



**Burroughs**

# **XE 500 CENTIX™**

Operations  
Reference  
Manual

Volume 4: System  
Operations, Part 2

Relative To Release Level 6.0  
Priced Item  
November 1986

Distribution Code SA  
Printed in U S America  
1207891



**Burroughs**

# **XE 500 CENTIX™**

## **Operations Reference Manual**

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# About This Manual

## Purpose

The purpose of the *XE 500 CENTIX Operations Reference Manual* is to provide a comprehensive reference for the XE 500 CENTIX operating system.

## Scope

This manual describes the commands, system calls, libraries, data files, and device interfaces that make up the CENTIX Operating System running on the XE 500 computer.

## Audience

Volumes 1 and 2 of this manual are intended for all users of the CENTIX operating system. CENTIX system programmers are the primary audience for Volumes 3 and 4.

## Prerequisites

General users of the CENTIX system should be familiar with the particular environments in which they will be working. A section called **Getting Started**, preceding the Shell Command descriptions in Volumes 1 and 2, provides a generic CENTIX tutorial.

Programmers should have an understanding of the CENTIX operating system structure and should be experienced at writing programs in the C programming language.

## How to Use This Manual

Use this manual as a starting point to find the documentation for a CENTIX feature with which you are unfamiliar. To find the entry you need, refer to the following:

- **Permuted Index.** This indexes each significant word in each entry's description. A complete Permuted Index for the whole manual is in each volume.
- **Contents Listing.** Included in the Contents Listing is an alphabetical list of entries, under the appropriate sections, together with the entry descriptions. Each volume contains the Contents Listing.
- **Related Shell Command Entries.** This section, for Volumes 1 and 2 only, groups together related shell command entries that are in Section 1.

## Organization

This manual consists of six sections:

Section 1, **Shell Commands**, describes programs that are intended to be invoked directly by the user through the CENTIX System shell.

Section 2, **System Calls**, describes the entries into the CENTIX kernel, including the C language interfaces.

Section 3, **Library Functions**, describes the available library functions and subroutines.

Section 4, **Special File Formats**, documents the structure of particular kinds of files.

Section 5, **Miscellaneous Facilities**, includes descriptions of macro packages, character set tables, and so on.

Section 6, **Device Files**, describes various device files that refer to specific hardware peripherals and CENTIX System device drivers.

## **Related Product Information**

*XE 500 CENTIX Administration Guide*

*XE 500 CENTIX centrEASE Operations Reference Manual*

*XE 500 CENTIX C Language Programming Reference Manual*

*XE 500 CENTIX Programming Guide*

*XE 500 CENTIX Operations Guide*



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# Contents

## Volume 1: Shell Operations, Part 1

### Section 1: Shell Commands ..... 1-1

|                  |  |
|------------------|--|
| <b>intro</b>     | introduction to shell commands                                   |
| <b>accept</b>    | allow LP requests  |
| <b>adb</b>       | absolute debugger  |
| <b>admin</b>     | create and administer SCCS files                                 |
| <b>allrc</b>     | system initialization shell script                               |
| <b>apnum</b>     | print Application Processor number                               |
| <b>ar</b>        | archive and library maintainer for portable object code archives |
| <b>as</b>        | mc68010 assembler  |
| <b>at, batch</b> | execute commands at a later time                                 |
| <b>awk</b>       | pattern scanning and processing language                         |
| <b>banner</b>    | make posters   |
| <b>basename</b>  | deliver portions of path names                                   |
| <b>batch</b>     | execute commands at a later time                                 |
| <b>bc</b>        | high-precision arithmetic language                               |
| <b>bcheckrc</b>  | system initialization shell script                               |
| <b>bcopy</b>     | interactive block copy   |
| <b>bdiff</b>     | big diff   |
| <b>bfs</b>       | big file scanner   |
| <b>brc</b>       | system initialization shell script                               |
| <b>cal</b>       | print calendar   |
| <b>calendar</b>  | reminder service   |
| <b>cancel</b>    | cancel requests to an LP line printer                            |
| <b>cat</b>       | concatenate and print files                                      |
| <b>cb</b>        | C program beautifier   |
| <b>cc</b>        | C compiler   |
| <b>cd</b>        | change working directory   |
| <b>cdc</b>       | change the delta commentary of an SCCS delta                     |

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|                     |  |
|---------------------|--|
| <b>centreCAP</b>    | function key shell for unskilled users             |
| <b>centreWINDOW</b> | window management                                  |
| <b>cflow</b>        | generate C flow graph                              |
| <b>chgrp</b>        | change group                                       |
| <b>chmod</b>        | change mode  |
| <b>chown</b>        | change owner                                       |
| <b>chroot</b>       | change root directory for a command                |
| <b>clear</b>        | clear terminal screen                              |
| <b>cli</b>          | clear inode  |
| <b>cmp</b>          | compare two files                                  |
| <b>col</b>          | filter reverse line-feeds                          |
| <b>comb</b>         | combine SCCS deltas                                |
| <b>comm</b>         | select or reject lines common to two sorted files  |
| <b>conrc</b>        | system initialization shell script                 |
| <b>console</b>      | control Application Processor pseudoconsole        |
| <b>convert</b>      | convert object and archive files to common formats |
| <b>cp</b>           | copy files   |
| <b>cpio</b>         | copy file archives in and out                      |
| <b>cpp</b>          | the C language preprocessor                        |
| <b>cpset</b>        | install object files in binary directories         |
| <b>cron</b>         | clock daemon                                       |
| <b>crontab</b>      | user crontab file                                  |
| <b>crup</b>         | create file system partition                       |
| <b>csplit</b>       | context split                                      |
| <b>ct</b>           | spawn getty to a remote terminal                   |
| <b>ctrace</b>       | C program debugger                                 |
| <b>cu</b>           | call another computer system                       |
| <b>cut</b>          | cut out selected fields of each line of a file     |
| <b>cxref</b>        | generate C program cross reference                 |
| <b>date</b>         | print and set the date                             |
| <b>dc</b>           | desk calculator                                    |

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|                 |  |
|-----------------|--|
| <b>dcopy</b>    | copy file systems for optimal access time        |
| <b>dd</b>       | convert and copy a file                          |
| <b>delta</b>    | make a delta (change) to an SCCS file            |
| <b>devnm</b>    | device name                                      |
| <b>df</b>       | report number of free disk blocks                |
| <b>diff</b>     | differential file comparator                     |
| <b>diff3</b>    | 3-way differential file comparison               |
| <b>dircmp</b>   | directory comparison                             |
| <b>dirname</b>  | deliver portions of path names                   |
| <b>disable</b>  | disable LP printers                              |
| <b>du</b>       | summarize disk usage                             |
| <b>dump</b>     | dump selected parts of an object file            |
| <b>echo</b>     | echo arguments                                   |
| <b>ed, red</b>  | text editor                                      |
| <b>edit</b>     | text editor                                      |
| <b>egrep</b>    | search a file for a pattern                      |
| <b>enable</b>   | enable LP printers                               |
| <b>env</b>      | set environment for command execution            |
| <b>ex, edit</b> | text editor                                      |
| <b>expr</b>     | evaluate arguments as an expression              |
| <b>factor</b>   | factor a number                                  |
| <b>false</b>    | false  |
| <b>ff</b>       | list file names and statistics for a file system |
| <b>fgrep</b>    | search a file for a pattern                      |
| <b>file</b>     | determine file type                              |
| <b>finc</b>     | fast incremental backup                          |
| <b>find</b>     | find files                                       |
| <b>fold</b>     | fold long lines for finite width output device   |
| <b>fpsar</b>    | File Processor system activity reporter          |
| <b>frec</b>     | recover files from a backup tape                 |

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|                 |   |
|-----------------|---|
| <b>fsck</b>     | file system consistency check and interactive repair      |
| <b>fsdb</b>     | file system debugger                                      |
| <b>fwtmp</b>    | manipulate connect accounting records                     |
| <b>get</b>      | get a version of an SCCS file                             |
| <b>getopt</b>   | parse command options                                     |
| <b>getty</b>    | set terminal type, modes, speed, and line discipline      |
| <b>grep</b>     | search a file for a pattern                               |
| <b>grpck</b>    | group file checker  |
| <b>gtdl</b>     | RS-232-C terminal download                                |
| <b>halt</b>     | terminate all processing                                  |
| <b>hd</b>       | hexadecimal and ASCII file dump                           |
| <b>head</b>     | give first few lines                                      |
| <b>help</b>     | ask for help for SCCS commands                            |
| <b>hyphen</b>   | find hyphenated words                                     |
| <b>icode</b>    | process control initialization                            |
| <b>id</b>       | print user and group IDs and names                        |
| <b>init</b>     | process control initialization                            |
| <b>install</b>  | install commands  |
| <b>ipcrm</b>    | remove a message queue, semaphore set or shared memory id |
| <b>ipcs</b>     | report inter-process communication facilities status      |
| <b>join</b>     | relational database operator                              |
| <b>keystate</b> | print XE 550 front panel keyswitch setting                |
| <b>kill</b>     | terminate a process                                       |
| <b>killall</b>  | kill all active processes                                 |
| <b>labelit</b>  | file system label checking                                |
| <b>ld</b>       | link editor for common object files                       |
| <b>lex</b>      | generate programs for simple lexical tasks                |
| <b>line</b>     | read one line   |
| <b>link</b>     | exercise link and unlink system calls                     |
| <b>lint</b>     | a C program checker                                       |

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|                |  |
|----------------|--|
| <b>ln</b>      | link files                                   |
| <b>login</b>   | sign on                                      |
| <b>logname</b> | get login name                               |
| <b>lorder</b>  | find ordering relation for an object library |
| <b>lp</b>      | send requests to an LP line printer          |
| <b>lpadmin</b> | configure the LP spooling system             |
| <b>lpmove</b>  | move LP requests                             |
| <b>lpr</b>     | line printer spooler                         |
| <b>lpsched</b> | start the LP request scheduler               |
| <b>lpset</b>   | set parallel line printer options            |
| <b>lpshut</b>  | stop the LP request scheduler                |
| <b>lpstat</b>  | print LP status information                  |
| <b>ls</b>      | list contents of directories                 |

## Volume 2: Shell Operations, Part 2

### Section 1: Shell Commands (Cont.) . . . . . 1-283

|                     |   |
|---------------------|---|
| <b>m4</b>           | macro processor                                     |
| <b>machid</b>       | mc68k, pdp11, u3b, vax, iAPX286 - processor type    |
| <b>mail</b>         | send or read mail                                   |
| <b>make</b>         | maintain, update, and regenerate groups of programs |
| <b>mesg</b>         | permit or deny messages                             |
| <b>mkboot</b>       | reformat CENTIX kernel and copy it to BTOS          |
| <b>mkdir</b>        | make a directory                                    |
| <b>mkfs</b>         | construct a file system                             |
| <b>mklost+found</b> | make a lost+found directory for fsck                |
| <b>mknod</b>        | build special file                                  |
| <b>more</b>         | text perusal  |
| <b>mount</b>        | mount and dismount file system                      |
| <b>mv</b>           | move files  |
| <b>mvdir</b>        | move a directory                                    |

