
 *help
                   allocate/free :   allocate/free fnodes, space blocks, bad blocks
backup/restore fnodes (bf/rf)    :   backup/restore fnode file to/from save area
                       Control-C :   abort the command in progress
                            disk :   display disk attributes
     display byte/word (d,db/dw) :   display the buffer in (byte/word format)
          display directory (dd) :   display the directory contents
              display fnode (df) :   display fnode information
      display next block (>,dnb) :   read and display 'next' volume block
  display previous block (<,dpb) :   read and display 'previous' volume block
        display save fnode (dsf) :   display saved fnode information
                       exit,quit :   quit disk verify
           list bad blocks (lbb) :   list bad blocks on the volume
                        read (r) :   read a disk block into the buffer
      restore volume label (rvl) :   copy volume label from save area
                            save :   save free fnodes, free space & bad block maps
  substitute byte/word (s,sb/sw) :   modify the buffer (byte/word format)
                          verify :   verify the disk
                       write (w) :   write to the disk block from the buffer
                 edit fnode (ef) :   edit an fnode
           edit save fnode (esf) :   edit a saved fnode
                             fix :   perform various fixes on the volume
         get bad track info (gb) :   get the bad track info on the volume

arithmetic and conversion commands-
                         address :   convert block number to absolute address
                           block :   convert absolute address to block number
                         hex/dec :   display number as hexadecimal/decimal number
     add,+,sub,-,mul,*,div,/,mod :   arithmetic operations on unsigned numbers
```

listbadblocks

Displays all the bad blocks on a named volume.

Syntax

```
lbb|listbadblocks
```

Output

Listbadblocks displays up to eight columns of block numbers from the bad blocks file, in this format:

```
Badblocks on Volume:  volumenum

<blocknum>  <blocknum>  <blocknum>  <blocknum>  <blocknum>
<blocknum>

<blocknum>  <blocknum>  <blocknum>  <blocknum>  <blocknum>
<blocknum>
    .           .           .           .           .           .
    .           .           .           .           .           .
    .           .           .           .           .           .
<blocknum>  <blocknum>  <blocknum>  <blocknum>  <blocknum>
<blocknum>
```

If no blocks have been marked as bad, **listbadblocks** displays this message:

```
no badblocks
```

Additional Information

You can abort this command by typing <Ctrl-C>.

Error Messages

`no badblocks file`

The volume does not have a bad blocks file. This message could appear because you used an earlier version of the HI **format** command when formatting the disk, or because the disk is a physical volume.

quit

Exits the DVU and returns control to the HI command level; identical to **exit**.

Syntax

```
q|quit
```

Additional Information

Although you can use **diskverify** to verify the system device (*:sd:*), all connections to this device are deleted by the OS. After exiting, you must reboot the system or use the warm start feature.

See also: Warm start feature, *System Debugger*

read

Reads a volume block from the disk into the working buffer.

Syntax

```
r|read [blocknum]
```

Parameter

blocknum

Number of the volume block to read. This number can range from 0 through (max blocks - 1), where max blocks is the number of volume blocks in the volume. If you omit this parameter, the **read** command reads the most recently accessed block.

Output

Read reads the block into the working buffer and displays:

```
read block number:  <blocknum>
```

Where:

`<blocknum>`
is the number of the block.

Additional Information

Read destroys any data currently in the working buffer. Once the block is in the working buffer, you can use **displaybyte** and **displayword** to display the block, and you can use **substitutebyte** and **substituteword** to change the data in the block. Finally, you can use the **write** command to write the modified block back to the volume and repair damaged volume data.

Error Messages

`argument error`
A nonnumeric character was specified in the *blocknum* parameter.

`<blocknum>, block out of range`
The block number specified was larger than the largest block number in the volume.

`FFFFFFFF, block out of range`
No block number was specified and no previous read request was executed on this volume.

restorefnode

Copies an fnode or a range of fnodes from the *r?save* file to the fnode file.

Syntax

```
rf|restorefnode fnodenum[,fnodenum]
```

Parameter

fnodenum

The hexadecimal number of the fnode to be restored. This number must be greater than or equal to 0 and less than the maximum number of fnodes defined when the volume was formatted. Two fnode numbers specifies a range of fnodes to be restored. The second number must be greater than the first.

Output

Before changing the fnode file, **restorefnode** displays each fnode number to be changed and prompts you to confirm (by entering a `Y` or `y`) that the fnode is to be restored:

```
restore fnode    (fnodenum)?  Y <CR>
```

When you respond `Y` or `y`, and the fnode is restored:

```
restored fnode number:    (fnodenum)
*
```

If you do not respond with `Y`, the fnode is not restored, and the response is the asterisk (*) prompt:

```
restore fnode    (fnodenum)?  <CR>
*
```

Restorefnode passes on to the next fnode in the range.

Additional Information

The **restorefnode** command enables you to rebuild a damaged fnode file, thereby re-establishing links to data that would otherwise be lost.

Since **restorefnode** operates on the *r?save* file (the fnode backup file), you must have reserved this file with the `reserve` option of the **format** command when the volume was formatted. Otherwise, **restorefnode** will return an error message.

⚠ **CAUTION**

When using this command, be sure that any fnode you restore represents a file that has not been modified since the last fnode backup. **Restorefnode** overwrites the specified fnode in the fnode file with the corresponding fnode in the *r?save* file. If that fnode has not been backed up since the last file modification, a valid fnode may be overwritten with invalid data. Thus, all links to the associated file will be destroyed, and you will lose all of the data in the file.

Example

```
super- diskverify :sd: <CR>
iRMX Disk Verify Utility, Vx.x
Copyright <year> Intel Corporation
All Rights Reserved
:sd:, outstanding connections to device have been deleted
*restorefnode 9,0B <CR>   or   rf 9,0B <CR>
restore fnode     9?  Y <CR>
restored fnode number:    9
restore fnode    0A?  Y <CR>
restored fnode number:   0A
restore fnode    0B?  Y <CR>
restored fnode number:   0B
*
```

Error Messages

`argument error`

The required argument was not supplied when the command was entered.

`no save area was reserved when volume was formatted`

To support fnode backup, use the **backup** command to save the data on the volume, reformat the volume using the `reserve` option of the **format** command, and then restore the volume data.

`not a named disk`

The volume specified when the DVU was invoked is a physical volume, not a named volume.

`<fnode num>, fnode out of range`

The fnode number specified is not in the range of 0 to (maximum fnodes - 1).

```
allocation bit not set for saved fnode
restore fnode <fnode num>?
```

The fnode you specified has not been backed up in the *r?save* file. If you respond to the query with a `Y` or `y`, the data in the file associated with the original fnode will be lost.

See also: Caution, **restorefnode** command

restorevolumelabel

Copies the duplicate volume label to the volume label on track 0.

Syntax

```
rvl|restorevolumelabel
```

Output

```
        Volume label restored
```

Additional Information

Use **restorevolumelabel** to rebuild a damaged volume label, thereby re-establishing links to data that would otherwise be lost.

The duplicate volume label must have been constructed when the volume was formatted, by using the `reserve` option of the **format** command. The volume label is automatically copied to the end of the *r?save* file at this time. Because the contents of the volume label do not change, no other volume label backup is required.

If a duplicate volume label has been reserved on a volume, the DVU can access that volume as a named volume even if the volume label is damaged. When the original volume label is corrupted, the DVU attempts to use the duplicate volume label. If the backup label is used, a `DUPLICATE VOLUME LABEL USED` message appears when the utility is invoked.

If the duplicate volume label was not reserved when the volume was formatted, **restorevolumelabel** will return an error message.

Example

```
super- diskverify :sd: <CR>
iRMX Disk Verify Utility, Vx.x
Copyright <year> Intel Corporation
All Rights Reserved
:sd:, outstanding connections to device have been deleted
DUPLICATE VOLUME LABEL USED
*restorevolumelabel <CR>  or  rvl <CR>
volume label restored
*
```

Error Messages

`argument error`

This command does not accept an argument, but one was supplied when the command was entered.

`no save area was reserved when volume was formatted`

To support volume label backup, use the **backup** command to save the data on the volume, reformat the volume using the `reserve` option of the **format** command, and then restore the volume data.

`not a named disk`

The volume specified when the DVU was invoked is a physical volume, not a named volume.

save

Writes the reconstructed free fnodes bit map, volume free space bit map, and the bad blocks bit map to the volume being verified.

Syntax

```
save
```

Output

```
        save fnode map?
```

If you want to write the reconstructed free fnodes map to the volume, enter `Y`, `y`, or `YES`. Otherwise, enter any other character or a <CR>. If you enter `Y`, **save** writes the fnode map to the volume and displays:

```
        free fnode map saved
```

In any case, **save** next displays this message:

```
        save space map?
```

If you want to write the reconstructed free space map to the volume, enter `Y`. Otherwise, enter any other character or a <CR>. If you enter `Y`, **save** writes the space map to the volume and displays:

```
        free space map saved
```

Save displays this message if the bad blocks map is reconstructed:

```
        save bad block map?
```

If you want to write the reconstructed bad blocks map to the volume, enter `Y`. Otherwise, enter any other character or a <CR>. If you enter `Y`, **save** writes the bad blocks map to the volume and displays:

```
        bad block map saved
```

Additional Information

The **save** command takes the free fnodes map, the volume free space map, and the bad block map created during the verify operation and writes them to the volume, replacing the maps that currently exist. The maps were originally created with the `named2` and `physical` options of the **verify** command.

See also: **verify** command, in this appendix

Example

This example illustrates the format of the **save** command after you use **verify** with the named or named2 option.

```
*VERIFY NAMED2 <CR>
'NAMED2' VERIFICATION
    .
    .
    .
   BIT MAPS O.K.
*SAVE <CR>
save fnode map? y <CR>
   free fnode map saved
save space map? y <CR>
   free space map saved
*
```

Error Message

`nothing to save`

No bit map was constructed with the **verify** command prior to invoking **save**.

substitutebyte

Interactively changes the contents of the working buffer, in byte format.

Syntax

```
s|sb|substitutebyte [offset]
```

Parameter

offset

Number of the first byte, relative to the start of the working buffer, that you want to change. This number can range from 0 to (block size - 1), where block size is the size of a volume block and thus the size of the working buffer. If you omit this parameter, the command assumes a value of 0.

Output

Substitutebyte displays the specified byte and waits for you to enter a new value:

```
<offset>: val -
```

Where:

`<offset>`	is the number of the byte, relative to the start of the buffer.
`val`	is the current value of the byte.

At this point, you can enter one of these:

<CR> alone	**Substitutebyte** leaves the current value as is, displays the next byte in the buffer, and waits for further input. If you enter a <CR> when you are at the last byte of the buffer, **substitutebyte** displays the first byte of the buffer.
A value and <CR>	**Substitutebyte** substitutes the new value for the current byte. If the value you enter requires more than one byte of storage, **substitutebyte** uses only the low-order byte of the value. It then displays the next byte in the buffer and waits for further input.
A value followed by a period (.) and <CR>	**Substitutebyte** substitutes the new value for the current byte. It then exits from the command and gives the asterisk (*) prompt, enabling you to enter any **diskverify** command.

A period (.) and <CR>	This exits the **substitutebyte** command and gives the asterisk (*) prompt, enabling you to enter any **diskverify** command.

Additional Information

Use **substitutebyte** to consecutively step through the working buffer and change whatever bytes are appropriate. When you finish changing the buffer, enter a period (.) followed by a <CR> to exit the command.

The **substitutebyte** command changes only the values in the working buffer. To make the changes in the volume, enter the **write** command to write the working buffer back to the volume.

You can abort this command by typing <Ctrl-C>.

Example

This example changes several bytes in two portions of the working buffer. Two **substitutebyte** commands are used.

```
*substitutebyte<CR>

0000: A0 - 00<CR>
0001: 80 - <CR>
0002: E5 - <CR>
0003: FF - 31<CR>
0004: FF - .<CR>

*substitutebyte 40<CR>

0040: 00 - E6<CR>
0041: 00 - E6.<CR>
*
```

Error Messages

`argument error`

A nonnumeric character was specified in the *`offset`* parameter.

`<offsetnum>, invalid offset`

An offset value larger than the number of bytes in the block was specified.

substituteword

Is identical to **substitutebyte**, except that it displays the working buffer in word format, and substitutes word values in the buffer.

Syntax

```
sw|substituteword [offset]
```

Example

This example changes several bytes in two areas of the working buffer. Two **substituteword** commands are used. In the first command the words begin on even addresses, and in the second command, they begin on odd addresses.

```
*substituteword<CR>

0000: A0B0 - 0000<CR>
0002: 8070 - <CR>
0004: E511 - <CR>
0006: FFFF - 3111<CR>
0008: FFFF - .<CR>

*substituteword 35<CR>

0035: 0000 - E6FF<CR>
0037: 0000 - E6AB.<CR>

*
```

verify

Checks physical and named volumes to ensure that the volumes contain valid file structures and data areas.

Syntax

```
v|verify [[named1|named|all] [,list]] [named2|physical]
```

Parameters

`named1` or `n1`

Checks named volumes to ensure that the information recorded in the fnodes is consistent and matches the information obtained from the directories themselves. **Verify** performs these operations during a `named1` verification:

- Checks fnode numbers in the directories to see if they correspond to allocated fnodes
- Checks the parent fnode numbers recorded in the fnodes to see if they match the information recorded in the directories
- Checks the fnodes against the files to determine if the fnodes specify the proper file type
- Checks the `pointer(`*n*`)` structures of long files to see if the indirect blocks accurately reflect the number of blocks used by the file
- Checks each fnode to see if the `total size`, `total blks`, and `this size` fields are consistent
- Checks the bad blocks file to see if the blocks in the file correspond to the blocks marked as bad on the volume
- Checks the checksum of each fnode

`named2` or `n2`

Checks named volumes to ensure that the information recorded in the free fnodes map and the volume free space map matches the actual files and fnodes. Verify performs these operations during a `named2` verification:

- Creates a free fnodes map by examining every directory in the volume. It then compares that free fnodes map with the one already on the volume.
- Creates a free space map by examining the information in the fnodes. It then compares that free space map with the one already on the volume.

- Checks to see if the block numbers recorded in the fnodes and the indirect blocks actually exist.
- Checks to see if two or more files use the same volume block. If so, it lists the files referring to each block.
- Checks the volume free space map for any bad blocks that are marked as free.
- Checks to see if two or more directories reference the same fnode. If so, it lists the directories referring to each fnode.

`named` or `n`

Performs both the `named1` and `named2` operations on a named volume. If you specify the **verify** command with no option, `named` is the default.

`physical`

Reads all blocks on the volume and checks for I/O errors. This parameter applies to both named and physical volumes. **Verify** also creates a bad blocks map by examining every block on the volume.

`all` Performs all operations appropriate to the volume. For named volumes, performs both the `named` and `physical` operations. For physical volumes, performs only the `physical` operations.

`list` When you specify this option, the file information shown in Named1 Output below is displayed for every file on the volume, even if the file contains no errors. You can use this option with all parameters that either explicitly or implicitly specify the `named1` parameter.

Output

Verify produces a different kind of output for each of the `named1`, `named2`, and `physical` options. The `named` and `all` options produce combinations of these three kinds of output.

Named1 Output

`Named1` used without the `list` option:

```
 DEVICE NAME = <devname>  : DEVICE SIZE = <devsize>  : BLOCK SIZE = <blksize>

 'NAMED1' VERIFICATION

 FILE=(<filename>, <fnodenum>):  LEVEL=<lev>:  PARENT=<parnt>:
TYPE=<typ>
     <error messages>
```

```
FILE=(<filename>, <fnodenum>):  LEVEL=<lev>:  PARENT=<parnt>:  TYPE=<typ>
     <error messages>
 FILE=(<filename>, <fnodenum>):  LEVEL=<lev>:  PARENT=<parnt>:
TYPE=<typ>
     <error messages>
```

Where:

`<devname>`	Physical name of the device, as specified in the **attachdevice** command.
`<devsize>`	Hexadecimal size of the volume, in bytes.
`<blksize>`	Hexadecimal volume granularity. This number is the size of a volume block.
`<filename>`	Name of the file (1 to 14 characters).
`<fnodenum>`	Hexadecimal number of the file's fnode.
`<lev>`	Hexadecimal level of the file in the file hierarchy. The root directory of the volume is the only level 0 file. Files contained in the root directory are level 1 files. Files contained in level 1 directories are level 2 files. This numbering continues for all levels of files in the volume.
`<parnt>`	Fnode number of the directory that contains this file, in hexadecimal.
`<typ>`	Type of file:

Type	**Meaning**
DATA	data files
DIR	directory files
SMAP	volume free space map
FMAP	free fnodes map
BMAP	bad blocks map
VLAB	volume label file

If **verify** cannot ascertain that the file is a directory or data file, it displays the characters `****` in this field.

`<error messages>`
Messages that indicate the errors associated with the previously-listed file. The possible error messages are listed later in this section.

As shown above, the `named1` option (without the `list` option) displays information about each file that is in error. If you use the `list` option with the `named1` option, the file information above is displayed for every file, even if the file contains no errors. The `named1` display also contains error messages that immediately follow the list of the affected files.

Named2 Output

If **verify** detects an error during `named2` verification, it displays one or more error messages in place of the `BIT MAPS O.K.` message.