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|                |   |
|----------------|---|
| <b>mvtpy</b>   | move PT/GT local printer device files                             |
| <b>ncheck</b>  | generate names from i-numbers                                     |
| <b>newform</b> | change the format of a text file                                  |
| <b>newgrp</b>  | log in to a new group   |
| <b>news</b>    | print news items  |
| <b>nice</b>    | run a command at low priority                                     |
| <b>nl</b>      | line numbering filter   |
| <b>nm</b>      | print name list of common object file                             |
| <b>nohup</b>   | run a command immune to hangups and quits                         |
| <b>od</b>      | octal dump  |
| <b>ofcli</b>   | command line interpreter for interactive BTOS JCL                 |
| <b>ofcopy</b>  | copy to or from the BTOS file system                              |
| <b>ofed</b>    | edit BTOS files   |
| <b>ofls</b>    | list BTOS files and directories                                   |
| <b>ofvi</b>    | edit BTOS files   |
| <b>pack</b>    | compress and expand files   |
| <b>page</b>    | text perusal  |
| <b>passwd</b>  | change login password   |
| <b>paste</b>   | merge same lines of several files or subsequent lines of one file |
| <b>path</b>    | locate executable file for command                                |
| <b>pbuf</b>    | print the kernel print buffer                                     |
| <b>perc</b>    | describe BTOS error return code (erc)                             |
| <b>pg</b>      | file perusal filter for soft-copy terminals                       |
| <b>pmon</b>    | display statistics for an Application Processor                   |
| <b>pr</b>      | print files   |
| <b>prfdc</b>   | operating system profiler   |
| <b>prfld</b>   | operating system profiler   |
| <b>prfpr</b>   | operating system profiler   |
| <b>prfsnap</b> | operating system profiler   |
| <b>prfstat</b> | operating system profiler   |

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|                 |  |
|-----------------|--|
| <b>prof</b>     | display profile data                               |
| <b>profiler</b> | operating system profiler                          |
| <b>prs</b>      | print an SCCS file                                 |
| <b>ps</b>       | report process status                              |
| <b>pstat</b>    | ICC statistics for processor                       |
| <b>ptdl</b>     | RS-232-C terminal download                         |
| <b>ptx</b>      | permuted index                                     |
| <b>pwck</b>     | password file checker                              |
| <b>pwd</b>      | working directory name                             |
| <b>rc</b>       | system initialization shell script                 |
| <b>red</b>      | restricted version text editor                     |
| <b>regcmp</b>   | regular expression compiler                        |
| <b>reject</b>   | prevent LP requests                                |
| <b>renice</b>   | alter priority of running process by changing nice |
| <b>rm</b>       | remove files                                       |
| <b>rmdel</b>    | remove a delta from an SCCS file                   |
| <b>rmdir</b>    | remove directories                                 |
| <b>rsh</b>      | shell, restricted command programming language     |
| <b>sa1</b>      | system activity reporter                           |
| <b>sa2</b>      | system activity reporter                           |
| <b>sact</b>     | print current SCCS file editing activity           |
| <b>sadc</b>     | system activity reporter                           |
| <b>sadp</b>     | disk access profiler                               |
| <b>sag</b>      | system activity graph                              |
| <b>sar</b>      | system activity reporter                           |
| <b>sarpkg</b>   | system activity report package                     |
| <b>sccsdiff</b> | compare two versions of an SCCS file               |
| <b>script</b>   | make typescript of terminal session                |
| <b>sdb</b>      | symbolic debugger                                  |
| <b>sdiff</b>    | side-by-side difference program                    |

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|                 |  |
|-----------------|--|
| <b>sed</b>      | stream editor  |
| <b>setmnt</b>   | establish mount table  |
| <b>setuname</b> | set name of system   |
| <b>sh</b>       | shell, the standard/restricted command programming language        |
| <b>shutdown</b> | terminate all processing   |
| <b>size</b>     | print section sizes of common object files                         |
| <b>sleep</b>    | suspend execution for an interval                                  |
| <b>sort</b>     | sort and/or merge files  |
| <b>spawn</b>    | execute a process on a specific Application Processor              |
| <b>spawnsrv</b> | service spawn execution requests                                   |
| <b>spell</b>    | hashmake, spellin, hashcheck - find spelling errors                |
| <b>split</b>    | split a file into pieces   |
| <b>strip</b>    | strip symbol and line number information from a common object file |
| <b>stty</b>     | set the options for a terminal                                     |
| <b>su</b>       | become super-user or another user                                  |
| <b>sum</b>      | print checksum and block count of a file                           |
| <b>sync</b>     | update the super block   |
| <b>tabs</b>     | set tabs on a terminal   |
| <b>tail</b>     | deliver the last part of a file                                    |
| <b>tar</b>      | tape file archiver   |
| <b>tdl</b>      | RS-232-C terminal download   |
| <b>tee</b>      | pipe fitting   |
| <b>telinit</b>  | process control initialization                                     |
| <b>test</b>     | condition evaluation command                                       |
| <b>tic</b>      | terminfo compiler  |
| <b>tidc</b>     | display decompiled version of terminfo entry                       |
| <b>time</b>     | time a command   |
| <b>timex</b>    | time a command; report process data and system activity            |
| <b>touch</b>    | update access and modification times of a file                     |
| <b>tput</b>     | query terminfo data base   |

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|                |  |
|----------------|--|
| <b>tr</b>      | translate characters                                       |
| <b>true</b>    | provide truth values                                       |
| <b>tset</b>    | set terminal, terminal interface, and terminal environment |
| <b>tsort</b>   | topological sort   |
| <b>tty</b>     | get the terminal's name                                    |
| <b>umask</b>   | set file-creation mode mask                                |
| <b>umount</b>  | dismount file system                                       |
| <b>uname</b>   | print name of system                                       |
| <b>unset</b>   | undo a previous get of an SCCS file                        |
| <b>uniq</b>    | report repeated lines in a file                            |
| <b>units</b>   | conversion program   |
| <b>update</b>  | provide disk synchronization                               |
| <b>uuclean</b> | uucp spool directory clean-up                              |
| <b>uucp</b>    | copy files between computer systems                        |
| <b>uulog</b>   | query a summary log of uucp and uux transactions           |
| <b>uuname</b>  | list uucp names of known systems                           |
| <b>uupick</b>  | accept or reject files transmitted by <b>uuto</b>          |
| <b>uustat</b>  | uucp status inquiry and job control                        |
| <b>uusub</b>   | monitor uucp network                                       |
| <b>uuto</b>    | public computer system-to-computer system file copy        |
| <b>uux</b>     | computer system to computer system command execution       |
| <b>val</b>     | validate SCCS file   |
| <b>vc</b>      | version control  |
| <b>vi</b>      | screen-oriented (visual) display editor                    |
| <b>view</b>    | visual editor  |
| <b>volcopy</b> | copy file systems with label checking                      |
| <b>wait</b>    | await completion of process                                |
| <b>wall</b>    | write to all users   |
| <b>wc</b>      | word count   |
| <b>what</b>    | identify SCCS files  |

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|                |  |
|----------------|--|
| <b>who</b>     | who is on the system                           |
| <b>whodo</b>   | who is doing what                              |
| <b>wm</b>      | window management                              |
| <b>write</b>   | write to another user                          |
| <b>wtmpfix</b> | manipulate connect accounting records          |
| <b>xargs</b>   | construct argument list(s) and execute command |
| <b>yacc</b>    | yet another compiler-compiler                  |

### **Volume 3: System Operations, Part 1**

#### **Section 2: System Calls . . . . . 2-1**

|                           |  |
|---------------------------|--|
| <b>intro</b>              | introduction to system calls and error numbers |
| <b>access</b>             | determines the accessibility of a file         |
| <b>acct</b>               | enable or disable process accounting           |
| <b>alarm</b>              | set a process alarm clock                      |
| <b>brk</b>                | change data segment spaced allocation          |
| <b>chdir</b>              | changes the current working directory          |
| <b>chmod</b>              | change mode of file                            |
| <b>chown</b>              | changes the owner and/or group of a file       |
| <b>chroot</b>             | change the root directory                      |
| <b>close</b>              | close a file descriptor                        |
| <b>creat</b>              | create a new file or rewrite an existing one   |
| <b>dup</b>                | duplicate an open file descriptor              |
| <b>exAllocExch</b>        | allocate exchange                              |
| <b>exCall</b>             | send a request and wait for the response       |
| <b>exchanges</b>          | obtain and abandon exchanges                   |
| <b>exCheck</b>            | examine an ICC message queue                   |
| <b>exCnxSendOnDealloc</b> | make final requests                            |
| <b>exCpRequest</b>        | remove a request from an exchange              |
| <b>exCpResponse</b>       | remove a response from an exchange             |
| <b>exDeallocExch</b>      | deallocate exchange                            |

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|                        |  |
|------------------------|--|
| <b>exDiscard</b>       | remove a response from an exchange                                 |
| <b>exec</b>            | execute files  |
| <b>execl</b>           | execute files  |
| <b>execle</b>          | execute a file   |
| <b>execlp</b>          | execute a file   |
| <b>execv</b>           | execute a file   |
| <b>execve</b>          | execute a file   |
| <b>execvp</b>          | execute a file   |
| <b>exfinal</b>         | make final requests  |
| <b>exit</b>            | terminate process  |
| <b>exReject</b>        | remove a request from an exchange                                  |
| <b>exRequest</b>       | send a message to a server   |
| <b>exRespond</b>       | send a message to a client   |
| <b>exSendOnDealloc</b> | make final requests  |
| <b>exServeRq</b>       | appropriate a request code   |
| <b>exWait</b>          | examine an ICC message queue                                       |
| <b>fcntl</b>           | file control   |
| <b>fork</b>            | create a new process   |
| <b>fstat</b>           | get file status  |
| <b>getegid</b>         | get effective group ID   |
| <b>geteuid</b>         | get effective user ID  |
| <b>getgid</b>          | get real group ID  |
| <b>getpgrp</b>         | get process group ID   |
| <b>getpid</b>          | get process, process group, and parent process IDs                 |
| <b>getppid</b>         | get parent process ID  |
| <b>getuid</b>          | get real user, effective user, real group, and effective group IDs |
| <b>ioctl</b>           | control device   |
| <b>kill</b>            | send a signal to a process or a group of processes                 |
| <b>link</b>            | link to a file   |
| <b>locking</b>         | exclusive access to regions of a file                              |

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|                 |  |
|-----------------|--|
| <b>lseek</b>    | move read/write file pointer                     |
| <b>mkdir</b>    | makes a directory, or a special or ordinary file |
| <b>mount</b>    | mount a file system                              |
| <b>msgctl</b>   | message control operations                       |
| <b>msgget</b>   | get message queue                                |
| <b>msgop</b>    | message operations                               |
| <b>nice</b>     | change priority of a process                     |
| <b>open</b>     | open a file for reading or writing               |
| <b>pause</b>    | suspend process until signal                     |
| <b>pipe</b>     | create an interprocess channel                   |
| <b>plock</b>    | lock process, text, or data in memory            |
| <b>profil</b>   | execution time profile                           |
| <b>ptrace</b>   | process trace                                    |
| <b>read</b>     | read from a file                                 |
| <b>sbrk</b>     | change data segment space allocation             |
| <b>semctl</b>   | semaphore control operations                     |
| <b>semget</b>   | get set of semaphores                            |
| <b>semop</b>    | semaphore operations                             |
| <b>setgid</b>   | get group ID                                     |
| <b>setpgrp</b>  | set process group ID                             |
| <b>setuid</b>   | set user ID                                      |
| <b>shmctl</b>   | shared memory control operations                 |
| <b>shmget</b>   | get shared memory segment                        |
| <b>shmop</b>    | shared memory operations                         |
| <b>signal</b>   | specify what to do upon receipt of a signal      |
| <b>stat</b>     | get file status                                  |
| <b>stime</b>    | set time   |
| <b>swrite</b>   | synchronous write on a file                      |
| <b>sync</b>     | update super-block                               |
| <b>syslocal</b> | special system requests                          |

---

|               |   |
|---------------|---|
| <b>time</b>   | get time                                      |
| <b>times</b>  | get process and child process times           |
| <b>ulimit</b> | get and set user limits                       |
| <b>umask</b>  | set and get the file creation mask            |
| <b>umount</b> | unmount a file system                         |
| <b>uname</b>  | get name of current CENTIX system             |
| <b>unlink</b> | remove directory entry                        |
| <b>ustat</b>  | get file system statistics                    |
| <b>utime</b>  | set file access and modification times        |
| <b>wait</b>   | wait for a child process to stop or terminate |
| <b>write</b>  | write on a file                               |

### **Section 3: Library Functions . . . . . 3-1**

|                |   |
|----------------|---|
| <b>intro</b>   | introduction to libraries and subroutines                   |
| <b>a64i</b>    | convert between long integer and base-64 ASCII string       |
| <b>abort</b>   | generate an IOT fault                                       |
| <b>abs</b>     | return integer absolute value                               |
| <b>assert</b>  | verify program assertion                                    |
| <b>atof</b>    | convert ASCII string to floating-point number               |
| <b>Bessel</b>  | Bessel functions  |
| <b>bsearch</b> | binary search a sorted table                                |
| <b>clock</b>   | report CPU time used  |
| <b>conv</b>    | translate characters  |
| <b>crypt</b>   | generate DES encryption                                     |
| <b>ctermid</b> | generate file name for terminal                             |
| <b>ctime</b>   | convert date and time to string                             |
| <b>ctype</b>   | classify characters   |
| <b>courses</b> | CRT screen handling and optimization package                |
| <b>userid</b>  | get character login name of the user                        |
| <b>dial</b>    | establish and release an out-going terminal line connection |

---

|                 |  |
|-----------------|--|
| <b>drand48</b>  | generate uniformly distributed pseudo-random numbers   |
| <b>ecvt</b>     | convert floating-point number to string                |
| <b>end</b>      | last locations in programs                             |
| <b>erf</b>      | error function and complementary error function        |
| <b>exp</b>      | exponential, logarithm, power, square root functions   |
| <b>fclose</b>   | close or flush a stream                                |
| <b>ferror</b>   | stream status inquiries                                |
| <b>floor</b>    | floor, ceiling, remainder, absolute value functions    |
| <b>fopen</b>    | open a stream  |
| <b>fread</b>    | binary input/output                                    |
| <b>frexp</b>    | manipulate parts of floating-point numbers             |
| <b>fseek</b>    | reposition a file pointer in a stream                  |
| <b>ftw</b>      | walk a file tree                                       |
| <b>gamma</b>    | log gamma function                                     |
| <b>getc</b>     | get character or word from a stream                    |
| <b>getcwd</b>   | get the path-name of the current working directory     |
| <b>getenv</b>   | return value for environment name                      |
| <b>getgrent</b> | get group file entry                                   |
| <b>getlogin</b> | get login name   |
| <b>getopt</b>   | get option letter from argument vector                 |
| <b>getpass</b>  | read a password  |
| <b>getpw</b>    | get name from UID                                      |
| <b>getpwent</b> | get password file entry                                |
| <b>gets</b>     | get a string from a stream                             |
| <b>getut</b>    | access utmp file entry                                 |
| <b>hsearch</b>  | manage hash search tables                              |
| <b>hypot</b>    | Euclidean distance function                            |
| <b>l3tol</b>    | convert between 3-byte integers and long integers      |
| <b>ldahread</b> | read the archive header of a member of an archive file |
| <b>ldclose</b>  | close a common object file                             |

---

|                              |   |
|------------------------------|---|
| <b>ldfthead</b>              | read the file header of a common object file                      |
| <b>ldgetname</b>             | retrieve symbol name for common object file symbol table entry    |
| <b>ldlread</b>               | manipulate line number entries of a common object file function   |
| <b>ldlseek</b>               | seek to line number entries of a section of a common object file  |
| <b>ldohseek</b>              | seek to the optional file header of a common object file          |
| <b>ldopen</b>                | open a common object file for reading                             |
| <b>ldrseek</b>               | seek to relocation entries of a section of a common object file   |
| <b>ldshread</b>              | read an indexed/named section header of a common object file      |
| <b>ldsseek</b>               | seek to an indexed/named section of a common object file          |
| <b>ldtbindex</b>             | compute the index of a symbol table entry of a common object file |
| <b>ldtbread</b>              | read an indexed symbol table entry of a common object file        |
| <b>ldtbseek</b>              | seek to the symbol tsble of a common object file                  |
| <b>lockf</b>                 | record locking on files   |
| <b>logname</b>               | return login name of user   |
| <b>lsearch</b>               | linear search and update  |
| <b>malloc (fast version)</b> | fast main memory allocator  |
| <b>malloc</b>                | main memory allocator   |
| <b>matherr</b>               | error-handling function   |
| <b>memory</b>                | memory operations   |
| <b>mktemp</b>                | make a unique file name   |
| <b>monitor</b>               | prepare execution profile   |
| <b>nlist</b>                 | get entries from the name list                                    |
| <b>ocurse</b>                | optimized screen functions  |
| <b>ofCreate</b>              | allocate BTOS files   |
| <b>ofDir</b>                 | BTOS directory functions  |
| <b>ofOpenFile</b>            | access BTOS files   |
| <b>ofRead</b>                | input/output on a BTOS file                                       |
| <b>ofRename</b>              | rename a BTOS file  |
| <b>ofStatus</b>              | BTOS file status  |
| <b>perror</b>                | system error messages   |

---

|                  |   |
|------------------|---|
| <b>popen</b>     | initiate pipe to/from a process                             |
| <b>printf</b>    | print formatted output                                      |
| <b>putc</b>      | put character or word on a stream                           |
| <b>putenv</b>    | change or add value to environment                          |
| <b>putpwent</b>  | write password file entry                                   |
| <b>puts</b>      | put a string on a stream                                    |
| <b>qsort</b>     | quicker sort  |
| <b>quAdd</b>     | add a new entry to a BTOS queue                             |
| <b>quRead</b>    | examine BTOS queue  |
| <b>quRemove</b>  | take back a BTOS queue request                              |
| <b>rand</b>      | simple random number generator                              |
| <b>regcmp</b>    | compile and execute regular expression                      |
| <b>scanf</b>     | convert formatted input                                     |
| <b>setbuf</b>    | assign buffering to a stream                                |
| <b>setjmp</b>    | non-local goto  |
| <b>sinh</b>      | hyperbolic functions  |
| <b>sleep</b>     | suspend execution for interval                              |
| <b>spawn</b>     | execute a process on a specific Application Processor       |
| <b>sputl</b>     | access long integer data in a machine-dependent fashion     |
| <b>spwait</b>    | wait for a spawned process to terminate                     |
| <b>ssignal</b>   | software signals  |
| <b>stdio</b>     | standard buffered input/output package                      |
| <b>stdipc</b>    | standard interprocess communication package ( <b>ftok</b> ) |
| <b>string</b>    | string operations   |
| <b>strtod</b>    | convert string to double-precision number                   |
| <b>strtol</b>    | convert string to integer                                   |
| <b>swab</b>      | swap bytes  |
| <b>swapshort</b> | translate byte orders to Motorola/Intel                     |
| <b>system</b>    | issue a shell command                                       |
| <b>termcap</b>   | terminal independent operations                             |

---

|                 |  |
|-----------------|--|
| <b>tmpfile</b>  | create a temporary file                            |
| <b>tmpnam</b>   | create a name for a temporary file                 |
| <b>trig</b>     | trigonometric functions                            |
| <b>tsearch</b>  | manage binary search trees                         |
| <b>ttyname</b>  | find name of a terminal                            |
| <b>ttyslot</b>  | find the slot in the utmp file of the current user |
| <b>ungetc</b>   | push character back into input stream              |
| <b>vprintf</b>  | print formatted output of a varargs argument list  |
| <b>wmgetid</b>  | get window ID                                      |
| <b>wmlayout</b> | get terminal's window layout                       |
| <b>wmop</b>     | window management operations                       |
| <b>wmsetid</b>  | associate a file descriptor with a window          |

## Volume 4: System Operations, Part 2

### Section 4: Special File Formats . . . . . 4-1

|                  |   |
|------------------|---|
| <b>intro</b>     | introduction to special file formats      |
| <b>a.out</b>     | common assembler and link editor output   |
| <b>ar</b>        | common archive file format                |
| <b>checklist</b> | list of file systems processed by fsck    |
| <b>core</b>      | format of core image file                 |
| <b>cpio</b>      | format of cpio archive                    |
| <b>dir</b>       | format of directories                     |
| <b>filehdr</b>   | file header for common object file        |
| <b>fs</b>        | format of file system                     |
| <b>fspec</b>     | format specification in text file         |
| <b>gettydefs</b> | speed and terminal settings used by getty |
| <b>group</b>     | group file                                |
| <b>inittab</b>   | script for the init file                  |
| <b>inode</b>     | format of an i-node                       |
| <b>issue</b>     | issue identification file                 |

---

|  |   |            |
|--|---|------------|
| <b>ldfcn</b>                               | common object file access routines                    |            |
| <b>linenum</b>                             | line number entries in a common object file           |            |
| <b>master</b>                              | master device information table                       |            |
| <b>mnttab</b>                              | mounted file system table                             |            |
| <b>passwd</b>                              | password file   |            |
| <b>profile</b>                             | setting up an environment at login time               |            |
| <b>reloc</b>                               | relocation information for a common object file       |            |
| <b>sccsfile</b>                            | format of SCCS file                                   |            |
| <b>scnhdr</b>                              | section header for a comon object file                |            |
| <b>syms</b>                                | common object file symbol table format                |            |
| <b>term</b>                                | format of compiled term file                          |            |
| <b>termcap</b>                             | terminal capability data base                         |            |
| <b>terminfo</b>                            | terminal capability data base                         |            |
| <b>utmp</b>                                | utmp and wtmp entry formats                           |            |
| <b>Section 5: Miscellaneous Facilities</b> | .....   | <b>5-1</b> |
| <b>intro</b>                               | introduction to miscellany                            |            |
| <b>environ</b>                             | user environment                                      |            |
| <b>fcntl</b>                               | file control options                                  |            |
| <b>math</b>                                | math functions and constants                          |            |
| <b>modemcap</b>                            | smart modem capability data base                      |            |
| <b>piif</b>                                | performance improvement in large files and direct I/O |            |
| <b>prof</b>                                | profile within a function                             |            |
| <b>regex</b>                               | regular expression compile and match routines         |            |
| <b>stat</b>                                | data returned by stat system call                     |            |
| <b>term</b>                                | conventional names for terminals                      |            |
| <b>types</b>                               | primitive system data types                           |            |
| <b>values</b>                              | machine-dependent values                              |            |
| <b>varargs</b>                             | handle variable argument list                         |            |

---

|                                      |  |
|--------------------------------------|--|
| <b>Section 6: Device Files</b> ..... | <b>6-1</b>                                   |
| <b>intro</b>                         | introduction to device files                 |
| <b>console</b>                       | console terminal                             |
| <b>dsk</b>                           | winchester, cartridge, and floppy disks      |
| <b>fp</b>                            | winchester, cartridge, and floppy disks      |
| <b>lp</b>                            | parallel printer interface                   |
| <b>mem</b>                           | core memory                                  |
| <b>mt</b>                            | interface for magnetic tape                  |
| <b>null</b>                          | the null file                                |
| <b>prf</b>                           | operating system profiler                    |
| <b>termio</b>                        | general terminal interface                   |
| <b>tp</b>                            | controlling terminal's local RS-232 channels |
| <b>tty</b>                           | controlling terminal interface               |
| <b>window</b>                        | window management primitives                 |



---

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## **Special File Formats**

### **intro**

#### **Name**

**intro** - introduction to special file formats

#### **Description**

This section outlines the formats of various files. The C struct declarations for the file formats are given where applicable. Usually, these structures can be found in the directories `/usr/include` or `/usr/include/sys`.

## a.out

### Name

a.out - common assembler and link editor output

### Description

The file name a.out is the output file from the assembler **as** and the link editor **ld**. Both programs will make a.out executable if there were no errors in assembling or linking and no unresolved external references.

A common object file consists of a file header, an operating system header, a table of section headers, relocation information, (optional) line numbers, a symbol table, and a string table. The order is given below.

```
File header.  
Operating System header.  
Section 1 header.  
  
...  
Section n header.  
Section 1 data.  
  
...  
Section n data.  
Section 1 relocation.  
  
...  
Section n relocation.  
Section 1 line numbers.  
  
...  
Section n line numbers.  
Symbol table.  
String table.
```

The last three parts (line numbers, symbol table and string table) may be missing if the program was linked with the **-s** option of **ld** or if they were removed by **strip**. Also note that if there were no unresolved external references after linking, the relocation information will be absent. The string table exists only if the symbol table contains symbols with names longer than eight characters..