```
DEVICE NAME = <devname> : DEVICE SIZE = <devsize> : BLK SIZE = <blksze>

'NAMED2' VERIFICATION

   BIT MAPS O.K.
```

The fields in the `named2` output are exactly the same as the corresponding fields in `named1` output.

Physical Output

```
DEVICE NAME = <devname> : DEVICE SIZE = <devsize> : BLOCK SIZE =
<blksize>

'PHYSICAL' VERIFICATION

              NO ERRORS
```

The fields in `physical` output are exactly the same as the corresponding fields in `named1` output.

If **verify** detects an error during `physical` verification, it displays this message in place of the `NO ERRORS` message:

```
<blocknum>, error
```

Named and All Output

If you specify `named` verification, **verify** displays both the `named1` and `named2` output. If you specify the `all` verification for a named volume, **verify** displays the `named1`, `named2`, and `physical` output. If you specify the `all` verification for a physical volume, **verify** displays the `physical` output.

Additional Information

Verify can perform three kinds of verification: `named1`, `named2`, and `physical`. `Named1` and `named2` verifications check the file structures of named volumes. They do not apply to physical volumes. A `physical` verification checks each data block of the volume for I/O errors, and applies to both named and physical volumes.

As part of the `named2` verification, **verify** creates a new free fnodes map and a new volume free space map. To create the free fnodes map, it examines every directory on the volume to determine which fnodes represent actual files. To create the volume free space map, it examines the `pointer(`*`n`*`)` fields of the fnodes to determine which volume blocks the files use. It compares these with the corresponding maps on the volume. You can use the **save** command to write the maps produced during `named2` verification to the volume, overwriting the maps on the volume.

When you perform a `physical` verification on a named volume, if the volume has a bad blocks file, **verify** also creates its own bad blocks map. It does this by examining every block on the volume, not by copying the maps that exist on the volume. **Verify** then compares the newly created maps with the maps that exist on the volume. If a discrepancy exists, **verify** displays a message indicating this. You can use the **save** command to write the bad blocks map produced during `physical` verification to the volume; this destroys the bad blocks map already on the volume.

You can abort this command by typing <Ctrl-C>.

Example

This command performs both named and physical verification on a named volume:

```
*verify ALL <CR>

 DEVICE NAME = F1   : DEVICE SIZE = 0003E900 : BLOCK SIZE = 0080

'named1' VERIFICATION

'named2' VERIFICATION
   BIT MAPS O.K.
'physical' VERIFICATION
   NO ERRORS
*
```

Error Messages

Four kinds of error messages can occur: as a result of entering the **verify** command, or from the `named1`, `named2`, or `physical` error messages.

Verify Command Error Messages

`argument error`

The parameter specified is not a valid **verify** parameter.

Named1 Error Messages

These messages can appear in a `named1` display, immediately after the file to which they refer:

`<blocknum 1 - blocknum n>, block bad`

The block numbers displayed in this message are marked as bad.

```
<blocknum 1 - blocknum n>, invalid block number recorded in the
      fnode/indirect block
```

One of the `pointer(`*n*`)` fields in the fnode specifies block numbers larger than the largest block number in the volume.

`directory stack overflow`

A directory on the volume lists itself or one of the parent directories in its pathname. Thus when the utility searches through the directory tree it continually loops through a portion of the tree, overflowing an internal buffer area. Performing `named2` verification may indicate the cause of this problem.

```
file size inconsistent
total_size = <totsize> :this_size = <thsize> :data blocks = <blks>
```

The `total size`, `this size`, and `total blks` fields of the fnode are inconsistent.

`<filetype>, illegal file type`

The file type of a user file, as recorded in the `type` field of the fnode, is not valid. The valid file types and their descriptions are:

File Type	**Number**	**Description**
smap	1	volume free space map
fmap	2	free fnodes map
bmap	4	bad blocks map
dir	6	directory
data	8	data
vlab	9	volume label file

`<fnodenum>, allocation status bit in this fnode not set`
: The file is listed in a directory but the flags field of its fnode indicates that fnode is free. The free fnodes map may or may not list the fnode as allocated.

`<fnodenum>, fnode out of range`
: The fnode number is larger than the largest fnode number in the fnode file.

`<fnodenum>, parent fnode number does not match`
: The file represented by *`fnodenum`* is contained within a directory whose fnode number does not match the parent field of the file.

`invalid blocknum recorded in the fnode/indirect block`
: One of the pointers within the fnode or within the indirect block specifies a block number that is larger than the largest block number in the volume.

`insufficient memory to create directory stack`
: There is not enough dynamic memory available in the system for the utility to perform the verification.

`sum of the blks in the indirect block does not match block in the fnode`
: The file is a long file, and the number of blocks listed in a `pointer(`*`n`*`)` field of the fnode does not agree with the number of blocks listed in the indirect block.

`total-blocks does not reflect the data-blocks correctly`
: The `total blks` field of the fnode and the number of blocks recorded in the `pointer(`*`n`*`)` fields are inconsistent.

```
Bad Checksum, checksum is : <number>
Checksum should be :  <number>
```
: The checksum recorded in the fnode does not match the checksum calculated by **diskverify**.

Named2 Error Messages

These messages can appear in a `named2` display:

`<blocknum1 - blocknum2>, bad block not allocated`
: The volume free space map indicates that the blocks are free, but they are marked as bad in the bad blocks file.

`<blocknum>, block allocated but not referenced`
: The volume free space map lists the specified volume block as allocated, but no fnode specifies the block as part of a file.

`<blocknum>, block referenced but not allocated`
: An fnode indicates that the specified volume block is part of a file, but the volume free space map lists the block as free.

`directory stack overflow`

A directory on the volume lists itself or one of the parent directories in its pathname. Thus when the utility searches through the directory tree it continually loops through a portion of the tree, overflowing an internal buffer area. In this case, performing `named2` verification may indicate the cause of this problem. The `Multiple reference` message (explained below) may help you find the cause of this problem.

`Fnodes map indicates fnodes > max_fnode`

The free fnodes map indicates that there are a greater number of unallocated fnodes than the maximum number of fnodes in the volume.

`<fnodenum>, fnode-map bit marked allocated but not referenced`

The free fnodes map lists the specified fnode as allocated, but no directory contains a file with the fnode number.

`<fnodenum>, fnode referenced but fnode-map bit marked free`

The specified fnode number is listed in a directory, but the free fnodes map lists the fnode as free.

`Free space map indicates Volume block > max_volume_block`

The free space map indicates that there are a greater number of unallocated blocks than the maximum number of blocks in the volume.

`insufficient memory to create directory stack`

Not enough dynamic memory is available in the system for the utility to perform the verification.

`insufficient memory to create fnode and space maps`

During a `named2` verification, the utility tried to create a free fnodes map and a volume free space map, but did not have enough dynamic memory available in the system.

```
Multiple reference to fnode <fnodenum>
Path name : <full path name>
referring fnodes:
<fnodenum> Path name: <full path name>
<fnodenum> Path name: <full path name>
```

The directories on the volume list more than one file associated with this fnode number.

```
Multiple reference to block <blocknum>
referring fnodes:
<fnodenum> Path name: <full path name>
<fnodenum> Path name: <full path name>
```

More than one fnode specifies this block as part of a file.

Physical Error Messages

`<blocknum>, error`

An I/O error occurred when **verify** tried to access the specified volume block. The volume probably has a physical defect.

`insufficient memory to create bad blocks map`

During a `physical` verification, the utility tried to create a bad blocks map, but did not have enough dynamic memory available in the system.

Miscellaneous Error Messages

These messages indicate internal errors in the Disk Verification Utility. Under normal conditions these messages should never appear. If these (or other undocumented messages) do appear during a `named1` or `named2` verification, exit the DVU and re-enter the **diskverify** command:

```
directory stack empty
directory stack error
directory stack underflow
```

write

Writes the contents of the working buffer to the volume.

Syntax

```
w|write [blocknum]
```

Parameter

`blocknum`

Number of the volume block to which the command writes the working buffer. This number can range from 0 through (max blocks-1), where max blocks is the maximum number of blocks in the volume. If you omit this parameter, **write** writes the buffer back to the block most recently accessed.

Output

```
write to block <blocknum>?
```

Where:

`<blocknum>`

is the number of the volume block to which **write** intends to write the working buffer.

If you respond by entering `Y` or any character string beginning with `Y` or `y`, **write** copies the working buffer to the specified block on the volume and displays:

```
written to block number:<blocknum>
```

Any other response aborts the write process.

Additional Information

The **write** command is used in conjunction with the **read**, **displaybyte**, **displayword**, **substitutebyte**, and **substituteword** commands to modify information on the volume. Initially you use **read** to copy a volume block from the volume to a working buffer. Then you can use **displaybyte** and **displayword** to view the buffer and **substitutebyte** and **substituteword** to change the buffer. Finally, you can use **write** to write the modified buffer back to the volume. By default, **write** copies the buffer to the block most recently accessed by a **read** or **write** command.

A **write** command does not destroy the data in the working buffer. The data remains the same until the next **substitutebyte**, **substituteword**, or **read** command modifies the buffer.

Example

This command copies the working buffer to the block from which it was read:

```
*write  <CR>
write 4B?  y <CR>
write to block 4B? y
written to block number: 4B

*
```

Error Messages

`argument error`
A syntax error was made or nonnumeric characters were specified in the *`blocknum`* parameter.

`<blocknum>, block out of range`
The block number specified was larger than the largest block number in the volume.

`FFFFFFFF, block out of range`
No *`blocknum`* was specified and no previous read request was executed on this volume.

❑❑❑

Structure of a Named Volume C

Introduction

This appendix describes the structure of an iRMX volume that contains named files. It is provided as reference information to help you interpret output from the commands (especially **diskverify**, **format**, and **restore**) or to help you create your own formatting utility programs. It covers the structure of directory files, the concepts of long and short files, and also includes information on the:

- ISO Volume Label
- iRMX Volume Label, including partition table
- MSA Bootloader Location Table
- Fnode file
- Volume free space map file
- Free fnodes map file
- Bad blocks map file
- Root directory

The blocks reserved for the Bootstrap Loader (in Figure C-1) are not discussed. Bootstrap Loader blocks are automatically included on a new volume when you format a volume with the **format** command.

See also: Bootstrap option, **format** command, Chapter 2

This appendix is for programmers with experience in reading and writing actual volume information. It does not attempt to teach these functions.

Volume Structure

Figure C-1 illustrates the general structure of a named file volume.

Figure C-1. General Structure of Named Volumes

Volume Labels

Each iRMX named volume contains ISO (International Standardization Organization) label information as well as iRMX label information and files. This section describes the structure of ISO volume labels and iRMX volume labels, both of which must be present on a named volume.

ISO Volume Label

The ISO volume label is recorded in absolute byte positions 768 through 895 of the volume (for example, sector 07 of a single-density diskette, or the middle of the second logical sector for a uniform-format double-density diskette). This is the structure of the volume label in PL/M notation:

```
DECLARE
      iso_vol_label STRUCTURE(
                   label_id(3)         BYTE,
                   reserved_a          BYTE,
                   vol_name(6)         BYTE,
                   vol_struc           BYTE,
                   reserved_b(60)      BYTE,
                   rec_side            BYTE,
                   reserved_c(4) BYTE,
                   ileave(2)           BYTE,
                   reserved_d          BYTE,
                   iso_version         BYTE,
                   reserved_e(48)      BYTE);
```

This is the structure in C notation:

```
typedef struct {
                   UINT_8              label_id[3];
                   UINT_8              reserved_a;
                   UINT_8              vol_name[6];
                   UINT_8              vol_struc;
                   UINT_8              reserved_b[60];
                   UINT_8              rec_side;
                   UINT_8              reserved_c[4];
                   UINT_8              ileave[2];
                   UINT_8              reserved_d;
                   UINT_8              iso_version;
                   UINT_8              reserved_e[48];
} ISO_VOL_LABEL_STRUCT;
```

Where:

`label_id(3)`	Label identifier. For named file volumes, this field contains the ASCII characters VOL.
`reserved_a`	Reserved field containing the ASCII character 1.
`vol_name(6)`	Volume name. This field can contain up to six printable ASCII characters, left-justified and space-filled. A value of all spaces implies that the volume name is recorded in the iRMX volume label (absolute byte positions 384-393).
`vol_struc`	For named file volumes, this field contains the ASCII character N, indicating that this volume has a non-ISO file structure.
`reserved_b(60)`	Reserved field containing 60 bytes of ASCII spaces.
`rec_side`	For named file volumes, this field contains the ASCII character 1 to indicate that only one side of the volume is to be recorded.
`reserved_c(4)`	Reserved field containing four bytes of ASCII spaces.
`ileave(2)`	Two ASCII digits indicating the interleave factor for the volume, in decimal. ASCII digits consist of the numbers 0 through 9. When formatting named volumes, you should set this field to the same interleave factor that you use when physically formatting the volume.
`reserved_d`	Reserved field containing an ASCII space.
`iso_version`	For named file volumes, this field contains the ASCII character 1, which indicates ISO version number one.
`reserved_e(48)`	Reserved field containing 48 ASCII spaces.

iRMX Volume Label and Partition Table

The iRMX volume label is recorded in absolute byte positions 384 through 511 of the volume (sector 04 of a single density diskette). If the disk is partitioned, the partition table is written into this location as well.

This is the structure of the Named32 volume label in PL/M notation:

```
DECLARE rmx_volume_information STRUCTURE(
                    vol_name(10)        BYTE,
                    flags               BYTE,
                    file_driver         BYTE,
                    vol_gran            WORD_16,
                    vol_size            WORD_32,
                    max_fnode           WORD_16,
                    fnode_start         WORD_32,
                    fnode_size          WORD_16,
                    root_fnode          WORD_16,
                    dev_gran            WORD_16,
                    interleave          WORD_16,
                    track_skew          WORD_16,
                    system_id           WORD_16,
                    system_name(12)     BYTE,
                    device_special(8)   BYTE,
                    vol_flags           BYTE),
```

This is the structure of the Named48 volume label in PL/M notation:

```
DECLARE rmx_volume_information STRUCTURE(
                    vol_name(10)        BYTE,
                    flags               BYTE,
                    file_driver         BYTE,
                    vol_gran            WORD_16,
                    vol_size            WORD_32,
                    max_fnode           WORD_16,
                    fnode_start         WORD_32,
                    fnode_size          WORD_16,
                    root_fnode          WORD_16,
                    dev_gran            WORD_16,
                    interleave          WORD_16,
                    track_skew          WORD_16,
                    system_id           WORD_16,
                    system_name(12)     BYTE,
                    device_special(8)   BYTE,
                    vol_flags           BYTE),
                    directory_type      BYTE   ,
                    firmware_flag       BYTE,
                    fnode_ptr_count     WORD_16,
                    dir_entry_size      WORD_32,
                    vol_size_hi         WORD_32,
                    fnode_ofst_hi       WORD_32,
                    max_fnodes_mid      WORD_16,
                    max_fnodes_hi       WORD_16;
```

This is the structure of the Named32 volume label in C notation:

```
typedef struct {
                    UINT_8              vol_name[10];
                    UINT_8              flags;
                    UINT_8              file_driver;
                    UINT_16             vol_gran;
                    UINT_32             vol_size;
                    UINT_16             max_fnode;
                    UINT_32             fnode_start;
                    UINT_16             fnode_size;
                    UINT_16             root_fnode;
                    UINT_16             dev_gran;
                    UINT_16             interleave;
                    UINT_16             track_skew;
                    UINT_16             system_id;
                    UINT_8              system_name[12];
                    UINT_8              device_special[8];
                    UINT_8              vol_flags;
} RMX_VOLUME_INFORMATION_STRUCT;
```

This is the structure of the Named48 volume label in C notation:

```
typedef struct {
                    UINT_8              vol_name[10];
                    UINT_8              flags;
                    UINT_8              file_driver;
                    UINT_16             vol_gran;
                    UINT_32             vol_size;
                    UINT_16             max_fnode;
                    UINT_32             fnode_start;
                    UINT_16             fnode_size;
                    UINT_16             root_fnode;
                    UINT_16             dev_gran;
                    UINT_16             interleave;
                    UINT_16             track_skew;
                    UINT_16             system_id;
                    UINT_8              system_name[12];
                    UINT_8              device_special[8];
                    UINT_8              vol_flags;
                    UINT_8              directory_type;
                    UINT_8              firmware_flag;
                    UINT_16             fnode_ptr_count;
                    UINT_32             dir_entry_size;
                    UINT_32             vol_size_hi;
                    UINT_32             fnode_ofst_hi;
                    UINT_16             max_fnodes_mid;
                    UINT_16             max_fnodes_hi;
} RMX_VOLUME_INFORMATION_STRUCT;
```

Where:

`vol_name(10)`
Volume name in printable ASCII characters, left-justified and zero-filled.

`flags` Byte that lists the device characteristics for automatic device recognition. The individual bits in this byte indicate these characteristics (bit 0 is rightmost bit):

Bit	**Meaning**
7-5	Reserved
4	vf_format flag. This bit indicates the type of format on track 0. When set to one, it indicates that all tracks, including track 0, have the same format (Uniform format). When set to 0, it indicates track 0 is formatted to be single density with 128-byte sectors (Standard format).

3	vf_mini flag. This bit indicates the size of the recording media. When set to one, it indicates double density. When set to 0, it indicates either quad density or an 8-inch diskette.
2	vf_sides flag. This bit indicates the number of recording sides on the volume. When set to one, it indicates a double-sided volume. When set to 0, it indicates a single-sided volume.
1	vf_density flag. This bit indicates the recording density of the volume. When set to one, it indicates modified frequency modulation (MFM) or double-density recording. When set to 0, it indicates frequency modulation (FM) or single-density recording.
0	vf_auto flag. When set to one, this bit indicates that the flags byte contains valid data for automatic device recognition. When set to 0, it indicates that the remaining flags contain meaningless data.

`file_driver`
: Number of the file driver used with this volume. For named file volumes, this field is set to four.

`vol_gran` Volume granularity, specified in bytes. This value must be a multiple of the device granularity. It sets the size of a logical device block, also called a volume block.

`vol_size` Size of the entire volume, in bytes.

`max_fnode` Number of fnodes in the fnode file.

See also: Fnodes, in this appendix

`fnode_start`
A 32-bit value that represents the number of the first byte in the fnode file (byte 0 is the first byte of the volume).

`fnode_size`
Size of an fnode, in bytes.

`root_fnode`
Number of the fnode describing the root directory.

`dev_gran` Device granularity of all tracks except track `0` (which contains the volume label). This field is important only when the system requires automatic device recognition.

`interleave`
Block interleave factor for this volume. This value indicates the physical distance, in blocks, between consecutively-numbered blocks on the volume. A value of one indicates that consecutively-numbered

blocks are adjacent. A value of 0 indicates an unknown or undefined interleave factor.

`track_skew`
: Offset, in bytes, between the first block on one track and the first block on the next track. A value of 0 indicates that all tracks are identical.

`system_id` Numerical code identifying the OS that formatted the volume. These codes are reserved for Intel OSs:

Operating System	**Code**
iRMX	0–0Fh
iNDX	20h–2Fh
	Currently, the OSs place a 0 in this field.

`system_name(12)`
: Several pieces of information are in this field:

The leftmost eight bytes of this field contain the name of the OS that formatted the volume, in printable ASCII characters, left-justified and space-filled. Zeros (ASCII nulls) indicate that the OS is unknown.

The next byte is an ASCII character that identifies the program that formatted the volume, usually F for the Human Interface **format** command. If the formatting program is unable to provide this information, it places an ASCII space in this field.

The Human Interface format command places characters in the last 3 bytes of this field based on the OS version. For iRMX III, the characters are 03.

`device_special(8)`
: Reserved for special device-specific information. When none exists, this field must contain 0s. For example, if the device is a hard disk with an SBC 214/215G controller, the iRMX OSs impose a structure on this field and supply this information (PL/M notation):

```
SPECIAL STRUCTURE(
      cylinders          WORD_16,
      fixed              BYTE,
      removable          BYTE,
      sectors            BYTE,
      sector_size        WORD_16,
      alternates         BYTE);
```

This is the structure in C notation:

```
typedef struct {
      UINT_16            cylinders;
```

```
                UINT_8              fixed;
                UINT_8              removable;
                UINT_8              sectors;
                UINT_16             sector_size;
                UINT_8              alternates;
        } SPECIAL_STRUCT;
```

Where:

`cylinders` Total number of cylinders on the disk drive.

`fixed` Number of heads on the fixed disk or Winchester disk.

`removable` Number of heads on the removable disk cartridge.

`sectors` Number of sectors in a track.

`sector size`
Sector size, in bytes.

`alternates`
Number of alternate cylinders or spare sectors on a track.

`vol_flags` Contains flags for general volume information, defined as:

Flag	Bit	Meaning
vf_integrity	0	The volume has been properly shut down.
	1	Possible disk corruption (the volume was attached, but was not subsequently detached).

`directory_type`
Specifies the directory type:

Linear	TBD
Sorted	TBD

`firmware_flag`
Reserved.

`fnode_ptr_count`
Specifies the number of pointers for each fnode.

`dir_entry_size`
Specifies the size of the directory.

`vol_size_hi`
Contains the upper 32 bits of the volume size.

`fnode_ofst_hi`
Contains the upper 32 bits of the location of the fnode file.

`max_fnodes_mid`
Specifies bits 32–47 of the maximum fnode number.

`max_fnodes_hi`
: Specifies bits 48–63 of the maximum fnode number.

Partition Table Structure

For an unpartitioned disk the remainder of the iRMX volume label (bytes 441 through 511) is reserved and must be set to 0.

A partitioned disk contains a partition table of 64 bytes beginning at byte 446 and ending at byte 509. The partition table contains four contiguous 16-byte structures as shown below in C notation:

```
typedef struct {
   UINT_8    boot;
   UINT_8    start_head;
   UINT_16   start_cylinder_sector;
   UINT_8    system;
   UINT_8    end_head;
   UINT_16   end_cylinder_sector;
   UINT_32   first_partition_sector;
   UINT_32   number_of_sectors;
}  PARTITION_TABLE_STRUCT;
```

Where:

`boot`	Specifies whether this is the active boot partition.
`start_head`	The beginning head of this partition.
`start_cylinder_sector`	The beginning cylinder of this partition.
`system`	Specifies the OS type and whether this is a primary or extended partition.
`end_head`	The last head of this partition
`end_cylinder_sector`	The last cylinder of this partition.
`first_partition_sector`	The beginning sector number of this partition.
`number_of_sectors`	Number of sectors in this partition.

Note

For more information on the partition table structure, refer to a DOS technical reference; this is the same structure used for a DOS partition table.

See also: Appendix F in this manual

Bootloader Location Table

The Bootloader Location Table (BOLT) describes the location of the Multibus II System Architecture (MSA) second stage bootstrap loader, which is normally in the file *r?secondstage*. The MSA first stage bootstrap loader requires the BOLT to read and load the MSA second stage. The BOLT describes the location of the *r?secondstage* file as a set of data blocks on the disk by listing the number of data blocks and the byte offset and length of each block. The BOLT also contains other information about the MSA second stage needed by the first stage.

The **format** command writes the BOLT structure to bytes 512 through 767 of a named volume. This replaces the area marked uninitialized, reserved for future ISO standardization in previous versions of the iRMX OSs.

The BOLT structure in PL/M is:

```
BOLT   STRUCTURE(
             reserved(4)              WORD_32,
             magic_word1              WORD_32,
             magic_word2              WORD_32,
             version                  WORD_16,
             types                    WORD_16
             data_size                WORD_32,
             num_entries              WORD_32,
             tbl_entry(num_entries)   STRUCTURE(
                                      byte_offset  WORD_32,
                                      length       WORD_16));
```

The BOLT structure in C:

```
typedef {
      UINT_32                          reserved[4];
      UINT_32                          magic_word1;
      UINT_32                          magic_word2;
      UINT_16                          version;
      UINT_16                          types;
      UINT_32                          data_size;
      UINT_32                          num_entries;
      struct tbl_entry[num_entries]{
                        UINT_32               byte_offset;
                        UINT_16               length;
}}BOLT_ STRUCT
```

Where:

`reserved(4)`
Reserved for future use. Set to 0.

`magic_word1`
A value which defines a valid MSA second stage bootloader image. This value is 0B00F10ADH.

`magic_word2`
Reserved for future use. Set to 0.

`version` The version of the BOLT structure. The BOLT structure listed here is version 2.

`types` Defines the type of code and data segments used in the second stage file to be bootloaded.

Bit	**Meaning**
1	Indicates the type of data segment: 0 = Use16 1 = Use32
0	Indicates the type of code segment: 0 = Use16 1 = Use32

The **format** command sets these bits to 0 (Use16).

`data_size` The size of the data segment for the second stage bootstrap loader.

`num_entries`

The number of entries in the table describing the second stage location.

`tbl_entry(num_entries)`

A table containing `byte_offset` and `length` pairs which indicate where the second stage is located on the media.

On disks larger than 4 Gbytes, this 32-bit value requires that the MSA second stage be placed within the first 4 Gbytes of the volume. The Format HI Command has been changed so that it will place the MSA Second Stage immediately after the Volume Label on drives larger than 4 Gbytes. On drives less than 4 Gbytes, the Format Command will continue to place the MSA Second Stage at the high (address) end of the volume.

`byte_offset`	The offset, in bytes, from the beginning of the media to this part of the second stage bootstrap loader.
`length`	The length of this part of the second stage bootstrap loader.

Initial Files

Any mechanism that formats iRMX named volumes must place seven files, with the option of an eighth and ninth file, on the volume during the format process. These files are:

File	**File Name**
fnode file	not accessible as a file
volume label file	*r?volumelabel*
volume free space map file	*r?spacemap*
free fnodes map file	*r?fnodemap*
bad blocks file	*r?badblockmap*
root directory	not accessible as a file
space accounting file,	not accessible as a file
Optionally, duplicate volume label file	*r?save*
Optionally, MSA second stage file	*r?secondstage*

The first of these files, the fnode file, contains information about all of the files on the volume. The general structure of the fnode file is discussed first. Then all of the files are discussed in terms of their fnode entries and their functions.

Fnode File

A data structure called a file descriptor node (fnode) describes each file in a named file volume. All the fnodes for the entire volume are grouped together in a file called the fnode file. When the I/O System accesses a file on a named volume, it examines the iRMX volume label to determine the location of the fnode file, and then examines the appropriate fnode to determine the actual location of the file.

See also: iRMX volume label, in this appendix

When a volume is formatted, the fnode file contains seven allocated fnodes and any number of unallocated fnodes. The original number of unallocated fnodes depends on the `files` parameter of the **format** command. These allocated fnodes represent the fnode file, the volume label file, the volume free space map file, the free fnodes map file, the bad blocks file, the root directory, and the space accounting file. The size of the fnode file is determined by the number of fnodes that it contains. The number of fnodes in the fnode file also determines the number of files that can be created on the volume. The number of files is set when you format the storage medium.

See also: Fnode file, volume label file, volume free space map file, free fnodes map file, bad blocks file, root directory, and space accounting file, in this appendix.

This the structure of an individual fnode in a Named32 file volume in PL/M notation:

```
DECLARE
      fnode STRUCTURE (
            flags               WORD_16,
            type                BYTE,
            gran                BYTE,
            owner               WORD_16,
            cr_time             WORD_32,
            access_time         WORD_32,
            mod_time            WORD_32,
            total_size          WORD_32,
            total_blks          WORD_32,
            pointr(40)          BYTE,
            this_size           WORD_32,
            reserved_a          WORD_16,
            chk_sum             WORD_16,
            id_count            WORD_16,
            acc(9)              BYTE,
            parent              WORD_16,
            aux(*)              BYTE);
```

This the structure of an individual fnode in a Named48 file volume in PL/M notation:

```
DECLARE
      fnode STRUCTURE (
            flags               WORD_16,
            type                BYTE,
            gran                BYTE,
            owner               WORD_16,
            cr_time             WORD_32,
            access_time         WORD_32,
            mod_time            WORD_32,
            total_size          WORD_32,
            total_size_hi       WORD_32,
            total_blks          WORD_32,
            total_blks_hi       WORD_32,
            pointr(40)          BYTE,
            pointr[72]          BYTE,
            this_size           WORD_32,
            this_size_hi        WORD_32,
            reserved_a          WORD_16,
            chk_sum             WORD_16,
            id_count            WORD_16,
            acc(9)              BYTE,
            parent              WORD_16,
            aux(*)              BYTE);
```

This is the structure of an individual fnode in a Named32 file volume, in C:

```
typedef struct {
             UINT_16             flags;
             UINT_8              type;
             UINT_8              gran;
             UINT_16             owner;
             UINT_32             cr_time;
             UINT_32             access_time;
             UINT_32             mod_time;
             UINT_32             total_size;
             UINT_32             total_blks;
             UINT_8              pointr[40];
             UINT_32             this_size;
             UINT_16             reserved_a;
             UINT_16             chk_sum;
             UINT_16             id_count;
             UINT_8              acc[9];
             UINT_16             parent;
             UINT_8              aux[2];/*adjust aux#
                                          for application*/
} FNODE_STRUCT
```

This is the structure of an individual fnode in a Named48 file volume, in C:

```
typedef struct {
             UINT_16             flags;
             UINT_8              type;
             UINT_8              gran;
             UINT_16             owner;
             UINT_32             cr_time;
             UINT_32             access_time;
             UINT_32             mod_time;
             UINT_32             total_size;
             UINT_32             total_size_hi;
             UINT_32             total_blks;
             UINT_32             total_blks_hi;
             UINT_8              pointr[40];
             UINT_8              pointr[72];
             UINT_32             this_size;
             UINT_32             this_size_hi;
             UINT_16             reserved_a;
             UINT_16             chk_sum;
             UINT_16             id_count;
             UINT_8              acc[9];
             UINT_16             parent;
             UINT_8              aux[2];/*adjust aux#
                                          for application*/
} FNODE_STRUCT
```

Where:

`flags` A word that defines a set of attributes for the file. The individual bits in this word indicate these attributes (bit 0 is the rightmost bit):

Bit	**Meaning**
15-7	Reserved bits, always set to 0.
6	Deletion attribute. This bit is set to one to indicate that the file is a temporary file or that the file will be deleted (the deletion may be postponed because additional connections exist to the file). Initially, when the volume is formatted, this bit is set to 0 in each fnode.
5	Modification attribute. Whenever a file is modified, this bit is set to one. Initially, when a volume is formatted, this bit is set to 0 in each fnode.
3-4	Reserved bits, always set to 0.
2	Reserved bit, always set to one.
1	Long or short file attribute. This bit describes how the ptr fields of the fnode are interpreted. If set to 0, indicating a short file, the ptr fields identify the actual data blocks of the file. If set to one, indicating a long file, the ptr fields identify indirect blocks. When formatting a volume, this bit is always set to 0, since the initial files on the volume are short files. See also: Indirect blocks, in this appendix
0	Allocation status. If set to one, this fnode describes an actual file. If set to 0, this fnode is available for allocation. When formatting a volume, this bit is set to one in the seven allocated fnodes. In other fnodes, it is set to 0.

`type` Type of file. These are acceptable types:

Mnemonic	**Value**	**Type**
`ft_fnode`	0	fnode file
`ft_volmap`	1	volume free space map
`ft_fnodemap`	2	free fnodes map
`ft_account`	3	space accounting file
`ft_badblock`	4	device bad blocks file
`ft_dir`	6	directory file
`ft_data`	8	data file
`ft_vlabel`	9	volume label file

During system operation, only the I/O System can access file types other than `ft_data` and `ft_dir`.

See also: File types, in this appendix

`gran` File granularity, specified in multiples of the volume granularity. The default value is 1. This value can be set to any multiple of the volume granularity.

`owner` User ID of the owner of the file. For the files initially present on the volume, this parameter is important only for the root directory. For the root directory, this parameter should specify the user World (FFFFH). The I/O System does not examine this parameter for the other files (fnode file, volume free space map file, free fnodes map file, bad blocks file, volume label), so a value of 0 can be specified.

`cr_time` Time and date that the file was created, expressed as a 32-bit value. This value indicates the number of seconds since a fixed, user-determined point in time. By convention, this point in time is midnight (00:00), January 1, 1978. For the files initially present on the volume, this parameter is important only for the root directory. A 0 can be specified for the other files (fnode file, volume free space map file, free fnodes map file, bad blocks file, volume label.)

`access_time`
Time and date of the last file access (read or write), expressed as a 32-bit value. For the files initially present on the volume, this parameter is important only for the root directory.

`mod_time` Time and date of the last file modification, expressed as a 32-bit value. For the files initially present on the volume, this parameter is important only for the root directory.

`total_size`
In Named32 file volumes, this field indicates the total size, in bytes, of

the actual data in the file. In Named48 file volumes, this field indicates the low 32 bits of total data.

`total_size_hi`
Available only in Named48 file volumes, this field indicates the upper 16 bits of total data.

`total_blks`
In Named32 file volumes, this field indicates the total number of volume blocks used by this file, including indirect block overhead. In Named48 file volumes, this field indicates the low 32 bits of total blocks used by the file.

A volume block is a block of data whose size is the same as the volume granularity. All memory in the volume is divided into volume blocks, which are numbered sequentially, starting with the block containing the smallest addresses (block 0).

See also: Indirect blocks, in this appendix

`total_blks_hi`
Available only in Named48 file volumes, this field indicates the upper 16 bits of total blocks used by the file.

`pointr(40)` A group of bytes on which this structure is imposed (in PL/M):

```
PTR(8) STRUCTURE(
      NUM_BLOCKS   WORD_16,
      BLK_PTR(3)   BYTE);
```

The same structure in C:

```
typedef struct {
      UINT_16      num_blocks;
      UINT_8       blk_ptr[3];
} ptr_struct[8];
```

This structure identifies the data blocks of the file. These data blocks may be scattered throughout the volume, but together they make up a complete file. If the file is a short file (bit 1 of the `flags` field is set to `0`), each `ptr` structure identifies an actual data block. In this case, the fields of the `ptr` structure contain:

`num_blocks`	Number of volume blocks in the data block.
`blk_ptr(3)`	A 24-bit value specifying the number of the first volume block in the data block. Volume blocks are numbered sequentially, starting with the block with the smallest address (block 0). The bytes in the blk_ptr array range from least significant (blk_ptr(0)) to most significant (blk_ptr(2)).

If the file is a long file (bit 1 of the `flags` field is set to one), each `ptr` structure identifies an indirect block (possibly consisting of more than one contiguous volume block), which in turn identifies the data blocks of the file. In this case, the fields of the `ptr` structure contain:

`num_blocks`	Number of volume blocks pointed to by the indirect block.
`blk_ptr(3)`	A 24-bit volume block number of the indirect block.

See also: Indirect blocks, in this appendix.

`pointr(72)`

A group of bytes on which this structure is imposed (in PL/M):

```
PTR(8) STRUCTURE(
      num_blocks   unsigned long,
      blk_ptr[5]   unsigned char;
```

The same structure in C:

```
typedef struct PTR_STRUCT {
      unsigned long      num_blocks;
      unsigned char      blk_ptr[5];
} ptr_struct[8];
```

This structure identifies the data blocks of the file. These data blocks may be scattered throughout the volume, but together they make up a complete file. If the file is a short file (bit 1 of the `flags` field is set to `0`), each `ptr` structure identifies an actual data block. In this case, the fields of the `ptr` structure contain:

`num_blocks`	Number of volume blocks in the data block.
`blk_ptr(5)`	A 24-bit value specifying the number of the first volume block in the data block. Volume blocks are numbered sequentially, starting with the block with the smallest address (block 0). The bytes in the blk_ptr array range from least significant (blk_ptr(0)) to most significant (blk_ptr(2)).

If the file is a long file (bit 1 of the `flags` field is set to one), each `ptr` structure identifies an indirect block (possibly consisting of more than one contiguous volume block), which in turn identifies the data blocks of the file. In this case, the fields of the `ptr` structure contain:

`num_blocks`	Number of volume blocks pointed to by the indirect block.
`blk_ptr(5)`	A 24-bit volume block number of the indirect block.

See also: Indirect blocks, in this appendix.

`this_size` In Named32 file volumes, this field indicates the size, in bytes, of the total data space allocated to the file. In Named48 file volumes, this field indicates the low 32 bits of total data space used by this file.

This figure does not include space used for indirect blocks, but it does include any data space allocated to the file, regardless of whether the file fills that allocated space.

`this_size_hi`
Available only in Named48 file volumes, this field indicates the upper 16 bits of total data space used by this file.

`reserved_a`
Reserved field, unsigend long, set to 0.

`chk_sum` Contains a checksum value for the fnode.

`Id_count` Number of access-ID pairs declared in the `acc(9)` field.

`acc(9)` A group of `bytes` on which this structure is imposed (in PL/M):

```
ACCESSOR(3)  STRUCTURE(
                   access   BYTE,
                   id       WORD_16);
```

The same structure in C:

```
typedef struct {
      UINT_8       access;
      UINT_16      id;
}ACCESSOR_STRUCT[3];
```

This structure contains the access-ID pairs that define the access rights for the users of the file. By convention, when a file is created, the owner's ID is inserted in `accessor(0)`, along with the code for the access rights. The fields of the `accessor` structure contain:

`access` Encoded access rights for the file. The settings of the individual bits in this field grant (if set to 1) or deny (if set to 0) permission for the corresponding operation. Bit 0 is the rightmost bit.

Bit	**Data File Operation**	**Directory Operation**
7-4	reserved (must be 0)	
3	update	change entry
2	append	add entry
1	read	list
0	delete	delete

`id` ID of the user who gains the corresponding access permission.

`parent` Fnode number of directory file that lists this file. For files initially present on the volume, this parameter is important only for the root directory. For the root directory, this parameter should specify the number of the root directory's own fnode. For other files (fnode file, volume free space map file, free fnodes map file, bad blocks file, volume label) the I/O System does not examine this field.

`aux(*)` Auxiliary bytes associated with the file. The named file driver does not interpret this field, but the user can access it by making **get_extension_data** and **set_extension_data** system calls. The size of this field is determined by the size of the fnode, specified in the iRMX volume label. If you use the **format** command or create your own utility to format a volume, you can make this field as large as you wish; however, a larger `aux` field implies slower file access.

Certain fnodes designate special files that appear on the volume. These sections discuss these fnodes and the associated files.

Fnode 0: Fnode File

The first fnode structure in the fnode file describes the fnode file itself. This file contains all the fnode structures for the entire volume. It must reside in contiguous locations in the volume. The fields of fnode 0 must be set as:

- The bits in the `flags` field are set to (bit 0 is the rightmost bit):

Bit	Value	Description
15-7	0	Reserved bits
6	0	File will not be deleted
5	0	Initial status is unmodified
3-4	0	Reserved bits
2	1	Primary fnode
1	0	Short file
0	1	Allocated file

- The `type` field is set to `ft_fnode`.
- The `gran` field is set to 1.
- The `owner` field is set to the ID of the user who formatted it.
- The `cr_time`, `access_time`, and `mod_time` fields are set to the time the system was formatted.
- Since the iRMX volume label specifies the size of an individual fnode structure and the number of fnodes in the fnode file, the value specified in the `total_size` field of fnode 0 must equal the product of the values in the `fnode_size` and `max_fnode` fields of the iRMX volume label.
- The `total_blocks` field specifies enough volume blocks to account for the memory listed in the `total_size` field. The product of the value in the `total_blocks` field and the volume granularity equals the value of the `this_size` field, since the fnode file is a short file.
- Since the fnode file must reside in contiguous locations in the volume, only one `ptr` structure describes the location of the file. The value in the `num_blocks` field of that `ptr` structure equals the value in the `total_blocks` field. The `blk_ptr` field indicates the number of the first block of the fnode file.
- The `id_count` field is set to 1.

Fnode 1: Volume Free Space Map File

The second fnode, fnode 1, describes the volume free space map file. The `type` field for fnode 1 is set to `ft_volmap` to designate the file as such.

The volume free space map file keeps track of all the space on the volume. It is a bit map of the volume, in which each bit represents one volume block (a block of space whose size is the same as the volume granularity). If a bit in the map is set to one, the corresponding volume block is free to be allocated to any file. If a bit in the map is set to 0, the corresponding volume block is already allocated to a file. The bits of the map correspond to volume blocks such that bit *n* of byte *m* represents volume block (`8 *` *m*) + *n*. The bits in the remaining space allocated to the map file (those that do not correspond to actual blocks of memory) must be set to 0.

When the volume is formatted, the volume free space map file indicates that the first 3328 bytes of the volume (the label and bootstrap information) plus any files initially placed on the volume (fnode file, volume free space map file, free fnodes map file, bad blocks file) are allocated. Space is also reserved for the *r?save* and *r?secondstage* files if they are selected during formatting.

Fnode 2: Free Fnodes Map File

The third fnode, fnode 2, describes the free fnodes map file. The type field of fnode 2 is set to `ft_fnodemap` to designate the file as such.

The free fnodes map file keeps track of all the fnodes in the fnodes file. It is a bit map in which each bit represents an fnode. If a bit in the map is set to one, the corresponding fnode is not in use and does not represent an actual file. If a bit in the map is set to 0, the corresponding fnode already describes an existing file. The bits in the map correspond to fnodes such that bit *n* of byte *m* represents fnode number (`8 *` *m*) + *n*. The bits in the remaining space allocated to the map file (those that do not correspond to actual fnode structures) must be set to 0.

When the volume is formatted, the free fnodes map file indicates that fnodes 0, 1, 2, 3, 4, 5, and 6 are in use. If the `reserve` option is selected when the volume is formatted, the map file also indicates fnode 7 is in use. If other files are initially placed on the volume, the free fnodes map file must be set to indicate this as well.

Fnode 3: Accounting File

Fnode 3 is a placeholder. When a volume is formatted, fnode 3 is set up representing a file of type `ft_account`. The fnode is set up as allocated, and of the indicated type, but it does not assign any actual space for the file.

Fnode 4: Bad Blocks Map File

The fifth fnode, fnode 4, describes a file containing a map of all the bad blocks on the volume. The `type` field of fnode 4 is set to `ft_badblock` to indicate this.

The bad block map file keeps track of all the bad blocks on the volume. It is a bit map of the volume, in which each bit represents one volume block (a block of space whose size is the same as the volume granularity). If a bit in the map is set to 0, the corresponding volume block has no bad blocks and may be allocated to any file. If a bit in the map is set to one, the corresponding volume block is bad. If a block is marked bad, it must also be marked allocated in the volume free space file. The bits of the map correspond to volume blocks such that bit *n* of byte *m* represents volume block (`8 *` *m*) + *n*.

Fnode 5: Volume Label File

This fnode describes a file containing the first 3328 bytes of any volume. The information in this file defines the volume as a whole. The `type` field of this fnode is set to `ft_vlabel`. You cannot write to this fnode.

Fnode 6: Root Directory

The root directory is a special directory file. It is the root of the named file hierarchy for the volume. The iRMX volume label specifies the fnode number of the root directory. The root directory is its own parent; thus the `parent` field of its fnode specifies its own fnode number.

The root directory (and all directory files) associates file names with fnode numbers. It consists of a number of entries that have this

This is the 16-byte structure in PL/M notation:

```
DECLARE
      DIR_ENTRY     STRUCTURE(
                    fnode                 WORD_16,
                    component(14) BYTE);
```

This is the 32-byte structure in PL/M notation:

```
DECLARE
      DIR32_ENTRY   STRUCTURE(
                    name[14]                    unsigned char,
                    reserved[5]                 unsigned short,
                    fnode_num_lo                unsigned_long,
                    fnode_num_hi                unsigned_long;
```

This is the 16-byte structure in C:

```
typedef struct {
        UINT_16             fnode;
        UINT_8              component[14];
} DIR_ENTRY_STRUCT;
```

This is the 32-byte structure in C:

```
typedef struct dir32_entry_struct {
        unsigned char       name[14];
        unsigned char       reserverd[5];
        unsigned long       fnode_num_lo;
        unsigned long              fnode_num_hi];
} DIR_ENTRY32_STRUCT;
```

Where:

`fnode` Fnode number of a file listed in the directory.

`fnode_num_lo`
: To be developed.

`fnode_num_hi`
: To be developed.

`component(14)`
: A string of ASCII characters that is the final component of the path name identifying the file. This string is left-justified and null padded to 14 characters.

`name[14]`
: To be developed.

`reserved[5]`
: To be developed.

When a file is deleted, its fnode number in the directory entry is set to 0.

Fnodes 7 and 8: R?secondstage and R?save

These fnodes may or may not be reserved depending on whether the `reserve` and `msaboot` (iRMX II only) options are used during formatting. If both options are used, the *r?secondstage* file is placed in fnode 7 and the *r?save* file is placed in fnode 8. If only reserve is used, *r?save* is placed in fnode 7 and fnode 8 remains unallocated. If only `msaboot` (iRMX II only) is used, *r?secondstage* is placed in fnode 7 and fnode 8 remains unallocated. If neither option is used, both fnode 7 and fnode 8 remain unallocated.

R?secondstage

R?secondstage is a file which may be optionally created by the `msaboot` option of the **format** command. *R?secondstage* is the second stage bootloader for systems that conform to the Multibus II System Architecture (MSA) specification. *R?secondstage* is created at the end of the volume. However, if the `reserve` option is also specified, *r?secondstage* will be placed in the volume blocks immediately preceding *r?save*. (The fnode for the *r?secondstage* file is allocated out of the fnodes reserved through the `files` parameter of the **format** command.)

R?save

R?save is a file which may be optionally created by the `reserve` option of the **format** command. *R?save* contains the duplicate volume label, in the innermost track of the volume. A copy of the iRMX volume label is placed at the physical end of the file and an fnode is allocated for *r?save* in the fnode file, out of the fnodes reserved through the `files` parameter of the **format** command.

The **format** command creates a backup of the fnode file in its initialized state. *R?save* is not subsequently updated as files are written to or deleted from the volume. Therefore, you will have to use the **backupfnodes** command or the `backup` option of the Human Interface **shutdown** command to back up the fnode file at regular intervals.

Other Fnodes

When formatting a volume, no other fnodes in the fnode file represent actual files. The remaining fnodes must have bit 0 (allocation status) set to 0.

Short and Long Files

A file on a volume is not necessarily one contiguous string of bytes. In many cases, it consists of several blocks of data scattered throughout the volume. The fnode for the file indicates the locations and sizes of these blocks in one of two ways, as short files or as long files.

Short Files

If the file consists of eight or fewer distinct blocks of data, its fnode can specify it as a short file. The fnode for a short file has bit 1 of the `flags` field set to `0`. This indicates to the I/O System that the PTR structures of the fnode identify the actual data blocks that make up the file. Figure C-2 illustrates an fnode for a short file. Decimal numbers are used in the figure for clarity.

Figure C-2. Short File Fnode

As you can see in Figure C-2, fnode 8 identifies the short file. The file consists of three distinct data blocks. Three `ptr` structures give the locations of the data blocks. The `num_blocks` field of each `ptr` structure gives the length of the data block (in volume blocks), and the `blk_ptr` field points to the first volume block of the data block.

The other fields shown in Figure C-2 include `total_blks`, `this_size`, and `total_size`. The `total_blks` field specifies the number of volume blocks allocated to the file, which in this case is eight. This equals the sum of `num_blocks` values (3 + 2 + 3), since short files use all allocated space as data space.

The `this_size` field specifies the number of bytes of data space allocated to the file. This is the sum of the `num_blocks` values (3 + 2 + 3) multiplied by the volume granularity (1024) and equals 8192.

The `total_size` field specifies the number of bytes of data space that the file occupies (designated in Figure C-2 by the shaded area). As you can see, the file does not occupy all the space allocated for it, so the `total_size` value (8000) is not as large as the `this_size` value.

Long Files

If the file consists of more than eight distinct blocks of data, its fnode must specify it as a long file. The fnode for a long file has bit 1 of the `flags` field set to one. This tells the I/O System that the `ptr` structures of the fnode identify indirect blocks. The indirect blocks identify the actual data blocks that make up the file.

Each indirect block contains a number of indirect pointers, which are structures similar to the `ptr` structures. However, an indirect block can contain more than eight structures and thus can point to more than eight data blocks. In fact, an indirect block can consist of more than one volume block; however, all volume blocks of an indirect block must be contiguous.

This is the 32-byte structure of each indirect pointer, in PL/M notation:

```
DECLARE
       IND_PTR STRUCTURE(
              nblocks                 BYTE,
              blk_ptr(3)              BYTE);
```

This is the 48-byte structure of each indirect pointer, in PL/M notation:

```
DECLARE
       IND_PTR STRUCTURE(
              num_blocks              BYTE,
              blk_ptr(5)              BYTE);
```

This is the 32-byte structure in C:

```
       typedef struct {
              UINT_8                  nblocks;
              UINT_8                  blk_ptr[3];
       } IND_PTR_STRUCT;
```

This is the 48-byte structure in C:

```
typedef struct indir48_ptr_struct{
      unsigned short            num_blocks;
      unsigned char             blk_ptr[5];
} INDIR48_PTR_STRUCT;
```

Where:

`nblocks, num_blocks`
: Number of volume blocks in the data block.

`blk_ptr`
: A 24-bit volume block number of the first volume block in the data block. Volume blocks are numbered sequentially throughout the volume, starting with the block with the smallest address (block 0).

The OS determines how many indirect pointers there are in an indirect block by comparing the `nblocks` fields of the indirect pointers with the `num_blocks` field of the fnode. It assumes that the indirect block contains as many pointers as necessary for the sum of the `nblocks` fields to equal the `num_blocks` field.

Because indirect blocks can span several volume blocks, any utility that uses indirect blocks must determine if an indirect block consists of more than one volume block. To do this:

1. Use the **read** DVU command to read the volume block pointed to by the `blk_ptr` field in the fnode's `pointr` structure. `Blk_ptr` points to the beginning of a volume block containing all or the first part of an indirect block.

2. If the sum of all `nblocks` fields in the volume block is less than `num_blocks`, the indirect block continues into the next contiguous volume block. The utility must read and process the next volume block.

3. Add the `nblocks` values in the new volume block to the sum of all previous `nblocks`. When the sum of the `nblock` values equals `num_blocks` you have reached the end of the indirect block. If necessary, continue reading volume blocks and summing `nblocks` values until the sum of the `nblocks` values equals `num_blocks`. The utility may have to read several volume blocks before finding the end of the indirect block.

Figure C-3 illustrates an fnode for a long file. Decimal numbers are used in the figure for clarity.

Figure C-3. Long File Fnode

As you can see in Figure C-3, fnode 9 identifies the long file. The actual file consists of nine distinct data blocks. One `ptr` structure and an indirect block give the locations of the data blocks. The `num_blocks` field of the `ptr` structure contains the number of volume blocks pointed to by the indirect block. The `blk_ptr` field points to the first volume block of the indirect block.

In the indirect block, each `nblocks` field gives the length of an individual data block, and each `blk_ptr` field points to the first volume block of a data block.

Figure C-3 also lists the `total_blks`, `+this_size`, and `total_size` values, which are more complex than for a short file. The `total_blks` field specifies the number of volume blocks allocated to the file, which in this case is 21. Of these 21 and 20 are used for actual data storage and 1 is used for the indirect block.

The `this_size` field specifies the number of bytes of data space allocated to the file, and does not include the size of the indirect block. This size is equal to the `num_blocks` value (20) or the sum of `nblocks` values in the indirect block (2 + 1 + 2 + 3 + 2 + 3 + 3 + 2 + 2 = 20) multiplied by the volume granularity (1024) and equals 20480.

The `total_size` field specifies the number of bytes of data space that the file currently occupies (designated in Figure C-3 by the shaded areas). As you can see, the file does not occupy all the space allocated for it, so the `total_size` value (20300) is not as large as the `this_size` value.

Diskette Formats

The diskette device drivers supplied with the iRMX Basic I/O Systems can support several diskette characteristics, listed in Tables C-1, C-2, and C-32.

Table C-1. Characteristics of 5 1/4-Inch Non-SCSI Boot Diskettes

Sector Size	Density	Sectors per Track	Format	Device Size (in bytes) One-Sided 40 Tracks	One-Sided 80 Tracks	Two-Sided 40 Tracks	Two-Sided 80 Tracks
128	Single	16	Standard	81920	163840	163840	327680
256	Single	9	Standard	91904	184064	184064	368384
512	Single	4	Standard	81920	163840	163840	327680
1024	Single	2	Standard	81920	163840	163840	327680
256	Double	16	Standard	1617921	325632	325632	653312
512	Double	8	Standard	1617921	325632	325632	653312
1024	Double	4	Standard	1617921	325632	325632	653312

For compatibility with ECMA (European Computer Manufacturers Association) and ISO (International Organization for Standardization), the iRMX device drivers, when called by the **format** command, can format the beginning tracks of all 5 1/4-inch diskettes in the same way. The device drivers format track 0 of side 0 with single-density, 128-byte sectors, with an interleave factor of 1.

Table C-2. Characteristics of 5 1/4-Inch SCSI Boot and Data Diskettes

Sector Size	Density	Sectors per Track	Format	Device Size (in bytes) One-Sided 40 Tracks	One-Sided 80 Tracks	Two-Sided 40 Tracks	Two-Sided 80 Tracks
512	Double	9	Uniform	--	--	368640	--
512	Quad	15	Uniform	--	--	--	1228800

Table C-3. Characteristics of 3 1/2-Inch SCSI Boot and Data Diskettes

Sector Size	Density	Sectors per Track	Format	Device Size (in bytes) One-Sided 80 Tracks	Two-Sided 80 Tracks
512	Quad	18	Uniform	--	14745600
512	Double	9	Uniform	737280	--

The iRMX device drivers map the sectors on these beginning tracks into blocks of device granularity size so that the BIOS and the Bootstrap Loader can treat diskettes as if they contained a contiguous string of blocks, all of the same size.

When the device driver tries to combine these leftover sectors of track 0, side 1 with the first sectors of track 1, side 0, it finds that the sectors of track 1, side 0 are already of device granularity size. Therefore, since the device driver cannot access partial sectors, it is left with one block (the leftover sectors of track 0, side 1) that is less than device granularity size. When the device granularity is 512, this small block is block 19; when the device granularity is 1024, it is block 9.

If nothing is done to exclude this smaller-than-normal block from use, the device driver will treat this block as a normal block, assuming it is of device granularity size. Thus, if you try to write information to that block, the driver will attempt to write an entire device granularity block of information into a block that is much smaller, thereby losing data.

To prevent this situation, the **format** command automatically declares this smaller-than-normal block as allocated in the volume free space map when it formats the volume. This prevents the BIOS from ever writing information into this block. If you write your own formatting utility, you should also declare this block as allocated.

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Real-Time Graphics Interface D

Description

The iRMX II and III OSs contain a driver that supports the SBX 279 and 279A graphics interface modules. These modules attach to a Multibus CPU board and provide users with a graphics interface, including:

- A windowed environment
- A mouse to use in manipulating windows
- A PC-style keyboard for entering data

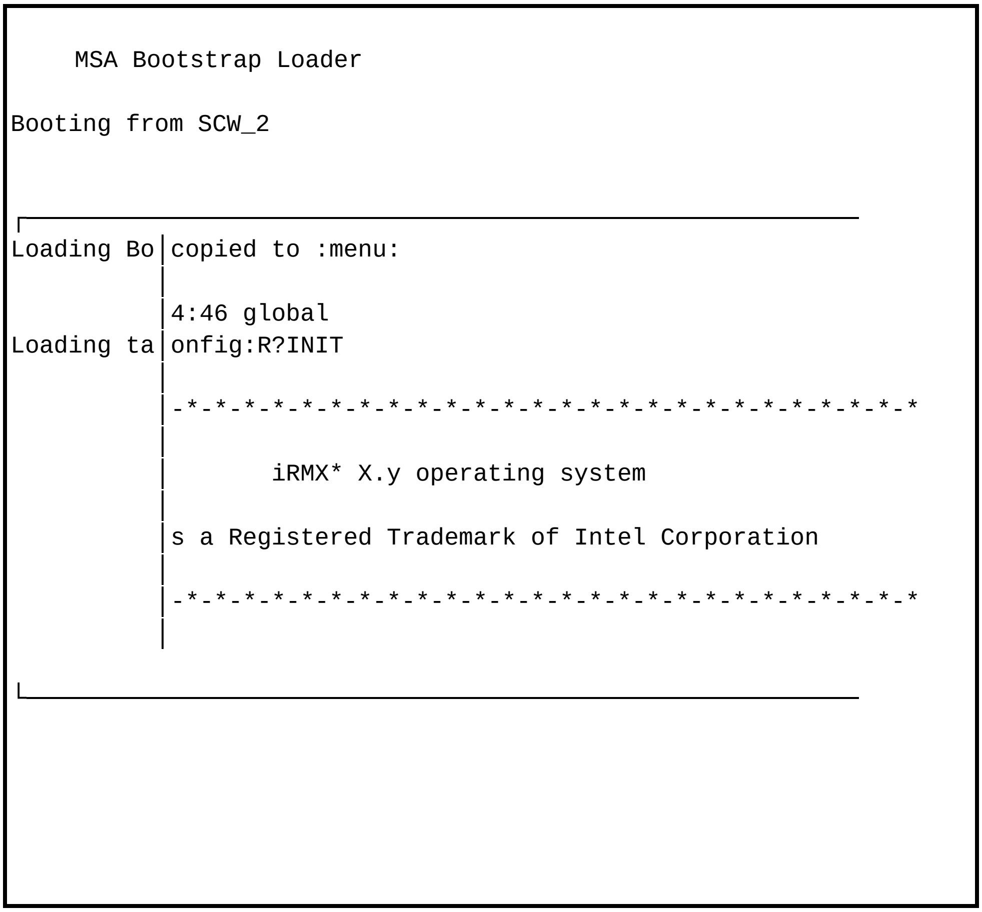
These sections describe the windows and how to manipulate them with the mouse.

Using the Windows

The windows provided by the SBX 279 or 279A board are ways of viewing many operations simultaneously on one screen. You can think of them as many terminals contained in one, with each window representing a terminal. For example, the System 520 initializes with multiple windows. For each CPU board there are at least two windows: one for the Monitor/Bootstrap loader/Debugger display and one for the CPU HI screen.

At system start-up, the windows are layered on top of each other. You can manipulate the windows with the mouse (move, resize, and relayer them) so that you can view all or some of the windows at once. In the example screen in Figure D-1, x is the OS (II for iRMX II, III for iRMX III) and y is the release level (1.0 for Release 1, 4.0 for Release 4).

Figure D-1 is a simple display showing two windows for a single CPU.



```
    MSA Bootstrap Loader

Booting from SCW_2


 ┌──────────────────────────────────────────────────────────
Loading Bo│copied to :menu:
          │
          │4:46 global
Loading ta│onfig:R?INIT
          │
          │-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*
          │
          │       iRMX* X.y operating system
          │
          │s a Registered Trademark of Intel Corporation
          │
          │-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*
          │

 └──────────────────────────────────────────────────────────
```

Figure D-1. An Example of Windows Displayed on the System 520

Using the Mouse

You can use the mouse to move, resize, and relayer the windows. All of these actions are provided in one of two pop-up menus: basic or expanded.

The basic menu exists in EPROM on the SBX 279A Multimodule before the OS is initialized. Once initialized, the OS can load the expanded menu when executing the *:config:r?init* file during the boot up procedure. The default system command file for the System 520 contains several options that are commented out. Activate the option that is appropriate. The expanded menu offers more options and provides a faster method of selecting windows: just point at the desired window and press any of the mouse buttons.

To select an option from either pop-up menu, do this:

1. Move the mouse so the pointer is outside any window.
2. Press and hold any one of the mouse buttons; the menu appears on the screen.
3. Move the mouse up or down the menu to select an option. Each option is highlighted as the pointer passes over it.
4. To select an option, release the mouse button when the option is highlighted. The menu disappears and the pointer changes to an icon. The icons are shown to the right of the menu in figures D-2 and D-3.

The mouse cannot be used to select anything inside a window (a file, for instance).

With the expanded menu **map window** function, you can also use the mouse to associate an <Alt>-Function key combination with a specific window. This is especially helpful when using numerous windows; for example, when there are multiple CPU boards in a Multibus II system.

To load the expanded menu as part of your application, enter:

```
ad g279_0 as :vdi: physical
copy :config:<menu-name> to :vdi:
dd :vdi:
```

Where `<menu-name>` is one of these; both menus are initially installed in the *:config:default* directory:

`menu.279`	For the SBX 279 board
`menu.279A`	For the SBX 279A board

If these commands are executed in a submit file, you cannot detach the *:vdi:* logical name until about 2 seconds after copying the menu, due to buffer flushing in the BIOS. If the copying has not completed before the device is detached, the menu is lost and the system must be restarted. To accomplish the 2 second delay, use the **pause** command or a status command such as **date** before the **detach** command.

Basic Menu

This section explains the selections provided by the basic menu, which is shown in Figure D-2. The icon for each menu selection is shown to the right of the menu item. This menu appears before the iRMX III OS is installed or initialized. Once installed, the OS invokes an expanded menu, which is described later.

Figure D-2. Basic Menu Selections

The meaning of the basic menu selections is:

Pop This causes the selected window to appear on top of all other windows. The keyboard might not be attached to the window that has been popped. Use the **Keyboard Focus** selection to direct keyboard input to the popped window.

1. Select **Pop** from the menu with the mouse. The pointer changes to an up arrow.
2. Place the arrow within the desired window and press any of the mouse buttons.
3. The selected window is displayed on top of all other windows.

Push This causes the selected window to be placed behind all other windows.

1. Select **Push** from the menu with the mouse. The pointer changes to a down arrow.
2. Place the arrow within the desired window and press any of the mouse buttons.
3. The selected window is placed behind all other windows.

Pan This moves the contents of a window within the window. This selection is useful for viewing the contents of a window that has been reduced in size.

1. Select **Pan** from the menu with the mouse. The pointer changes to the icon shown in Figure D-2.
2. Place the icon within the desired window. Press and hold down any of the mouse buttons.
3. Moving the mouse moves the contents of the window.
4. Release the mouse button when the desired contents are displayed.

Move This moves a window around the screen.

1. Select **Move** from the menu with the mouse. The pointer changes to the icon shown in Figure D-2.
2. Position the icon within the desired window. Press and hold down any of the mouse buttons.
3. Moving the mouse moves the entire window.
4. Release the mouse button when the window is in the desired location.

Resize This selection changes the size of a window.

1. Select **Resize** from the menu with the mouse. The pointer changes to the icon shown in Figure D-2.
2. Position the icon within the desired window and near one of the four corners of the window. The selected corner will be the part of the window that moves. Press and hold down any of the mouse buttons.
3. Move the mouse to shrink or enlarge the window.
4. Release the mouse button when the window is at the desired size. Window contents are not rescaled when the window is resized. The maximum size of a window is either the size of the bitmap in which it is drawn or the size of the screen.

Keyboard Focus

This selection directs keyboard input to a window.

1. Select **Keyboard Focus** from the menu with the mouse. The pointer changes to a box icon.
2. Position the icon within the desired window and press any of the mouse buttons.
3. Keyboard input is now directed to the selected window.

Pop/Focus

This causes the selected window to appear on top of all the other windows, with keyboard input directed to the selected window. This is the same as using **Pop** followed by **Keyboard Focus**.

1. Select **Pop/Focus** from the menu with the mouse. The pointer changes to the icon shown in Figure D-3.
2. Position the icon within the desired window and press any of the mouse buttons.
3. The selected window is displayed on top of all other windows and keyboard input is directed to it.

Pop/Focus/Resize

This causes the selected window to appear on top of the other windows with keyboard input directed to it, and expands the window to full width and approximately three-quarter height.

1. Select **Pop/Focus/Resize** from the menu with the mouse. The pointer changes to the icon shown in Figure D-3.
2. Position the icon within the desired window and press any of the mouse buttons.
3. The selected window is displayed on top of other windows, expanded in size, with keyboard input directed to it.

Exit Use this selection to leave the menu list without affecting the windows.

Expanded Menu

This section explains the selections provided by the expanded menu, which is shown in Figure D-3. The icon for each menu selection is shown to the right of that menu item. This menu is provided by the OS on the System 520.

Figure D-3. Expanded Menu Selections

The meaning of the expanded menu selections is:

Pan This moves the contents of a window within the window. This selection is useful for viewing the contents of a window that has been reduced in size.

1. Select **Pan** from the menu with the mouse. The pointer changes to the icon shown in Figure D-3.
2. Place the icon within the desired window. Press and hold down any of the mouse buttons.
3. Moving the mouse moves the contents of the window.
4. Release the mouse button when the desired contents are displayed.

Attach Keyboard
This selection directs keyboard input to a window.

1. Select **Attach Keyboard** from the menu with the mouse. The pointer changes to a box icon.
2. Position the icon within the desired window and press any of the mouse buttons.
3. Keyboard input is now directed to the selected window.

Pop to Foreground
This causes the selected window to appear on top of all other windows. The keyboard might not be attached to the window that has been popped. Use the **Attach Keyboard** selection to direct keyboard input to the popped window.

1. Select **Pop to Foreground** from the menu with the mouse. The pointer changes to an up arrow.
2. Place the arrow within the desired window and press any of the mouse buttons.
3. The selected window is displayed on top of all other windows.

Push to Background
This causes the selected window to be placed behind all other windows.

1. Select **Push to Background** from the menu with the mouse. The pointer changes to a down arrow.
2. Place the arrow within the desired window and press any of the mouse buttons.
3. The selected window is placed behind all other windows.

Pop and Set Focus

This causes the selected window to appear on top of all other windows, with keyboard input directed to the selected window.

1. Select **Pop and Set Focus** from the menu with the mouse. The pointer changes to a combination box and up arrow icon.
2. Place the icon within the desired window and press any of the mouse buttons.
3. The selected window is displayed on top of all other windows and keyboard input is directed to it.

Move Window

This moves a window around the screen.

1. Select **Move Window** from the menu with the mouse. The pointer changes to the icon shown in Figure D-3.
2. Position the icon within the desired window. Press and hold down any of the mouse buttons.
3. Move the mouse to move the entire window.
4. Release the mouse button when the window is in the desired location.

Resize Window

This selection changes the size of a window.

1. Select **Resize Window** from the menu with the mouse.
2. Position the icon within the desired window and near one of the four corners of the window. The selected corner will be the part of the window that moves. Press and hold down any of the mouse buttons.
3. Move the mouse to shrink or enlarge the window.
4. Release the mouse button when the window is at the desired size. Window contents are not rescaled when the window is resized. The maximum size of a window is either the size of the bitmap in which it is drawn or the size of the screen.

Expand Window

This causes the selected window to appear on top of the other windows with keyboard input directed to it, and expands the window to full width and approximately three-quarter height.

1. Select **Expand Window** from the menu with the mouse.
2. Position the icon within the desired window and press any of the mouse buttons.
3. The selected window is displayed on top of other windows, expanded in size, with keyboard input directed to it.

Reduce Window

This selection allows you to shrink the size of a window quickly and move it out of the way of other windows.

1. Select **Reduce Window** from the menu with the mouse.
2. Position the icon within the desired window next to one of the four corners. Press and hold down any one of the mouse buttons.
3. Move the mouse; the window shrinks rapidly.
4. Release the mouse when the window reaches the desired size and position on the screen.

Map Window

This selection assigns an <Alt>-Function key combination (F1-F10) to each window. When the <Alt>-Function key combination is pressed, the corresponding window is displayed on top of other windows and keyboard input is directed to that window.

1. Select **Map Window** from the menu with the mouse.
2. Position the icon within the desired window and press any one of the mouse buttons.
3. On the keyboard, hold down the <Alt> key and press the function key you want assigned to the window.
4. To use the function keys to select a window, hold down the <Alt> key and press the corresponding function key. The window assigned to that key is displayed on top of other windows and keyboard input is directed to it.

See also: *SBX 279A Display Subsystem Hardware Reference Manual* and *Programmer's Guide to the Real-Time Graphics Interface*

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Supplied Device Drivers and Physical Device Names E

Supplied Device Drivers

Preconfigured Drivers, DOSRMX and iRMX For PCs

These are the device drivers that are built into DOSRMX and iRMX for PCs:

- ROM BIOS-based Hard Disk Driver
- ROM BIOS-based Diskette Driver
- Byte Bucket Driver
- COM1 driver and COM2 driver

If you are using an iRMX driver to attach a flexible disk or hard disk partition, don't attempt to attach it using the EDOS file driver.

ROM BIOS-based Hard Disk Driver

The ROM BIOS-based Hard Disk Driver is the link between iRMX and one or two IBM PC-AT-compatible hard disk controllers. This is a random access driver. The driver supports one to four partitions on a single hard disk. Each partition is accessed as a logical device. The partitions can support different file structures, allowing multiple operating systems to exist on a single drive. The Physical File driver can access all partitions created on a hard disk; the Named File driver can access only iRMX partitions.

A generic unit is associated with each physical drive. This unit automatically maps to the first iRMX partition. The unit is part of the Automatic Device Characteristics Recognition (ADCR) feature of the OS.

Each disk drive can support up to six device-units, as shown in Table E-1.

Table E-1. Hard Disk Partition Names

DUIB Name	Description
C_RMX	Generic name for C: drive
C_RMX0	DUIB for entire drive (all partitions)
C_RMX1	Partition 1
C_RMX2	Partition 2
C_RMX3	Partition 3
C_RMX4	Partition 4
D_RMX	Generic DUIB name for D: drive
D_RMX0	DUIB for entire drive
D_RMX1	Partition 1
D_RMX2	Partition 2
D_RMX3	Partition 3
D_RMX4	Partition 4

ROM BIOS-based Diskette Driver

The ROM BIOS-based diskette driver is the link between `DOSRMX` and one IBM PC-AT-compatible diskette controller. This random-access driver supports the disk controller as one device with two device-units. Table E-2 lists the device names available for the diskette drives.

Note
You must use the drivers in Table E-2 for iRMX For PCs. Do not use `a_dos` and `b_dos`.

Table E-2. Diskette Driver Device Names

Device Name	Disk Capacity	Drive 0 (Unit 0) Disk Format	Drive Capacity
A	360 Kbytes	Uniform	360 Kbytes 48 TPI
AH	1.2 Mbytes	Uniform	1.2 Mbytes 96 TPI
AM	720 Kbytes	Uniform	135 TPI
AMH	1.44 Mbytes	Uniform	135 TPI
AMO	2.88 Mbytes	Uniform	135 TPI
Device Name	**Disk Capacity**	**Drive 1 (Unit 1) Disk Format**	**Drive Capacity**
B	360 Kbytes	Uniform	360 Kbytes 48 TPI
BH	1.2 Mbytes	Uniform	1.2 Mbytes 96 TPI
BM	720 Kbytes	Uniform	135 TPI
BMH	1.44 Mbytes	Uniform	135 TPI
BMO	2.88 Mbytes	Uniform	135 TPI

Byte Bucket Driver

This driver provides a pseudo device interface for operations that don't require device activity. It is used for discarding output (byte bucket) and for direct communication between tasks (stream files).

Driver characteristics are

- Returns EOF for read operations and write-completed for write operations
- Accepts all operations except special and seek, in the case of stream files, but does no operations for them

See also: Stream files, *System Concepts*

COM1 and COM2 Driver

See also: *comdrv*, *System Configuration and Administration*, for a description of the COM1 and COM2 drivers and how to set the I/O addresses and interrupts to use them

Loadable Device Drivers

You add loadable drivers to the OS dynamically using the **sysload** command instead of building the driver into the OS with the ICU.

See also: Loadable Jobs and Device Drivers, *System Configuration and Administration*, for descriptions of each loadable driver

The OS includes source code for loadable driver initialization front-ends in these directories: */rmx386/demo/c/ldd* for C and */rmx386/demo/plm/ldd* for PL/M. The default drivers are found in */rmx386/drivers*. Use the soource code examples when writing your own loadable drivers.

See also: Making a Driver Loadable, *Driver Programming Concepts*
loadable device drivers, *System Configuration and Administration*

Loadable Device Driver Support Files

The OS provides a number of include files, for both C and PL/M, and a library that supports loadable drivers. The files contain literal and data structure definitions, macros, and utilities required for custom, random access, and terminal drivers. These files are described below:

lddinfo.lit	Contains the PL/M literal declarations that define the data structures used by loadable drivers.
lddinfo.h	Contains the C literal declarations that define the data structures used by loadable drivers.
lddinfo.mac	Contains ASM literal declarations and macros that are used to produce loadable device driver configuration files.
lddupc.ext	Contains PL/M external declarations for a number of driver utilities found in the loadable device driver library *ldd.lib*.
lddupc.h	Contains C external declarations for a number of driver utility procedures found in the loadable device driver library *ldd.lib*. The procedures are described in later chapters.
ldd.lib	Contains the linkable utility procedure and driver modules provided in loadable and reconfigurable form. The library is found in the */rmx386/lib* directory along with the standard iRMX interface libraries.

ICU-configurable Drivers For iRMX III Systems

Table E-3 lists the ICU-configurable random access, terminal, and custom drivers.

See also: ICU help screens for complete reference and usage information

Table E-3. Supplied ICU-configurable Device Drivers

Type	Device Driver
Random Access or Common	Mass Storage Controller (MSC) driver * Line printer driver for SBX 350 Line printer driver for x86/12 PCI driver ** SBC 208 diskette driver SBC 220 SMD driver
Terminal	Terminal Communications Controller (TCC) driver ATCS Driver *** 8251A terminal driver 8274 terminal driver 82530 terminal driver
Custom	Byte bucket driver RAM-disk driver

* Supports the SBC 214, SBC 215G, and SBC 221 controllers, and the SBX 217C controller when mounted on the SBC 215G board

** Supports the SBC 386/258 and 386/258D, 386/12S, 486/12S, 486/133SE, 486/166SE, SBCP5xxx boards, and PC SCSI controllers

*** The SBC 186/410 cannot pass error codes when the device cannot be attached; subsequent read/write operations will fail

The PCI driver includes generic SCSI DUIBs, `gscw_N` (for 1024-byte granularity) and `gscw5_N` (for 512-byte granularity) where `N` is the SCSI target ID of the device. The generic DUIBs allow you to format new SCSI hard disk drives, as well as attach, read and write to them, without creating a specific DUIB for each SCSI hard disk drive. You must configure the `rq_pci_a` parameter in the BPS file when using the `gscw_N` DUIBs.

See also: Table E-10 of this appendix
Partitioning information, Appendix F
BPS parameters, *MSA for the iRMX Operating System*

The OS reads the disk geometry and defect management information from the hard disk drive and uses its defaults when you use the **format** command.

See also: UPCI PCI Driver Unit Information and IPCI PCI Driver Device-unit Information ICU help screens, particularly the GRA parameter

The PCI driver also includes SCSI DUIB, `scw_N` where *N* is the device-unit number of the device. This DUIBs allow you to attach, read and write iRMX preformatted SCSI hard disk drives.

See also: Table E-10 of this appendix

Physical Device Names

The tables in this section list the physical device names for disk drives, tape drives, and terminals, as supplied by default drivers in the operating system. You can make other device names available by loading device drivers. Physical names identify a particular Device Unit Information Block (DUIB) that specifies the physical characteristics of the device.

See also: Loadable device drivers, *System Configuration and Administration*
physname command, Chapter 2

You use the physical names for disk and tape devices in the **attachdevice** and **mirror** commands. The physical name you use to attach a device is also used by the **format** and **backup** commands to properly format the device. Therefore, it is important to use the name that specifically describes the device characteristics, or use the `gscw_N` DUIBs provided. The non-generic DUIBs listed in the tables specify product names. If a device by a different manufacturer corresponds to the physical characteristics of a device listed in the table (number of cylinders, heads, etc.), you may use the physical name in the table.

If a device is already formatted and you are attaching it to read or write files (but not to back up files), you may attach it under a generic name (`scw_N`) listed in the appropriate table.

You use the physical names for terminals in the **attachdevice**, **connect**, **lock**, and **unlock** commands. You also specify terminal physical names in the *:config:terminals* file.

See also: **attachdevice**, **mirror**, **format**, **backup**, **connect**, **lock**, and **unlock** commands, Chapter 2

DOSRMX and iRMX for PCs Systems

The following tables list the default device names for `DOSRMX` and iRMX for PCs.

Table E-4. `DOSRMX`/PCs Default Device Names

Device Names Drive 1	Drive 2	Device Type	Density	Bytes/ Sector	Tracks/ Inch
iRMX-FORMAT DISKETTE DRIVES					
a	b	5.25 inch uniform format, 360 Kbyte	Double	512	48
ah	bh	5.25 inch uniform format, 1.2 Mbyte	High	512	96
am	bm	3.5 inch, 7.2 Mbyte	Double	512	135
amh	bmh	3.5 inch, 1.44 Mbyte	High	512	135
amo	bmo	3.5 inch, 2.88 Mbyte	High	512	135
iRMX-FORMAT HARD DISK DRIVES					
c_rmx	d_rmx	First iRMX partition on the drive			
c_rmx0	d_rmx0	The whole physical drive			
c_rmx1	d_rmx1	First partition on the drive, including DOS or other partitions			
c_rmx2	d_rmx2	Second partition on the drive, including DOS or other partitions			
c_rmx3	d_rmx3	Third partition on the drive, including DOS or other partitions			
c_rmx4	d_rmx4	Fourth partition on the drive, including DOS or other partitions			
Device Names		**Device Type**			
DOS-FORMAT LOGICAL DRIVES (DOSRMX only)					
a_dos ...	b_dos	Correspond to DOS drives A: through Z:, using the EDOS filedriver (if those drives are available under DOS)			
c_dos ...	z_dos	Correspond to DOS drives A: through Z:, using the DOS filedriver (if those drives are available under DOS)			
OTHER DEVICES					
com1	com2	Same as DOS COM1 and COM2			
lpt1* ...	lpt3**	Same as DOS LPT1 to LPT3			
d_cons*		DOS console device (CON)			

* Installed by loadable jobs or device drivers

Table E-5. PC Terminal Device Names

Controller	Device Names	Unit
Serial Port	com1	0
	com2	0
Console	d_cons	0

Note

The PCI driver makes available a set of DUIBs including generic DUIBS for SCSI devices and for partitioned SCSI devices. Partitioned SCSI hard disk drives have different DUIBs than non-partitioned drives. Refer to Appendix F for information on how partitions are specified.

See also: Tables of DUIBs in *pcidrv, System Configuration and Administration*

iRMX III Systems

The tables in this section list device names for iRMX III systems using various controller boards.

iRMX III PC Systems

The tables in this section list device names available on standard PC platforms running the iRMX III OS with no dependence on the ROM BIOS.

Table E-6. Device names for PC systems

Device Names				Bytes/	Tracks/
Drive 1	**Drive 2**	**Device Type**	**Density**	**Sector**	**Inch**
iRMX-FORMAT DISKETTE DRIVES					
a	b	3.5 inch, 1.44 Mbyte	High	512	135
OTHER DEVICES					
com1	com2	Same as DOS COM1 and COM2			
con		DOS console device (CON)			

Table E-7. Device Names for IDE Controllers

Device Names	IDE Controller	Master/ Slave	Partition
ATA-COMPATIBLE HARD DRIVES			
hda0	0	Master	whole disk
hda1	0	Master	1
hda2	0	Master	2
hda3	0	Master	3
hda4	0	Master	4
hda	0	Master	active
hdb…	0	Slave	as above
hdc…	1	Master	as above
hdd…	1	Slave	as above
ATAPI CD-ROM DRIVES			
cda	0	Master	(n/a)
cdb	0	Slave	(n/a)