## a.out

The sizes of each section (contained in the header, discussed below) are in bytes and are even.

When an a.out file is loaded into memory for execution, three logical segments are set up: the text segment, the data segment (initialized data followed by uninitialized, the latter actually being initialized to all 0's), and a stack. The text segment begins at location 0x0000 in the core image. The header is never loaded, except for magic 0413 files created with the **-F** option of **ld**. If the magic number (the first field in the operating system header) is 407 (octal), it indicates that the text segment is not to be write-protected or shared, so the data segment will be contiguous with the text segment. If the magic number is 410 (octal), the data segment and the text segment are not writable by the program; if other processes are executing the same a.out file, the processes will share a single text segment. Magic number 413 (octal) is the same as 410 (octal), except that 413 (octal) permits demand paging. Both the **-z** and **-F** options of the loader **ld** create a.out files with magic numbers 0413. If the **-z** option is used, both the text and data sections of the file are on 1024-byte boundaries. If the **-F** option is used, the text and data sections of the file are contiguous. Loading a single 4096-byte page into memory requires 4 transfers of 1024 bytes each for **-z**, and typically one transfer of 4096 bytes for **-F**. Thus, a.out files created with **-F** can load faster and require less disk space.

The stack begins at the end of memory and grows towards lower addresses. The stack is automatically extended as required. The data segment is extended only as requested by the **brk** system call.

The value of a word in the text or data portions that is not a reference to an undefined external symbol is exactly the value that will appear in memory when the file is executed. If a word in the text involves a reference to an undefined external symbol, the storage class of the symbol-table entry for that word will be marked as an "external symbol," and the section number will be set to 0. When the file is processed by the link editor and the external symbol becomes defined, the value of the symbol will be added to the word in the file.

## a.out

### File Header

The format of the filehdr header is

```
struct filehdr
{
    unsigned short f_magic;      /*magic number*/
    unsigned short f_nscns;     /*number of sections*/
    long          f_tmdat;      /*time and date stamp*/
    long          f_symptr;     /*file ptr to symtab*/
    long          f_nsyms;      /* # symtab entries*/
    unsigned short f_opthdr;    /*sizeof(opt hdr)*/
    unsigned short f_flags;     /*flags*/
};
```

### Operating System Header

The format of the operating system header is

```
typedef struct southdr
{
    short  magic;      /*magic number*/
    short  vstamp;    /*version stamp*/
    long   tsz;       /*text size in bytes, padded*/
    long   dsz;       /*initialized data (.data)*/
    long   bsz;       /*uninitialized data (.bss)*/
    long   entry;     /*entry point*/
    long   text_start; /*base of text used for file*/
    long   data_start; /*base of data used for file*/
} AOUTHDR;
```

### Section Header

The format of the section header is

```
struct schdr
{
    char      s_name[SYMNMLEN]; /*section name*/
    long     s_paddr;          /*physical address*/
    long     s_vaddr;          /*virtual address*/
    long     s_size;           /*section size*/
    long     s_scnptr;         /*file ptr to raw data*/
    long     s_relptr;         /*file ptr to relocation*/
    long     s_innoptr;        /*file ptr to line numbers*/
    unsigned short s_nreloc;   /*# reloc entries*/
    unsigned short s_nlnno;    /*# line number entries*/
    long     s_flags;          /*flags*/
};
```

## a.out

### Relocation

Object files have one relocation entry for each relocatable reference in the text or data. If relocation information is present, it will be in the following format:

```

struct reloc
{
    long    r_vaddr;    /*(virtual) address of ref.*/
    long    r_symndx;   /*index into symbol table*/
    short   r_type;    /*relocation type*/
};

```

The start of the relocation information is *s-relptr* from the Section Header. If there is no relocation information, *s-relptr* is 0.

### Symbol Table

The format of the symbol table header is

```

#define SYMNMLEN    8
#define FILNMLEN    14
#define SYMESZ      16    /*the size of a SYMENT*/

struct syment
{
    union                /*all ways to get a symbol name*/
    {
        char            _n_name[SYMNMLEN]; /*name of symbol*/
        struct
        {
            long        _n_zeroes; /*==0L if in string table*/
            long        _n_offset; /*location in string table*/
        }_n_n;
        char            *_n_nptr[2]; /*allows overlaying*/
    }_n;
    unsigned long      n_value; /*value of symbol*/
    short              n_scnm; /*section number*/
    unsigned short     n_type; /*type and derived type*/
    char               n_class; /*storage class*/
    char               n_numaux; /*number of aux entries*/
};

#define n_name        _n._n_name
#define n_zeroes      _n._n_n._n_zeroes
#define n_offset      _n._n_n._n_offset
#define n_nptr        _n._n_nptr[1]

```

## a.out

Some symbols require more information than a single entry; they are followed by auxiliary entries that are the same size as a symbol entry. The format is as follows:

```

union auxent {
  struct {
    long    x_tagndx;
    union {
      struct {
        unsigned short x_inno;
        unsigned short x_size;
      } x_insz;
      long    x_fsize;
    } x_misc;
    union {
      struct {
        long    x_innoptr;
        long    x_endndx;
      } x_fcn;
      struct {
        unsigned short x_dimen[DIMNUM];
      } x_ary;
    } x_fcary;
    unsigned short x_tvndx;
  } x_sym;

  struct {
    char    x_fname[FILNMLEN];
  } x_file;

  struct {
    long    x_scnlen;
    unsigned short x_nreloc;
    unsigned short x_nlinno;
  } x_scn;

  struct {
    long    x_tvfill;
    unsigned short x_tvlen;
    unsigned short x_tvran[2];
  } x_tv;
};

```

Indexes of symbol table entries begin at zero. The start of the symbol table is *f\_symptr* (from the file header) bytes from the beginning of the file. If the symbol table is stripped, *f\_symptr* is 0. The string table (if one exists) begins at *f\_symptr* + (*f\_nsyms* \* SYMESZ) bytes from the beginning of the file.

## **a.out**

### **See Also**

**as**, **cc**, **ld** in Section 1; **brk** in Section 2; **filehdr**, **ldfcn**, **linenum**, **reloc**, **scnhdr**, **syms** in Section 4.

# ar

## Name

ar - common archive file format

## Description

The archive command **ar** is used to combine several files into one. Archives are used mainly as libraries to be searched by the link editor **ld**.

Each archive begins with an archive file header, made up of the following components:

```
#define ARMAG      "<ar>"
#define SARMAG    4

struct ar_hdr {
    char    ar_magic[SARMAG];    /*magic number*/
    char    ar_name[16];        /*archive name*/
    char    ar_date[4];        /*date of last ar. mod.*/
    char    ar_syms[4];        /*no. of ar_sym entries*/
};
```

Each archive that contains common object files (see **a.out**, above) includes an archive symbol table. This symbol table is used by the link editor **ld** to determine which archive members must be loaded during the link edit process. The archive file header described above is followed by a number of symbol table entries. The number of symbol table entries is indicated in the *ar\_syms* variable. Each symbol table entry has the following format:

```
struct ar_sym {
    char    sym_name[8];        /*symbol name, recog. by ld*/
    char    sym_ptr[4];        /*archive position of symbol*/
};
```

The archive symbol table is automatically created and/or updated by the **ar** command.

## ar

Following the archive header and symbol table are the archive file members. Each file member is preceded by a file member header which is of the following format:

```
struct arf_hdr {          /*archive file member header*/
    char arf_name[16];    /*file member name*/
    char arf_date[4];     /*file member date*/
    char arf_uid[4];      /*file member user ID*/
    char arf_gid[4];      /*file member group ID*/
    char arf_mode[4];     /*file member mode*/
    char arf_size[4];     /*file member size*/
};
```

All information in the archive header, symbol table and file member headers is stored in a machine independent fashion. All character data is automatically portable. The numeric information contained in the headers is also stored in a machine independent fashion. All numeric data is stored as four bytes and is accessed by the special archive I/O functions described under `sputl` in Section 3. Common format archives can be moved from system to system as long as the portable archive command `ar` is used.

Each archive file member begins on a word boundary; a null byte is inserted between files if necessary. Nevertheless the size given reflects the actual size of the file, padding excluded.

Notice there is no provision for empty areas in an archive file.

## See Also

`ar` and `ld` in Section 1; `sputl` in Section 3.

# checklist

## Name

checklist - list of file systems processed by **fsck**

## Description

Checklist resides in directory `/etc` and contains a list of at most 15 special file names. Each special file name is contained on a separate line and corresponds to a file system. Each file system will then be automatically processed by the **fsck** shell command.

## See Also

**fsck** in Section 1.

## core

### Name

core - format of core image file

### Description

CENTIX writes out a core image of a terminated process when any of various errors occur. See **signal** in Section 2 for the list of reasons; the most common are memory violations, illegal instructions, bus errors, and user-generated quit signals. The core image is called **core** and is written in the process's working directory (provided it can be; normal access controls apply). A process with an effective user ID different from the real user ID will not produce a core image.

The first section of the core image is a copy of the system's per-user data for the process, including the registers as they were at the time of the fault. The size of this section depends on the parameter **USIZE**, which is defined in `/usr/include/sys/param.h`. The remainder represents the actual contents of the user's core area when the core image was written. If the text segment is read-only and shared, or separated from data space, it is not dumped.

The format of the information in the first section is described by the user structure of the system, defined in `/usr/include/sys/user.h`. The important things not detailed therein are the locations of the registers, which are outlined in `/usr/include/sys/reg.h`.

### See Also

**crash** in Section 1; **setuid** and **signal** in Section 2.

# cpio

## Name

cpio - format of cpio archive

## Description

The header structure, when the `-c` option of `cpio` is not used, is:

```
struct {
    short    h_magic,
            h_dev;
    ushort  h_ino,
            h_mode,
            h_uid,
            h_gid;
    short    h_nlink,
            h_rdev,
            h_mtime[2],
            h_namesize,
            h_filesiz[2];
    char     h_name[h_namesize rounded to word];
} Hdr;
```

When the `-c` option is used, the header information is described by:

```
sscanf(Chdr, "%6o%6o%6o%6o%6o%6o%6o%6o%11lo%6o%11lo%a",
        &Hdr.h_magic, &Hdr.h_dev, &Hdr.h_ino, &Hdr.h_mode,
        &Hdr.h_uid, &Hdr.h_gid, &Hdr.h_nlink, &Hdr.h_rdev,
        &Longtime, &Hdr.h_namesize, &Longfile, Hdr.h_name);
```

*Longtime* and *Longfile* are equivalent to *Hdr.h\_mtime* and *Hdr.h\_filesiz*, respectively. The contents of each file are recorded in an element of the array of varying length structures, archive, together with other items describing the file. Every instance of *h\_magic* contains the constant 070707 (octal). The items *h\_dev* through *h\_mtime* have meanings explained in Section 2, under `stat`. The length of the null-terminated path name *h\_name*, including the null byte, is given by *h\_namesize*.

The last record of the archive always contains the name TRAILER!!!. Special files, directories, and the trailer are recorded with *h\_filesiz* equal to zero.

## **cpio**

In PILF files, *h\_rdev* contains the cluster size exponent. This should not cause any portability problems, as *h\_rdev* is otherwise ignored, except for device special files.

### **See Also**

**cpio** and **find** in Section 1; **stat** in Section 2; **pilf** in Section 5.

# dir

## Name

dir - format of directories

## Format

```
#include <sys/dir.h>
```

## Description

A directory behaves exactly like an ordinary file, save that no user may write into a directory. The fact that a file is a directory is indicated by a bit in the flag word of its i-node entry (see **fs** later in this section). The structure of a directory entry as given in the include file is:

```
#ifndef DIRSIZ
#define DIRSIZ14
#endif
struct    direct
{
        ino_t    d_ino;
        char    d_name[DIRSIZ];
};
```

By convention, the first two entries in each directory are `.` and `..`. The first is an entry for the directory itself. The second is for the parent directory. The meaning of `..` is modified for the root directory of the master file system; there is no parent, so `..` and `.` have the same meaning.

## See Also

**fs** in Section 4.

# filehdr

## Name

filehdr - file header for common object files

## Format

```
#include <filehdr.h>
```

## Description

Every common object file begins with a 20-byte header. The following C struct declaration is used:

```
struct filehdr
{
    unsigned short    f_magic;      /*magic number*/
    unsigned short    f_nscns;     /*no. of sections*/
    long              f_timdat;    /*time & date stamp*/
    long              f_symptr;    /*file ptr to symtab*/
    long              f_nsyms;     /* # symtab entries*/
    unsigned short    f_opthdr;    /*sizeof(opt hdr)*/
    unsigned short    f_flags;     /*flags*/
};
```

*f\_symptr* is the byte offset into the file at which the symbol table can be found. Its value can be used as the offset in the **fseek** library function to position an I/O stream to the symbol table. The operating system optional header is always 36 bytes. The valid magic numbers are given below. The first three apply to an Application Processor.

```
#define MC68KWRMAGIC 0520 /*writable test segments*/
#define MC68KROMAGIC 0521 /*readonly shareable text segs.*/
#define MC68KPGMAGIC 0522 /*demand paged text segments*/

#define N3BMAGIC     0550 /*3B20S*/
#define NTVMAGIC     0551 /*3B20S*/

#define VAXWRMAGIC   0570 /*VAX writable text segments*/
#define VAXROMAGIC   0575 /*VAX readonlyshareable*/
                      /*textsegments*/
```

## filehdr

The value in *f\_timdat* is obtained from the **time** system call.  
Flag bits currently defined are:

```
#define F_RELFLG    00001    /*relocation entries stripped*/
#define F_EXEC      00002    /*file is executable*/
#define F_LNNO      00004    /*line numbers stripped*/
#define F_LSYMS     00010    /*local symbols stripped*/
#define F_MINMAL    00020    /*minimal object file*/
#define F_UPDATE    00040    /*update file, ogen produced*/
#define F_SWABD     00100    /*file is "pre-swabbed"*/
#define F_AR16WR    00200    /*16 bit DEC host*/
#define F_AR32WR    00400    /*32 bit DEC host*/
#define F_AR32W     01000    /*non-DEC host*/
#define F_PATCH     02000    /*"patch" list in opt hdr*/
```

## See Also

**time** in Section 2; **fseek** in Section 3; **a.out**.

# fs

## Name

fs - format of file system

## Format

```
#include <sys/filsys.h>
#include <sys/types.h>
#include <sys/param.h>
```

## Description

Every file system has a common format for certain vital information. Every such file system is divided into a certain number of 512-byte long sectors. Sector 0 is unused and is available to contain a bootstrap program or other information.

Sector 1 is the super-block. The format of a super-block is:

```
/*
 * Structure of the super-block
 */
struct filsys
{
    ushort    s_lsiz; /* size in blocks of l-list */
    daddr_t   s_fsiz; /* size in blocks of file sys */
    short     s_nfree; /* no. of addresses in s_free */
    daddr_t   s_free[NICFREE]; /* free block list */
    short     s_ninode; /* number of i-nodes in s_inode */
    ino_t     s_inode[NICINOD]; /* free i-node list */
    char      s_flock; /* lock during free list manip. */
    char      s_llock; /* lock during i-list manip. */
    char      s_fmod; /* super block modified flag */
    char      s_ronly; /* mounted readonly flag */
    time_t    s_time; /* last super block update */
    short     s_dinfo[4]; /* device information */
    daddr_t   s_tfree; /* total free blocks */
    ino_t     s_tinode; /* total free i-nodes */
    char      s_fname[6]; /* file system name */
    char      s_fpack[6]; /* file system pack name */
    long      s_fsize[11]; /* ADJUST; make size of filsys */
                /* 512 */
};
```

## fs

```

short   s_dummy; /*reserved for future use*/
short   s_cluster; /*cluster size (PILF only)*/
long    s_bitsize; /*size of free block bit map*/
long    s_magic; /*magic no. to indicate new*/
        /*file system*/
long    s_type; /*type of new file system*/
};

#define FsMAGIC    0xfd187e20 /*s_magic number*/
#define Fs1b      1 /*512 byte block*/
#define Fs2b      2 /*1024 byte block*/
#define FsPILF    0x10000 /*PILF file system*/

```

CENTIX recognizes three kinds of file systems, specified by *s\_type*:

- Oriented to 512-byte I/O. Identified by an *s\_type* equal to Fs1b. This type is also assumed if *s\_magic* is not equal to FsMAGIC. (This type was originally the only type supported by UNIX Systems; CENTIX does not currently support this type.)
- Oriented to 1024-byte I/O. Identified by an *s\_type* equal to Fs2b. This is essentially the standard file system for CENTIX and UNIX System V.
- PILF (Performance Improvement In Large Files) file system. Identified by an *s\_type* equal to FsPILF. A PILF file system can be used like a standard file system, but is substantially more efficient when used with direct cluster I/O (see **pilf** in Section 5).

In the following description, the size of a logical block is determined by the file system type. For the original 512-byte oriented file system, a block is 512 bytes. For the 1024-byte oriented file system and the PILF file system, a block is 1024 bytes or two sectors. The operating system takes care of all conversions from logical block numbers to physical sector numbers.

## fs

*S\_size* is the address of the first data block after the i-list; the i-list starts just after the super-block, namely in block 2; thus the i-list is *s\_size* - 2 blocks long. *S\_size* is the first block not potentially available for allocation to a file. These numbers are used by the system to check for bad block numbers; if an "impossible" block number is allocated from the free list or is freed, a diagnostic is written on the on-line console. Moreover, the free array is cleared, so as to prevent further allocation from a presumable corrupted free list.

The free list is provided on 512-byte and 1024-byte file systems, but not on PILF file systems. It is maintained as follows. The *s\_free* array contains, in *s\_free*[1], ..., *s\_free*[*s\_nfree*-1], up to 49 numbers of free blocks. *S\_free*[0] is the block number of the head of a chain of blocks constituting the free list. The first long in each free-chain block is the number (up to 50) of free-block numbers listed in the next 50 longs of this chain member. The first of these 50 blocks is the link to the next member of the chain. To allocate a block: decrement *s\_nfree*, and the new block is *s\_free*[*s\_nfree*]. If the new block number is 0, there are no blocks left, so give an error. If *s\_nfree* became 0, read in the block named by the new block number, replace an *s\_nfree* by its first word, and copy the block numbers in the next 50 longs into the *s\_free* array. To free a block, check if *s\_nfree* is 50; if so, copy *s\_nfree* and the *s\_free* array into it, write it out, and set *s\_nfree* to 0. In any event set *s\_free*[*s\_nfree*] to the freed block's number and increment *s\_nfree*.

*S\_tfree* is the total free blocks available in the file system.

*S\_ninode* is the number of free i-numbers in the *s\_inode* array. To allocate an i-node: if *s\_ninode* is greater than 0, decrement it and return *s\_inode*[*s\_ninode*]. If it was 0, read the i-list and place the numbers of all free i-nodes (up to 100) into the *s\_inode* array, then try again. To free an i-node, provided *s\_ninode* is less than 100, place its number into *s\_inode*[*s\_ninode*] and increment *s\_ninode*. If *s\_ninode* is already 100, do not bother to enter the freed i-node into any table. This list of i-nodes is only to speed up the allocation process; the information as to whether the i-node is really free or not is maintained in the i-node itself.

## fs

*S\_tinode* is the total free i-nodes available in the file system.

*S\_flock* and *s\_ilock* are flags maintained in the core copy of the file system while it is mounted and their values on disk are immaterial. The value of *s\_fmod* on disk is likewise immaterial; it is used as a flag to indicate that the super-block has changed and should be copied to the disk during the next periodic update of file system information.

*S\_roonly* is a read-only to indicate write-protection.

*S\_time* is the last time the super-block of the file system was changed, and is the number of seconds that have elapsed since 00:00 Jan. 1, 1970 (GMT). During a reboot, the *s\_time* of the super-block for the root file system is used to set the system's idea of the time.

*S\_fname* is the name of the file system and *s\_fpack* is the name of the pack.

On a PILF file system, *s\_cluster* is the default cluster size exponent, used by a process that creates a file on the file system without specifying a default cluster size (see *syslocal* in Section).

I-numbers begin at 1, and the storage for i-nodes begins in block 2. I-nodes are 64 bytes long. I-node 1 is reserved for future use. I-node 2 is reserved for the root directory of the file system, but no other i-number has a built-in meaning. Each i\_node represents one file. For the format of an i-node and its flags, see *inode* (later in this section).

On a PILF file system, the bit map serves the function of the free list by showing which blocks are allocated to files. It is at the very end of the file system. *S\_bitsize* is the number of blocks in the bit map. Each bit in the bit map is 0 if the corresponding 1K data block is allocated to a file.

# fs

## Files

`/usr/include/sys/filsys.h`  
`/usr/include/sys/stat.h`

## See Also

**fsck**, **fsdb**, **mkfs** in Section 1; **inode**; **pilf** in Section 5.

# fspec

## Name

fspec - format specification in text files

## Description

It is sometimes convenient to maintain text files on CENTIX with non-standard tabs, (that is, tabs that are not set at every eighth column). Such files must generally be converted to a standard format, frequently by replacing all tabs with the appropriate number of spaces, before they can be processed by CENTIX commands. A format specification occurring in the first line of a text file specifies how tabs are to be expanded in the remainder of the file.

A format specification consists of a sequence of parameters separated by blanks and surrounded by the brackets <: and >:. Each parameter consists of a keyletter, possibly followed immediately by a value. The following parameters are recognized:

- |                |  |
|----------------|--|
| <i>ttabs</i>   | The <b>t</b> parameter specifies the tab settings for the file. The value of <i>tabs</i> must be one of the following 1) A list of column numbers separated by commas, indicating tabs set at the specified columns; 2) A - followed immediately by an integer <i>n</i> , indicating tabs at intervals of <i>n</i> columns; or 3) A - followed by the name of a "canned" tab specification. Standard tabs are specified by <b>t-8</b> , or equivalently, <b>t1, 9, 17, 25</b> , and so on. The canned tabs that are recognized are defined by the <b>tabs</b> shell command (see <b>tabs</b> , Section 1). |
| <i>ssize</i>   | The <b>s</b> parameter specifies a maximum line size. The value of <i>size</i> must be an integer. Size checking is performed after tabs have been expanded, but before the margin is prepended.   |
| <i>mmargin</i> | The <b>m</b> parameter specifies a number of spaces to be prepended to each line. The value of <i>margin</i> must be an integer.   |

## fspec

- d**                    The **d** parameter takes no value. Its presence indicates that the line containing the format specification is to be deleted from the converted file.
- e**                    The **e** parameter takes no value. Its presence indicates that the current format is to prevail only until another format specification is encountered in the file.

Default values, which are assumed for parameters not supplied, are **t-8** and **m0**. If the **s** parameter is not specified, no size checking is performed. If the first line of a file does not contain a format specification, the above defaults are assumed for the entire file. The following is an example of a line containing a format specification:

```
*<: t5,10,15 s72:>*
```

If a format specification can be disguised as a comment, it is not necessary to code the **d** parameter.

Several CENTIX commands correctly interpret the format specification for a file.

### See Also

**ed**, **newform**, **tabs** in Section 1.

# gettydefs

## Name

gettydefs - speed and terminal settings used by getty

## Description

The `/etc/gettydefs` file contains information used by the `getty` shell command to set up the speed and terminal settings for a line. It supplies information on what the login prompt should look like. It also supplies the speed to try next if the user indicates the current speed is not correct by typing a `<break>` character.

Each entry in `/etc/gettydefs` has the following format:

```
label# initial-flags # final-flags # login-prompt #next label
```

Each entry is followed by a blank line. The various fields can contain quoted characters of the form `/b`, `/n`, `/c`, and so on, as well as `/nnn`, where `nnn` is the octal value of the desired character. The various fields are:

### *label*

This is the string against which `getty` tries to match its second argument. It is often the speed, such as `1200`, at which the terminal is supposed to run, but it need not be (see below).