cdc	1	Master	(n/a)
cdd	1	Slave	(n/a)

iRMX III Multibus I and Multibus II Systems

The tables in this section list device names available on Multibus I and Multibus II systems running the iRMX III OS.

Table E-8. Device Names for SBC 214, 221, and 215G/217C/218A Controllers

Device Names	Device Type	Unit Number	Sides	Density	Bytes/ Sector	Tracks/ Inch
5.25-INCH DISKETTE DRIVES						
wqf0*	Teac 55GFR	8	2	High	512	96
wqf1*	Teac 55GFR	9	2	High	512	96
wdf0*	Shugart 460	9	2	Double	512	48
wdf1*	Shugart 460	9	2	Double	512	48
wdos0*	Shugart 460	9	2	Double	512	48
wmf0	Shugart 450	8	2	Double	512	48
wmf1	Shugart 450	9	2	Double	512	48
wmfdy0	Shugart 460	8	2	Double	512	96
wmfdy1	Shugart 460	9	2	Double	512	96

* Uniform granularity, other diskettes use iRMX standard granularity

continued

Table E-8. Device Names for SBC 214, 221, and 215G/217C/218A Controllers (continued)

Device Names	Device Type	Unit Number	Bytes/Sector
HARD DISK DRIVES			
w0	generic drive	0	1024
w1	generic drive	1	1024
cm0	CMI 5412	0	1024
cm1	CMI 5412	1	1024
cmb0	CMI 5419 and Fujitsu M2235	0	1024
cmb1	CMI 5419 and Fujitsu M2235	1	1024
mma0	Maxtor XT-1140	0	1024
mma1	Maxtor XT-1140	1	1024
mmb0	Maxtor XT-1085	0	1024
mmb1	Maxtor XT-1085	1	1024
mmc0	Maxtor XT-4170E	0	1024
mmc1	Maxtor XT-4170E	1	1024
mmd0	Maxtor XT-4380E	0	1024
mmd1	Maxtor XT-4380E	1	1024
mme0	Maxtor XT-8760E	0	1024
mme1	Maxtor XT-8760E	1	1024
qma0	Quantum Q540	0	1024
qma1	Quantum Q540	1	1024
sma0	Seagate ST-225	0	1024
sma1	Seagate ST-225	1	1024
tma0	Toshiba MK56FB	0	1024
tma1	Toshiba MK56FB	0	1024
5.25-INCH CARTRIDGE TAPE DRIVES			
wta0	Archive	12	N/A
ADDITIONAL DEVICE NAMES FOR iSBC 221S CONTROLLER ONLY			
GW500M_0	Generic 500 Mbyte drive	0	512
GW500M_1	Generic 500 Mbyte drive	1	512
GW700M_0	Generic 700 Mbyte drive	0	512
GW700M_1	Generic 700 Mbyte drive	1	512
GW1G_0	Generic 1 Gbyte drive	0	512
GW1G_1	Generic 1 Gbyte drive	1	512
GW2G_0	Generic 2 Gbyte drive	0	512
GW2G_1	Generic 2 Gbyte drive	1	512
GW4G_0	Generic 4 Gbyte drive	0	512
GW4G_1	Generic 4 Gbyte drive	1	512

Table E-9. Device Names for SBC 386/12S and 486/12S SCSI Controllers

Device Names	Example Device Type	SCSI Adapter	SCSI-ID Number	Density	Bytes/ Sector
5.25-INCH DISKETTE DRIVES					
sqf0*	Teac 55GFR	NCR ADP-20	0	high	512
sqf1*	Teac 55GFR	NCR ADP-20	1	high	512
sdf0*	Teac 55GFR	NCR ADP-20	0	double	512
sdf1*	Teac 55GFR	NCR ADP-20	1	double	512
smf0**	Teac 55GFR	NCR ADP-20	0	double	512
smf1**	Teac 55GFR	NCR ADP-20	1	double	512
t55_0*	Teac 55GFR***	N/A	0	high	512
t55_1*	Teac 55GFR***	N/A	1	high	512
t55D_0*	Teac 55GFR***	N/A	0	double	512
t55D_1*	Teac 55GFR***	N/A	1	double	512
Device Names	**Device Type**		**SCSI-ID (N)**		**Bytes/Sector**
5.25-INCH CARTRIDGE TAPE DRIVES					
sta0	Archive 2125S		6		N/A
OPTICAL DRIVES					
OPT 1G1G_N	Maxoptix Tahiti II		0, 1, 2, 3		1024
OPT 1G1G5_N	Maxoptix Tahiti II		0, 1, 2, 3		512
OPT 650M_N	Maxoptix Tahiti II		0, 1, 2, 3		1024
OPT 650M5_N	Maxoptix Tahiti II		0, 1, 2, 3		512

* Uniform granularity

** Using the SCSI interface, `smf0/1` diskettes that have iRMX Standard granularity can be read only if they are formatted on a Multibus I system with the parameters:
format :F:disk ms=0 ext=41. They cannot be written to or formatted on a SCSI device.

*** The SCSI adapter is part of this drive. No separate SCSI adapter board (for example, an NCR ADP-20) is required.

See also: Table E-10 for Hard Drive names
PCI Generic SCSI DUIB, *Driver Programming Concepts*
MSA for the iRMX Operating System Manual

Table E-10. Device Names for SBC 386/258(D) and 486/133SE Controllers

Device Names	Example Device Type	SCSI Adapter	SCSI-ID Number	Density	Bytes/ Sector
5.25-INCH DISKETTE DRIVES					
wqf0*	Teac 55GFR	NCR ADP-20	0	high	512
wqf1*	Teac 55GFR	NCR ADP-20	1	high	512
wdf0*	Teac 55GFR	NCR ADP-20	0	double	512
wdf1*	Teac 55GFR	NCR ADP-20	1	double	512
wmf0**	Teac 55GFR	NCR ADP-20	0	double	512
wmf1**	Teac 55GFR	NCR ADP-20	1	double	512
t55_0*	Teac 55GFR***	N/A	0	high	512
t55_1*	Teac 55GFR***	N/A	1	high	512
t55D_0*	Teac 55GFR***	N/A	0	double	512
t55D_0*	Teac 55GFR***	N/A	1	double	512
3.5-INCH DISKETTE DRIVES					
t235_0*	FD-235HF***	N/A	0	high	512
t235_1*	FD-235HF***	N/A	1	high	512

Device Names	Device Type	SCSI-ID (N)	Bytes/Sector
OPTICAL DRIVES			
OPT 1G1G_N	Maxoptix Tahiti II	0, 1, 2, 3	1024
OPT 1G1G5_N	Maxoptix Tahiti II	0, 1, 2, 3	512
OPT 650M_N	Maxoptix Tahiti II	0, 1, 2, 3	1024
OPT 650M5_N	Maxoptix Tahiti II	0, 1, 2, 3	512

* Uniform granularity

continued

** Using the SCSI interface, `wmf0/1` diskettes that have iRMX Standard granularity can be read only if they are formatted on a Multibus I system with the parameters:
format :F:disk ms=0 ext=41. They cannot be written to or formatted on a SCSI device.

*** The SCSI adapter is part of this drive. No separate SCSI adapter board (for example, an NCR ADP-20) is required.

Note

The DUIBs `wmf0` and `wmf1`, which refer to standard format iNDX-compatible diskettes, are only present for backward compatibility and are not recommended. Their use is strictly READ-ONLY.

Table E-10. Device Names for SBC 386/258(D) and 486/133SE Controllers (continued)

Device Names		Device Type	SCSI-ID (N)	Bytes/Sector
HARD DISK DRIVES				
scw_N*		Generic SCSI	2, 3	1024
gscw5_N		Generic SCSI	2, 3	512
gscw_N		Generic SCSI	2, 3	1024
gscw5_NMxEy		Generic Partitioned SCSI	2, 3	512
m4170_N		Maxtor XT-4170S	2, 3	1024
m4380_N		Maxtor XT-4380S	2, 3	1024
m8380_N		Maxtor XT-8380S	2, 3	1024
m8760_N		Maxtor XT-8760S	2, 3	1024
CARTRIDGE TAPE DRIVES				
wta0	wtab0	Tape drive	6	N/A
CD-ROM DRIVES				
cd0		CDROM drive	5	2048
cd1		CDROM drive	6	2048

* This DUIB can be used to access SCSI hard drives that have been formatted with the iRMX **format** command, without creating a specific DUIB for each type of disk.

See also: PCI Generic SCSI DUIB, *Driver Programming Concepts*

Note

Partitioned SCSI hard disk drives have different DUIBs than non-partitioned drives. Refer to Appendix F for information on how partitions are specified.

Table E-11 lists standard physical device names of terminals. Where a board number appears, the ICU definition file supports multiple instances of the controller board.

Table E-11. Multibus I Terminal Device Names

Controller	CPU Boards	Device Names	Unit	
8251A	SBC 386/2x/3x	t0	0	
8247	SBC 386/12(S) SBC 486/12(S)	t1	0	
SBC 544A	SBC 386/12(S) SBC 486/12(S)	t3 t4 t5	1 2 3	
SBC 188/56	SBC 386/12(S) SBC 486/12(S) SBC 386/2X/3X			
SBC 548	SBC 386/12(S) SBC 486/12(S)			
Controller	**CPU Boards**	**Device Names**	**Unit**	**Board**
SBC 547	SBC 386/2X/3X	t547_0 ... t547_7	0-7	1
		t547_8 ... t547_1	0-7	2
		t547_16 ... t547_23	0-7	3

Table E-12 lists standard physical device names of Multibus II terminals. ATCS devices refer to devices defined by the Asynchronous Terminal Controller Server.

See also: ATCS driver, *ICU User's Guide and Quick Reference*
atcsdrv, *System Configuration and Administration*

Table E-12. Multibus II Terminal Device Names

Controller	**CPU Board**	**Device Name**	**Unit**
82530	SBC 386/100 (with SBX 354)	t82530_0	0
	SBC 386/116 (with SBX 354)	t82530_1	1
	SBC 386/120 (with SBX 354)		
	SBC 386/133		
	SBC 386/258D		
	SBC 486/125		
	SBC 486/150		
	SBC 486/133SE		
	SBC 486/166SE		
82091AA	P5090/120ISE	COM1	0
	SBC P5090-	COM2	0

ATCS DEVICE NAMES: All Multibus II definition files that include the ATCS device driver provide the same ATCS device names

Controller Boards:	**CPU Boards:**
SBC 186/410 or 186/450	Any Multibus II CPU or I/O Server Board
MIXn86/020(A) with MIX/450 modules	hosting the ATCS/450 Server Job
MPI 450	

Board ID	**Device Names**			**Unit**	**Instance**
186/410	t_atcs_a0	...	t_atcs_a11	0-11	1
186/450	t_atcs_b0	...	t_atcs_b11	0-11	1
MIXn86/020(A) (with MIX/450 modules)	t_atcs_c0	...	t_atcs_c35	0-35	1
486/125 (used for any CPU board)	t_atcs_d0	...	t_atcs_d35	0-35	1
486/133SE	atcs_con_0			0	1
(used for any I/O server board)	t279_0	...	t279_4	0-4	1

Table E-13 lists suggested physical device names for iRMX III systems using other controller boards.

Table E-13. Suggested Physical Device Names for Other Devices

Device Names	Device Type	Unit Number	Sides	Density	Bytes/ Sector	Tracks/ Inch
8-INCH DISKETTE DRIVES CONTROLLED BY THE SBC 208 BOARD						
af0	Shugart SA800	0	1	Single	128	77
af1	Shugart SA800	1	1	Single	128	77
afd0	Shugart SA800	0	1	Double	256	77
afd1	Shugart SA800	1	1	Double	256	77
afdd0	Shugart SA850/SA851	0	2	Double	256	77
afdd1	Shugart SA850/SA851	1	2	Double	256	77
afdx0	Shugart SA850/SA851	0	2	Double	1024	77
afdx1	Shugart SA850/SA851	1	2	Double	1024	77
5.25-INCH DISKETTE DRIVES CONTROLLED BY THE SBC 208 BOARD						
amf0	Shugart 450	0	2	Double	512	48
amf1	Shugart 450	1	2	Double	512	48
amfdy0	Shugart 460	0	2	Double	512	96
amfdy1	Shugart 460	1	2	Double	512	96

continued

Table E-13. Suggested Physical Device Names For Other Devices (continued)

Device Names	Device Type	Unit Number	Bytes/Sector
HARD DISK DRIVES CONTROLLED BY THE SBC 186/224A BOARD			
w0	generic	0	1024
w1	generic	1	1024
cm0	CMI 5412	0	1024
cm1	CMI 5412	1	1024
cmb0	CMI 5419 and Fujitsu M2235	0	1024
cmb1	CMI 5419 and Fujitsu M2235	1	1024
qma0	Quantum Q540	0	1024
qma1	Quantum Q540	1	1024
mma0	Maxtor XT-1140	0	1024
mma1	Maxtor XT-1140	1	1024
mmb0	Maxtor XT-1085	0	1024
mmb1	Maxtor XT-1085	1	1024
5.25-INCH CARTRIDGE TAPE DRIVES Controlled by the SBC 186/224A Board			
wta0	QIC-02	12	N/A
STORAGE MODULE DISK DRIVES (SMD) Controlled by the SBC 220 Board			
smd0		0	1024
smd1		1	1024

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Partitioning PCI Hard Disk Drives F

This appendix describes how you can use the iRMX OS to configure partitions on a SCSI hard disk managed by the iRMX PCI (peripheral controller interface) driver. The typical use of partitions in the iRMX OS is to provide multiple system devices (*:sd:*) on a single hard disk in a Multibus II system. A file server board runs the PCI server and controls the hard disk. Diskless boards in the system that boot dependently each use a separate partition as the *:sd:* device.

See also: The ICU definition files *p90scpp.bck* and *433scpp.bck* for examples of DUIBs on partitioned devices

To partition a hard disk, you first attach the full drive with an **attachdevice** command and perform a low-level format with the iRMX **format** command. Then partition the drive with the **rdisk** command. After partitioning, you attach each partition with the appropriate DUIB name for that partition, then format each partition to install the appropriate file system. For example, you could install an iRMX file system on one partition and DOS on another.

The Partition Table

The **rdisk** utility sets up a partition table compatible with DOS 3.3 and later, which supports a linked list of partitions within an Extended Partition table entry. An Extended Partition entry is not a partition itself, but it lets you add logical drives, each of which is simply another partition on the hard disk Because DOS uses alphabetic drive letters, it is limited to 24 logical devices (C-Z) on a hard disk. However, because the mechanism is a linked list there is no inherent limit on the number of partitions. The number of partitions under the iRMX OS is limited only by the amount you want to subdivide your hard disk.

The partition table starts at byte 1BEH in the Master Partition Boot sector located in the first physical sector of the hard disk drive. There are four 16-byte entries in the partition table. Each entry describes the physical location of the partition on the hard disk drive, the size of the partition, and the type of operating system. DOS can use only two of these entries: one primary partition and one Extended partition (which can hold multiple logical drives).

Figure F-1 is an example of a partition table that has both DOS and iRMX partitions. The first two entries indicate the DOS primary partition and DOS extended partition. The extended partition is the beginning of a list pointing to two additional DOS partitions. From this partition table, DOS finds three logical DOS drives: D:, E:, and F: (assuming that this is not a disk drive from which DOS boots, which would be drive C:). The DOS primary partition is drive d: and the two logical drives in the Extended Partition are drives E: and F:.

Entries 3 and 4 in the partition table are an iRMX primary partition and an iRMX Extended Partition, which contains two logical drives The iRMX OS is not limited to one partition of each type. For example, you could have two iRMX primary partitions and two iRMX extended partitions. Or you could have up to three iRMX extended partitions. Entry 1 of the partition table must be a primary partition, not an extended partition. There is no inherent limit on the number of logical drives you can create within an iRMX extended partition.

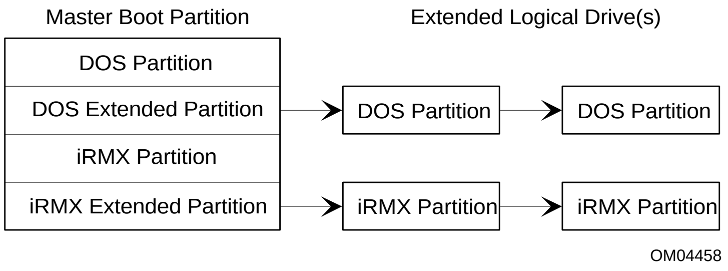

Figure F-1. Partition Table With iRMX and DOS Partitions

Specifying iRMX Partitions

A special DUIB name supports partitioned SCSI hard disk drives, `gscw5_`*`NM`*`x`*`E`*`y`. This name is formed by adding a Master Boot Partition (M) number and Extended Logical Drive (E) number to the generic SCSI disk drive DUIB. In this DUIB name, substitute SCSI ID 2 or 3 for *N*. The M and E are part of the name. For *x* and *y*, substitute:

x	The number of the Master Boot Partition, in the range 1-4.
y	The decimal number of the Extended Logical Drive. Only Master Boot partitions 2-4 can have Extended Logical Drives.

Example DUIB Name

The PCI DUIB `gscw5_2` specifies a generic SCSI hard disk drive with 512-byte granularity and a SCSI ID of 2. Using the example of Figure F-1, the DUIB `gscw5_2M3` describes the first iRMX partition. The DUIB `gscw5_2M4E2` specifies the second Extended Logical Drive of the iRMX extended partition.

How to Use PCI Partitioning

To prepare a hard disk drive for the installation of a new operating system, you must perform three tasks:

1. Low-level format, with 512-byte granularity required for PCI support.
2. Partitioning
3. High-level format

If the hard disk drive is already formatted with the required granularity (512), a low-level format is unnecessary. If, however, the hard disk drive is not formatted with 512 byte granularity, you must perform a low level format. Use the iRMX **format** command and specify either the `named` or `dos` option without the `quick` option to perform the low-level format. If you do a `named` format, specify the `msa` option to install the second-stage bootstrap loader on the disk; this is required if you want to boot the iRMX OS from this disk.

After the drive is low-level formatted, use the **rdisk** command to partition the hard disk and build the partition table. Typically, you also use the partitioning utility to specify one of the primary partitions as the active boot partition.

After partitioning, use either the DOS or iRMX **format** command to perform a high-level format on each partition. A high-level format writes OS-dependent file system information (volume label, FAT, root directory, etc.). Before using the iRMX **format** command, you must attach each partition with the **attachdevice** command, specifying the DUIB name that identifies each partition.

Partitioning and Formatting Tools

These tools are used for partitioning and formatting PCI hard disk drives:

rdisk	A DOS and iRMX command provided by the iRMX OS for partitioning hard disk drives
format	An iRMX command that can perform a low level format (physical sectoring) and high level format (iRMX file system information) of hard drives and diskettes
format	A DOS command that can perform a high level format (DOS files system information) of hard drives and diskettes

CAUTION

If a hard disk drive is partitioned with the DOS version of **rdisk**, use only the DOS version of **rdisk** to view or modify the partition table. The different OS versions of **rdisk** get the CHS (cylinder, head, sector) information in two different ways. The two ways are not consistent and trying to use the two different versions of **rdisk** interchangeably will corrupt the hard disk drive.

Partitioning Example for the iRMX III OS

This example includes a 20-slot Multibus II system with an I/O Server and six CPU boards. The I/O Server board contains a diskette drive, a tape drive, and a 1 Gbyte hard disk drive. Assuming that each CPU board requires a system disk, partition the hard disk drive into six partitions of approximately equal size (165 Mbytes) to hold the OS. The general procedure for partitioning the hard drive is:

1. Boot the iRMX OS from a diskette.
2. Attach the hard disk with the **attachdevice** command. Use a DUIB that describes the entire hard disk, for example, `gscw_2`.
3. Low-level format: Use the iRMX **format** command to install the MSA second stage on the hard disk by specifying the `named` and `MSA` switches on the command line. If the disk already has a low-level format with 512-byte granularity, you can skip the low-level format by specifying the `quick` option. At this point you need not specify the `files` option.
4. Partitioning: Use **rdisk** to partition the drive into six parts. The Master Boot Partition Table will have only two entries, an iRMX primary partition and an iRMX extended partition which is the header to a linked list of five partitions.
5. High-level format: Attach each partition with the appropriate DUIB name and format the partition using the **format** command with the `quick` option to write the file system information on the partition while skipping the low level format. If you forget to specify the `quick` option, the PCI device driver ignores a low level format request on a partition. Specify the `files` option and any other options you want for each partition.
6. Use the ICU to create an iRMX OS image for each board in the system, with the required DUIBs to recognize the disk partition(s) that OS will use. Install the iRMX OS images and development tools on each formatted partition since each partition will serve as a different board's system disk.

Note

If you are installing the OS as described in the *Installation and Startup* manual, most of the steps listed above are performed by submit files during the installation. Steps 3 and 4 above are covered by the partitioning instructions of Chapter 5, Step 4 in the Installation manual. Steps 5 and 6 above are covered for installation on the first partition by the instructions in Chapter 5, Step 5 of the Installation manual.

After you install the OS on the first partition, you may choose to perform the installation in Step 6 above by attaching subsequent partitions and copying files from the first partition.

MSA Booting

The Bootstrap Loader operates in two stages. The first stage loader resides in ROM and is independent of the OS. The first stage loads the second stage from the mass storage device. The second stage loads the OS. The second stage bootstrap process can follow one of three methods: independent, dependent, or quasi-independent.

Boards that have a hard disk drive attached locally, such as the SBC 486/166SE or SBC P5120ISE, can boot independently. The disks attached to these boards must be formatted with the `msa` option. The `msa` option writes the MSA second stage at the end of the disk. The exact location of the second stage is written into an entry in the Bootloader Location Table (BOLT), also written by **format**. As long as these tracks at the end of the disk space are not included in any partition, the second stage is available to boot from. **Rdisk** reserves the last cylinder of the disk for this purpose; it will not allow you to include that cylinder in any partition you define.

The MSA second stage uses the `bl_boot_master_part` and `bl_boot_logical_part` BPS parameters to specify which partition to boot from. Use these parameters to override the default (active) boot partition. You must specify these BPS parameters at the Master Test Handler (MTH) prompt using the **mp** command. If you don't enter the master partition number at the MTH prompt and the hard disk drive is partitioned, with the master partition marked active, then the second stage boots from that partition.

For example, to specify the primary iRMX partition from Figure F-1, you would set `bl_boot_master_part=3` because it is the third entry in the master partition table.

To specify the last iRMX logical drive partition from Figure F-1, you would set `bl_boot_master_part=4` and `bl_boot_logical_part=2`. This partition is the second logical drive entry in the fourth entry of the master partition table.

See also: BPS parameters, *MSA for the iRMX Operating System*

Partition Support for Multibus I Systems or PCs

The iRMX partitioning support is only provided for SCSI drives controlled by the PCI driver. Support is thus limited for systems other than the iRMX III OS in a Multibus II chassis.

Multibus I Systems

These limitations apply in a Multibus I system:

- There is no boot support for partitioned drives
- Once booted, PCI can support a second disk drive that has been partitioned, but this does not allow for booting diskless boards from individual partitions, as in a Multibus II system. Thus there is little point in partitioning the drive.

PC Systems

On a PC or PC-compatible board in a Multibus system you can run DOSRMX or iRMX for PCs. These limitations apply to such systems:

- There is no boot support for partitioned drives
- The DUIBs to support partitioning are provided by the loadable PCI driver, *pcidrv*. However, these DUIBs are not available until the driver is loaded from the disk, so they can support only a second disk drive that has been partitioned, after booting.

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