### *initial-flags*

These flags are the initial `ioctl` system call settings to which the terminal is to be set if a terminal type is not specified to `getty`. The flags that `getty` understands are the same as the ones listed in `/usr/include/sys/termio.h` (see `termio` in Section 6). Normally only the speed flag is required in the *initial-flags*. `getty` automatically sets the terminal to raw input mode and takes care of most of the other flags. The *initial-flag* settings remain in effect until `getty` executes `login`.

## gettydefs

### *final-flags*

These flags take the same values as the *initial-flags* and are set just prior to **getty** executes **login**. The speed flag is again required. The composite flag SANE takes care of most of the other flags that need to be set so that the processor and terminal are communicating in a rational fashion. The other two commonly specified final-flags are TAB3, so that tabs are sent to the terminal as spaces, and HUPCL, so that the line is hung up on the final close.

### *login-prompt*

This entire field is printed as the *login-prompt*. Unlike the above fields where white space is ignored (a space, tab or new-line), they are included in the *login-prompt* field.

### *next-label*

If this entry does not specify the desired speed, indicated by the user typing a <break> character, then **getty** will search for the entry with *next-label* as its label field and set up the terminal for those settings. Usually, a series of speeds are linked together in this fashion, into a closed set; for instance, 2400 linked to 1200, which in turn is linked to 300, which finally is linked to 2400.

If **getty** is called without a second argument, then the first entry of `/etc/gettydefs` is used, thus making the first entry of `/etc/gettydefs` the default entry. It is also used if **getty** cannot find the specified label. If `/etc/gettydefs` itself is missing, there is one entry built into the command that will bring up a terminal at 9600 baud.

It is strongly recommended that after making or modifying `/etc/gettydefs`, it be run through **getty** with the check option to be sure there are no errors.

## Files

`/etc/gettydefs`

## See Also

**getty**, **login** in Sec. 1; **ioctl** in Sec. 2; **termio** in Sec. 6.

# group

## Name

group - group file

## Description

Group contains for each group the following information:

- group name
- encrypted password
- numerical group ID
- comma-separated list of all users allowed in the group

This is an ASCII file. The fields are separated by colons; each group is separated from the next by a new-line. If the password field is null, no password is demanded.

This file resides in directory /etc. Because of the encrypted passwords, it can and does have general read permission and can be used, for example, to map numerical group IDs to names.

## Files

/etc/group

## See Also

**newgrp** and **passwd** in Section 1; **crypt** in Section 3; **passwd** in Section 4.

# inittab

## Name

inittab - script for the `init` process

## Description

The `inittab` file supplies the script to `init`'s role as a general process dispatcher. A separate `inittab` is required for each processor; the last two characters of the name are the processor number. The process that constitutes the majority of `init`'s process dispatching activities is the line process `/etc/getty` that initiates individual terminal lines. Other processes typically dispatched by `init` are daemons and the shell.

The `inittab` file is composed of entries that are position dependent and have the following format:

```
id:rstate:action:process
```

Each entry is delimited by a new-line, however, a backslash (\) preceding a new-line indicates a continuation of the entry. Up to 512 characters per entry are permitted. Comments may be inserted in the process field using the `sh` command convention for comments. Comments for lines that spawn `gettys` are displayed by the `who` command. It is expected that they will contain some information about the line, such as the location. There are no limits (other than maximum entry size) imposed on the number of entries within the `inittab` file. The entry fields are:

*id*

This is one to four characters used to uniquely identify an entry.

# inittab

## *rstate*

This defines the run-level in which this entry is to be processed. Run-levels effectively correspond to a configuration of processes in the system. That is, each process spawned by *init* is assigned a run-level or run-levels in which it is allowed to exist. The run-levels are represented by a number ranging from 0 through 6. As an example, if the system is in run-level 1, only those entries having a 1 in the *rstate* field will be processed. When *init* is requested to change run-levels, all processes that do not have an entry in the *rstate* field for the target run-level will be sent the warning signal (SIGTERM) and allowed a 20-second grace period before being forcibly terminated by a kill signal (SIGKILL). The *rstate* field can define multiple run-levels for a process by selecting more than one run-level in any combination from 0-6. If no run-level is specified, then the process is assumed to be valid at all run-levels 0-6. There are three other values, *a*, *b*, and *c*, which can appear in the *rstate* field, even though they are not true run-levels. Entries that have these characters in the *rstate* field are processed only when the *telinit* (see *init* in Section 1) process requests them to be run (regardless of the current run-level of the system). They differ from run-levels in that *init* can never enter run-level *a*, *b* or *c*. Also, a request for the execution of any of these processes does not change the current run-level. Furthermore, a process started by an *a*, *b*, or *c* command is not killed when *init* changes levels. They are only killed if their line in */etc/inittab* is marked *off* in the action field, their line is deleted entirely from */etc/inittab*, or *init* goes into the single-user state.

## *action*

Key words in this field tell *init* how to treat the process specified in the process field. The actions recognized by *init* are as follows:

### **respawn**

If the process does not exist, start the process; do not wait for its termination (continue scanning the inittab file). When it dies, restart the process. If the process currently exists, do nothing and continue scanning the inittab file.

# inittab

|                  |  |
|------------------|--|
| <b>wait</b>      | Upon <code>init</code> 's entering the run-level that matches the entry's <i>rstate</i> , start the process and wait for its termination. All subsequent reads of the <code>inittab</code> file while <code>init</code> is in the same run-level will cause <code>init</code> to ignore this entry.  |
| <b>once</b>      | Upon <code>init</code> 's entering a run-level that matches the entry's <i>rstate</i> , start the process; do not wait for its termination. When it dies, do not restart the process. If upon entering a new run-level, where the process is still running from a previous run-level change, the program will not be restarted.  |
| <b>boot</b>      | The entry is to be processed only at <code>init</code> 's boot-time read of the <code>inittab</code> file. <code>init</code> is to start the process, not wait for its termination, and when it dies, not restart the process. In order for this instruction to be meaningful, the <i>rstate</i> should be the default or it must match <code>init</code> 's run-level at boot time. This action is useful for an initialization function following a hardware reboot of the system. |
| <b>bootwait</b>  | The entry is to be processed only at <code>init</code> 's boot-time read of the <code>inittab</code> file. <code>init</code> is to start the process, wait for its termination and, when it dies, not restart the process.   |
| <b>powerfail</b> | Execute the process associated with this entry only when <code>init</code> receives a power fail signal (SIGPWR). See <code>signal</code> , Section 2.   |

# inittab

|                    |   |
|--------------------|---|
| <b>powerwait</b>   | Execute the process associated with this entry only when <b>init</b> receives a power fail signal (SIGPWR) and wait until it terminates before continuing any processing of inittab.  |
| <b>off</b>         | If the process associated with this entry is currently running, send the warning signal (SIGTERM) and wait 20 seconds before forcibly terminating the process via the kill signal (SIGKILL). If the process is nonexistent, ignore the entry.   |
| <b>ondemand</b>    | This instruction is really a synonym for the <b>respawn</b> action. It is functionally identical to <b>respawn</b> but is given a different keyword in order to divorce its association with run-levels. This is used only with the <b>a</b> , <b>b</b> , or <b>c</b> values described in the <i>rstate</i> field.  |
| <b>initdefault</b> | An entry with this action is only scanned when <b>init</b> is initially invoked. <b>init</b> uses this entry, if it exists, to determine which run-level to enter initially. It does this by taking the highest run-level specified in the <i>rstate</i> field and using that as its initial state. If the <i>rstate</i> field is empty, this is interpreted as <b>0123456</b> , causing <b>init</b> to enter run-level 6. Also, the <b>initdefault</b> entry can use <b>s</b> to specify that <b>init</b> start in the single-user state. Additionally, if <b>init</b> doesn't find an <b>initdefault</b> entry in <i>/etc/inittab</i> , then it will request an initial run-level from the user at reboot time. |

# inittab

## sysinit

Entries of this type are executed before `init` tries to access the console. It is expected that this entry will be only used to initialize devices on which `init` might try to ask the run-level question. These entries are executed and waited for before continuing.

## *process*

This is a `sh` command to be executed. The entire *process* field is prefixed with `exec` and passed to a forked `sh` as `sh -c 'exec command'`. For this reason, any legal `sh` syntax can appear in the *process* field. Comments can be inserted with the `;` *comment* syntax.

## Files

`/etc/inittab??` (last two characters specify the Application Processor)

## See Also

`getty`, `init`, `sh`, `who` in Section 1; `exec`, `open`, `signal` in Section 2.

# inode

## Name

inode - format of an i-node

## Format

```
#include <sys/types.h>
#include <sys/ino.h>
```

## Description

An i-node for a plain file or directory in a file system has the following structure defined by <sys/ino.h>.

```
/*inode structure as it appears on a disk block.*/
struct dinode
{
    ushort di_mode;      /*mode and type of file*/
    short di_nlink;     /*number of links to file*/
    ushort di_uid;     /*owner's user id*/
    ushort di_gid;     /*owner's group id*/
    off_t di_size;     /*number of bytes in file*/
    char di_addr[39];  /*disk block addresses*/
    char di_cl;        /*PILF cluster size exponent*/
    time_t di_atime;   /*time last accessed*/
    time_t di_mtime;  /*time last modified*/
    time_t di_ctime;  /*time of last file stat change*/
};
/*
 * the 40 address bytes:
 * 39 used; 13 addresses
 * of 3 bytes each.
 */
```

For the meaning of the defined types *off\_t* and *time\_t*, see **types** in Section 5.

In a PILF file, addresses are organized as in a standard 1K file system, with identical use of blocks of additional addresses. Data addresses, however, do not point to individual 1K blocks; instead, each points to the first block of a contiguous cluster of blocks, each of which is  $2^n$  1K blocks long, where *n* is the value in the *di\_cl* field.

# inode

## Files

`/usr/include/sys/ino.h`

## See Also

`stat` in Section 2; `fs`; `piif`, `types` in Section 5.

# issue

## Name

issue - issue identification file

## Description

The file `/etc/issue` contains the issue or project identification to be printed as a login prompt. This is an ASCII file that is read by program **getty** and then written to any terminal spawned or respawned from the lines file.

## Files

`/etc/issue`

## See Also

**login** in Section 1.

# ldfcn

## Name

ldfcn - common object file access routines

## Format

```
#include <stdio.h>
#include <filehdr.h>
#include <ldfcn.h>
```

## Description

The common object file access routines are a collection of functions for reading an object file that is in common object file form. Although the calling program must know the detailed structure of the parts of the object file that it processes, the routines effectively insulate the calling program from knowledge of the overall structure of the object file.

The interface between the calling program and the object file access routines is based on the defined type LDFILE, defined as struct ldfile, declared in the header file ldfcn.h. The primary purpose of this structure is to provide uniform access to both simple object files and to object files that are members of an archive file.

The library function **ldopen** allocates and initializes the LDFILE structure and returns a pointer to the structure to the calling program. The fields of the LDFILE structure may be accessed individually through macros defined in ldfcn.h. They contain the following information:

|                               |   |
|-------------------------------|---|
| LDFILE *ldptr;<br>TYPE(ldptr) | The file magic number, used to distinguish between archive members and simple object files. |
| OPTR(ldptr)                   | The file pointer returned by <i>fopen</i> and used by the standard input/output functions.  |

## ldfcn

|               |   |
|---------------|---|
| OFFSET(ldptr) | The file address of the beginning of the object file; the offset is non-zero if the object file is a member of an archive file. |
| HEADER(ldptr) | The file header structure of the object file.   |

The object file access functions themselves may be divided into four categories:

### 1 Functions that open or close an object file.

- **ldopen** and **ldaopen** open a common object file.
- **ldclose** and **ldaclose** close a common object file.

### 2 Functions that read header or symbol table information.

- **ldahread** reads the archive header of a member of an archive file.
- **ldfhread** reads the file header of a common object file.
- **ldshread** and **ldnshread** read a section header of a common object file.
- **ldtbread** reads a symbol table entry of a common object file.

### 3 Functions that position an object file at (seek to) the start of the section, relocation, or line number information for a particular section.

- **ldohseek** seek to the optional file header of a common object file.
- **ldsseek** and **ldnsseek** seek to a section of a common object file.
- **ldrseek** and **ldnrseek** seek to the relocation information for a section of a common object file.
- **ldlseek** and **ldnlseek** seek to the line number information for a section of a common object file.
- **ldtbseek** seek to the symbol table of a common object file.

### 4 The function **ldtbindex**, which returns the index of a particular common object file symbol table entry

## ldfcn

These functions are described in detail in their respective manual pages in Section 3.

All the functions except **ldopen**, **ldaopen** and **ldtbindx** return either **SUCCESS** or **FAILURE**, both constants defined in **ldfcn.h**. **ldopen** and **ldaopen** both return pointers to an **LDFILE** structure.

## Macros

Additional access to an object file is provided through a set of macros defined in **ldfcn.h**. These macros parallel the standard input/output file reading and manipulating functions, translating a reference of the **LDFILE** structure into a reference to its file descriptor field.

The following macros are provided:

```
LDFILE*ldptr;

GETC(ldptr)
FGETC(ldptr)
GETW(ldptr)
UNGETC(c, ldptr)
FGETS(s, n, ldptr)
FREAD((char*) ptr, sizeof (*ptr), nitems, ldptr)
FSEEK(ldptr, offset, ptrname)
FTELL(ldptr)
REWIND(ldptr)
FEOF(ldptr)
FERROR(ldptr)
FILENO(ldptr)
SETBUF(ldptr, buf)
```

See the manual entries for the corresponding standard input/output library functions for details on the use of these macros.

The program must be loaded with the object file access routine library **libld.a**.

# ldfcn

## Caution

The macro FSEEK defined in the header file ldfcn.h translates into a call to the standard input/output function fseek. FSEEK should not be used to seek from the end of an archive file since the end of an archive file may not be the same as the end of one of its object file members!

## See Also

**fseek, ldahread, ldclose, ldfhread, ldhread, ldseek, ldohseek, ldopen, ldrseek, ldseek, ldshread, ldtbindex, ldtbread, ldtbseek** in Section 3.

# linenum

## Name

linenum - line number entries in a common object file

## Format

```
#include <linenum.h>
```

## Description

Compilers based on **pcc** generate an entry in the object file for each C source line on which a breakpoint is possible (when invoked with the **-g** option; see **cc** in Section 1). Users can then reference line numbers when using the appropriate software test system. The structure of these line number entries appears below.

```
struct lineno
{
    union
    {
        long      l_symndx;
        long      l_paddr;
    }
    unsigned short l_inno;
};
```

## linenum

Numbering starts with one for each function. The initial line number entry for a function has *L\_Inno* equal to zero, and the symbol table index of the function's entry is in *L\_symndx*. Otherwise, *L\_Inno* is non-zero, and *L\_paddr* is the physical address of the code for the referenced line. Thus the overall structure is the following:

| <i>L_addr</i>         | <i>L_Inno</i> |
|-----------------------|---------------|
| function symtab index | 0             |
| physical address      | line          |
| physical address      | line          |
| ....                  |               |
| function symtab index | 0             |
| physical address      | line          |
| physical address      | line          |
| ....                  |               |

### See Also

cc in Section 1; a.out.

# master

## Name

master - master device information table

## Description

This file is used by the **config** program to obtain device information that enables it to generate the configuration files. Do not modify it unless you fully understand its construction. The file consists of 3 parts, each separated by a line with a dollar sign (\$) in column 1. Part 1 contains device information; part 2 contains names of devices that have aliases; part 3 contains tunable parameter information. Any line with an asterisk (\*) in column 1 is treated as a comment.

Part 1 contains lines consisting of 6 or 7 fields, with the fields delimited by tabs and/or blanks:

|          |   |
|----------|---|
| Field 1: | device name (S chars. maximum).   |
| Field 2: | device mask (octal)-each "on" bit indicates that the handler exists:<br>000100 initialization handler<br>000040 power-failure handler<br>000020 open handler<br>000010 close handler<br>000004 read handler<br>000002 write handler<br>000001 ioctl handler                             |
| Field 3: | device type indicator (octal):<br>000200 allow only one of these devices<br>000100 suppress count field in conf.c file<br>000040 suppress interrupt vector<br>000020 required device<br>000010 block device<br>000004 character device<br>000002 floating vector<br>000001 fixed vector |
| Field 4: | handler prefix (4 chars. maximum).  |
| Field 5: | major device number for block-type device   |
| Field 6: | major device number for character-type device   |
| Field 7: | (optional) maximum serial devices on system   |

## master

Part 2 contains lines with 2 fields each:

Field 1:                    alias name of device (8 chars. maximum).  
Field 2:                    reference name of device (8 chars. maximum; specified in  
                              part 1).

Part 3 contains lines with 2 or 3 fields each:

Field 1:                    parameter name (as it appears in description file; 20 chars.  
                              maximum)  
Field 2:                    parameter name (as it appears in the **conf.c** file; 20 chars.  
                              maximum)  
Field 3:                    default parameter value (20 chars. maximum; parameter  
                              specification is required if this field is omitted)

## See Also

**config** in Section 1.

# mnttab

## Name

mnttab - mounted file system table

## Format

```
#include <mnttab.h>
```

## Description

Mnttab resides in directory /etc and contains a table of devices, mounted by the **mount** shell command, in the following structure as defined by <mnttab.h>:

```
struct    mnttab {
          char          mt_dev[32];
          char          mt_fsys[32];
          short         mt_ro_flg;
          time_t        mt_time;
};
```

Each entry is 70 bytes in length; the first 32 bytes are the null-padded name of the place where the special file is mounted; the next 32 bytes represent the null-padded root name of the mounted special file; the remaining 6 bytes contain the mounted special file's read/write permissions and the date on which it was mounted.

The maximum number of entries in mnttab is based on the system parameter NMOUNT located in /usr/src/uts/cf/conf.c, which defines the number of allowable mounted special files.

## See Also

**mount** and **setmnt** in Section 1.

# passwd

## Name

passwd - password file

## Description

Passwd contains for each user the following information:

- login name
- encrypted password
- numerical user ID
- numerical group ID
- a field with no standard use
- initial working directory
- program to use as Shell

This is an ASCII file. Each field within each user's entry is separated from the next by a colon. The fifth field exists for historical reasons; it is often used to hold the user's name and address. Each user is separated from the next by a new-line. If the password field is null, no password is demanded; if the Shell field is null, the Shell itself is used.

This file resides in directory /etc. Because of the encrypted passwords, it can and does have general read permission and can be used, for example, to map numerical user IDs to names.

The encrypted password consists of 13 characters chosen from a 64-character alphabet (., /, 0-9, A-Z, a-z), except when the password is null, in which case the encrypted password is also null. Password aging is effected for a particular user if his or her encrypted password in the password file is followed by a comma and a non-null string of characters from the above alphabet. (Such a string must be introduced in the first instance by the super-user.)

## passwd

The first character of the age, *M* say, denotes the maximum number of weeks for which a password is valid. A user who attempts to login after his or her password has expired will be forced to supply a new one. The next character, *m* say, denotes the minimum period in weeks that must expire before the password may be changed. The remaining characters define the week (counted from the beginning of 1970) when the password was last changed. (A null string is equivalent to zero.) *M* and *m* have numerical values in the range 0-63 that correspond to the 64-character alphabet shown above (that is, / = 1 week; z = 63 weeks). If  $m = M = 0$  (derived from the string . or ..) the user will be forced to change his password the next time he or she logs in (and the "age" will disappear from the entry in the password file). If  $m > M$  (signified, for example, by the string ./) only the super-user will be able to change the password.

## Files

/etc/passwd

## See Also

login, passwd in Section 1; a64l, crypt, getpwent in Section 3; group.

# profile

## Name

profile - setting up an environment at login time

## Description

If your login directory contains a file named `.profile`, that file will be executed (via the shell's `exec .profile`) before your session begins; `.profiles` are handy for setting exported environment variables and terminal modes. If the file `/etc/profile` exists, it will be executed for every user before the `.profile`. The following example is typical (except for the comments):

```
# Make some environment variables global
export MAIL PATH TERM
# Set file creation mask
umask 22
# Tell me when new mail comes in
MAIL = /usr/mail/myname
# Add my /bin directory to the shell search sequence
PATH = $PATH:$HOME/bin
# Set terminal type
export TERM
while true
do
    echo 'terminal: /c'
    read TERM
    if tset
    then
        break
    fi
done
```

## Files

`$HOME/.profile`  
`/etc/profile`

## See Also

`tset`, `env`, `login`, `mail`, `sh`, `stty`, `su` in Section 1; `environ`, `term` in Section 5.

# reloc

## Name

reloc - relocation information for a common object file

## Format

```
#include <reloc.h>
```

## Description

Object files have one relocation entry for each relocatable reference in the text or data. If relocation information is present, it will be in the following format:

```
struct reloc
{
    long   r_vaddr; /*(virtual) address of reference*/
    long   r_symndx; /*index into symbol table*/
    short  r_type; /*relocation type*/
};

/*
 * All generics
 *   reloc. already performed to symbol in the same section
 */
#define R_ABS          0

/*
 * 3B generic
 *   24-bit direct reference
 *   24-bit "relative" reference
 *   16-bit optimized "indirect" TV reference
 *   24-bit "indirect" TV reference
 *   32-bit "indirect" TV reference
 */
#define R_DIR24       04
#define R_REL24       05
#define R_OPT16       014
#define R_IND24       015
#define R_IND32       016

/*
 * DEC Processors VAX 11/780 and VAX 11/750
 * Also Motorola Processors 68000, 68010, and 68020
 */
/*
 */
#define R_RELBYTE     017
#define R_RELWORD     020
#define R_RELLONG     021
#define R_PCRBYTE     022
#define R_PCRWORD     023
#define R_PCRLONG     024
```

## reloc

As the link editor reads each input section and performs relocation, the relocation entries are read. They direct how references found within the input section are treated.

|           |   |
|-----------|---|
| R_ABS     | The reference is absolute, and no relocation is necessary. The entry will be ignored.   |
| R_DIR24   | A direct, 24-bit reference to a symbol's virtual address.   |
| R_REL24   | A "PC-relative," 24-bit reference to a symbol's virtual address. Relative references occur in instructions such as jumps and calls. The actual address used is obtained by adding a constant to the value of the program counter at the time the instruction is executed. |
| R_OPT16   | An optimized, indirect, 16-bit reference through a transfer vector. The instruction contains the offset into the transfer vector table to the transfer vector where the actual address of the referenced word is stored.  |
| R_IND24   | An indirect, 24-bit reference through a transfer vector. The instruction contains the virtual address of the transfer vector, where the actual address of the referenced word is stored.  |
| R_IND32   | An indirect, 32-bit reference through a transfer vector. The instruction contains the virtual address of the transfer vector, where the actual address of the referenced word is stored.  |
| R_RELBYTE | A direct 8-bit reference to a symbol's virtual address.   |
| R_RELWORD | A direct 16-bit reference to a symbol's virtual address.  |
| R_RELLONG | A direct 32-bit reference to a symbol's virtual address.  |
| R_PCRBYTE | A "PC-relative," 8-bit reference to a symbol's virtual address.   |
| R_PCRWORD | A "PC-relative," 16-bit reference to a symbol's virtual address.  |
| R_PCRLONG | A "PC-relative," 32-bit reference to a symbol's virtual address.  |

On the VAX processors, relocation of a symbol index of -1 indicates that the relative difference between the current segment's start address and the program's load address is added to the relocatable address.

Other relocation types will be defined as they are needed.

## **reloc**

Relocation entries are generated automatically by the assembler and automatically utilized by the link editor. A link editor option exists for removing the relocation entries from an object file.

### **See Also**

**ld, strip** in Section 1; **a.out, syms**.

# sccsfile

## Name

sccsfile - format of SCCS file

## Description

An SCCS file is an ASCII file. It consists of six logical parts: the *checksum*, the *delta table* (contains information about each delta), *user names* (contains login names and/or numerical group IDs of users who may add deltas), *flags* (contains definitions of internal keywords), *comments* (contains arbitrary descriptive information about the file), and the *body* (contains the actual text lines intermixed with control lines).

Throughout an SCCS file there are lines that begin with the ASCII SOH (start of heading) character (octal 001). This character is hereafter referred to as the control character and will be represented graphically as @. Any line described below which is not depicted as beginning with the control character is prevented from beginning with the control character.

Entries of the form DDDDD represent a five-digit string (a number between 00000 and 99999).

Each logical part of an SCCS file is described in detail below.

## Checksum

The checksum is the first line of an SCCS file. The form of the line is:

@hDDDDD

The value of the checksum is the sum of all characters, except those of the first line. The @h provides a magic number of (octal) 064001.

## sccsfile

### Delta table

The delta table consists of a variable number of entries of the form:

```

@s DDDDD/DDDDD/DDDDD
@d <type><SCCS ID> yr/mo/da hr:mi:se <pgmr> DDDDD DDDDD

@i DDDDD ...
@x DDDDD ...
@g DDDDD ...
@m <MR number>
.
.
.
@c <comments> ...
.
.
.
@e

```

The first line (**@s**) contains the number of lines inserted/deleted/unchanged, respectively. The second line (**@d**) contains the type of the delta (currently, normal: **D**, and removed: **R**), the SCCS ID of the delta, the date and time of creation of the delta, the login name corresponding to the real user ID at the time the delta was created, and the serial numbers of the delta and its predecessor, respectively.

The **@i**, **@x**, **@g** lines contain the serial numbers of deltas included, excluded, and ignored, respectively. These lines are optional.

The **@m** lines (optional) each contain one **MR** number associated with the delta; the **@c** lines contain comments associated with the delta.

The **@e** line ends the delta table entry.

# sccsfile

## User names

The list of login names and/or numerical group IDs of users who may add deltas to the file, separated by new-lines. The lines containing these login names and/or numerical group IDs are surrounded by the bracketing lines @u and @U. An empty list allows anyone to make a delta. Any line starting with a ! prohibits the succeeding group or user from making deltas.

## Flags

Keywords used internally (see **admin** in Section 1 for more information on their use). Each flag line takes the form:

@f<flag>      <optional text>

The following flags are defined:

|     |                                  |
|-----|----------------------------------|
| @ft | <type of program>                |
| @fv | <program name>                   |
| @fi | <keyword string>                 |
| @fb |                                  |
| @fm | <module name>                    |
| @ff | <floor>                          |
| @fc | <ceiling>                        |
| @fd | <default-sid>                    |
| @fn |                                  |
| @fj |                                  |
| @fl | <lock-releases>                  |
| @fq | <user defined>                   |
| @fz | <reserved for use in interfaces> |

## sccsfile

The **t** flag defines the replacement for the **%Y%** identification keyword. The **v** flag controls prompting for MR numbers in addition to comments; if the optional text is present it defines an MR number validity checking program. The **i** flag controls the warning/error aspect of the "No id keywords" message. When the **i** flag is not present, this message is only a warning; when the **i** flag is present, this message will cause a "fatal" error (the file will not be gotten, or the delta will not be made). When the **b** flag is present, the **-b** keyletter may be used on the **get** command to cause a branch in the delta tree. The **m** flag defines the first choice for the replacement text of the **%M%** identification keyword. The **f** flag defines the "floor" release (the release below which no deltas may be added). The **c** flag defines the "ceiling" release (the release above which no deltas may be added). The **d** flag defines the default SID to be used when none is specified on a **get** command. The **n** flag causes **delta** to insert a "null" delta (a delta that applies no changes) in those releases (for example, when delta 5.1 is made after delta 2.7, releases 3 and 4 are skipped). The absence of the **n** flag causes skipped releases to be completely empty. The **j** flag causes **get** to allow concurrent edits of the same base SID. The **l** flag defines a list of releases that are locked against editing (**get** with the **-e** keyletter). The **q** flag defines the replacement for the **%Q%** identification keyword. The **s** flag is used in certain specialized interface programs.

### Comments

Arbitrary text is surrounded by the bracketing lines **@t** and **@T**. The comments section typically will contain a description of the file's purpose.

## sccsfile

### Body

The body consists of text lines and control lines. Text lines do not begin with the control character, control lines do. There are three kinds of control lines: insert, delete, and end, represented by:

```
@I DDDDD  
@D DDDDD  
@E DDDDD
```

respectively. The digit string is the serial number corresponding to the delta for the control line.

### See Also

**admin, delta, get, prs** in Section 1.

# scnhdr

## Name

scnhdr - section header for a common object file

## Format

```
#include <scnhdr.h>
```

## Description

Every common object file has a table of section headers to specify the layout of the data within the file. Each section within an object file has its own header. The C structure appears below.

```
struct scnhdr
{
    char          s_name[SYMNMLEN]; /*section name*/
    long          s_paddr; /*physical address*/
    long          s_vaddr; /*virtual address*/
    long          s_size; /*section size*/
    long          s_scnptr; /*file ptr to raw data*/
    long          s_relptr; /*file ptr to relocat.*/
    long          s_innoptr; /*file ptr to line #s*/
    unsigned short s_nreloc; /*# reloc entries*/
    unsigned short s_nlnno; /*# line no. entries*/
    long          s_flags; /*flags*/
};
```

File pointers are byte offsets into the file; they can be used as the offset in a call to **fseek** (see Section 3). If a section is initialized, the file contains the actual bytes. An uninitialized section is somewhat different. It has a size, symbols defined in it, and symbols that refer to it. But it can have no relocation entries, line numbers, or data. Consequently, an uninitialized section has no raw data in the object file, and the values for *s\_scnptr*, *s\_relptr*, *s\_innoptr*, *s\_nreloc*, and *s\_nlnno* are zero.

## See Also

**ld** in Section 1; **fseek** in Section 3; **a.out**.

# syms

## Name

syms - common object file symbol table format

## Format

```
#include <syms.h>
```

## Description

Common object files contain information to support symbolic software testing (see **sdb** in Section 1). Line number entries (see **linenum**), and extensive symbolic information permit testing at the C source level. Every object file's symbol table is organized as shown below.

```
File name 1.
Function 1.
    Local symbols for function 1.
Function 2.
    Local symbols for function 2.
...
Static externs for file 1.

File name 2.
Function 1.
    Local symbols for function 1.
Function 2.
    Local symbols for function 2.
...
Static externs for file 2.
...

Defined global symbols.
Undefined global symbols.
```

The entry for a symbol is a fixed-length structure. The members of the structure hold the name (null padded), its value, and other information.

## syms

The C structure is given below.

```
#define SYMNLEN 8
#define FILNLEN 14
#define DIMNUM 4

struct syment
{
    union /*all ways to get symbol name*/
    {
        char    _n_name[SYMNLEN]; /*symbol name*/
        struct
        {
            long    _n_zeroes; /*==0L when in string table*/
            long    _n_offset; /*location of name in table*/
        }_n_n;
        char    *_n_nptr[2]; /*allows overlaying*/
    }_n;
    long    n_value; /*value of symbol*/
    short   n_scnum; /*section number*/
    unsigned short n_type; /*type and derived type*/
    char    n_class; /*storage class*/
    char    n_numaux; /*number of aux entries*/
};

#define n_name    _n._n_name
#define n_zeroes  _n._n_n._n_zeroes
#define n_offset  _n._n_n._n_offset
#define n_nptr    _n._n_nptr[1]
```

Some symbols require more information than a single entry; they are followed by auxiliary entries that are the same size as a symbol entry. The format follows.

## syms

```

union auxent
{
    struct
    {
        long      x_tagndx;
        union
        {
            struct
            {
                unsigned short  x_inno;
                unsigned short  x_size;
            } x_insz;
            long x_fsize;
        } x_misc;
        union
        {
            struct
            {
                long x_innoptr;
                long x_endndx;
            } x_fcn;
            struct
            {
                unsigned short  x_dimen[DIMNUM];
            } x_ary;
        } x_fcary;
        unsigned short x_tvndx;
    } x_sym;
    struct
    {
        char x_fname[FILNMLEN];
    } x_file;
    struct
    {
        long x_scnlen;
        unsigned short x_nreloc;
        unsigned short x_nlinno;
    } x_scn;

    struct
    {
        long x_tvfill;
        unsigned short x_tvlen;
        unsigned short x_tvran[2];
    } x_tv;
};

```

Indexes of symbol table entries begin at zero.

## **syms**

### **Cautions**

CENTIX C longs are equivalent to ints and are converted to ints in the compiler to minimize the complexity of the compiler code generator. Thus, the information about which symbols are declared as longs and which symbols are declared as ints does not show up in the symbol table.

### **See Also**

**sdb** in Section 1; **a.out**, **linenum**.

# term

## Name

term - format of compiled term file.

## Format

term

## Description

Compiled terminfo descriptions are placed under the directory `/usr/lib/terminfo`. In order to avoid a linear search of a huge directory, a two-level scheme is used:

`/usr/lib/terminfo/c/name` where *name* is the name of the terminal, and *c* is the first character of *name*. Thus, `act4` can be found in the file `/usr/lib/terminfo/a/act4`. Synonyms for the same terminal are implemented by multiple links to the same compiled file.

The format has been chosen so that it will be the same on all hardware. An 8 or more bit byte is assumed, but no assumptions about byte ordering or sign extension are made.

The compiled file is created with the `compile` program, and read by the routine `setupterm`. Both of these pieces of software are part of `curses` (see Section 3). The file is divided into six parts: the header, terminal names, Boolean flags, numbers, strings, and string table.

The header section begins the file. This section contains six short integers in the format described below. These integers are (1) the magic number (octal 0432); (2) the size, in bytes, of the names section; (3) the number of bytes in the Boolean section; (4) the number of short integers in the numbers section; (5) the number of offsets (short integers) in the strings section; (6) the size, in bytes, of the string table.

## term

Short integers are stored in two 8-bit bytes. The first byte contains the least significant 8 bits of the value, and the second byte contains the most significant 8 bits. (Thus, the value represented is  $256 * \text{second} + \text{first}$ .) The value -1 is represented by 0377, 0377; other negative values are illegal. The -1 generally means that a capability is missing from this terminal. Note that this format corresponds to the hardware of the VAX and PDP-11. Machines where this does not correspond to the hardware read the integers as two bytes and compute the result.

The terminal names section comes next. It contains the first line of the terminfo description, listing the various names for the terminal, separated by the "|" character. The section is terminated with an ASCII NUL character.

The Boolean flags have one byte for each flag. This byte is either 0 or 1 as the flag is present or absent. The capabilities are in the same order as the file <term.h>.

Between the Boolean section and the number section, a null byte will be inserted, if necessary, to ensure that the number section begins on an even byte. All short integers are aligned on a short word boundary.

The numbers section is similar to the flags section. Each capability takes up two bytes, and is stored as a short integer. If the value represented is -1, the capability is taken to be missing.

The strings section is also similar. Each capability is stored as a short integer, in the format above. A value of -1 means the capability is missing. Otherwise, the value is taken as an offset from the beginning of the string table. Special characters in  $\backslash X$  or  $\backslash c$  notation are stored in their interpreted form, not the printing representation. Padding information  $\$<nn>$  and parameter information  $\%x$  are stored intact in uninterpreted form.

The final section is the string table. It contains all the values of string capabilities referenced in the string section. Each string is null terminated.

## term

Note that it is possible for **setupterm** to expect a different set of capabilities than are actually present in the file. Either the database may have been updated since **setupterm** has been recompiled (resulting in extra unrecognized entries in the file) or the program may have been recompiled more recently than the database was updated (resulting in missing entries). The routing **setupterm** must be prepared for both possibilities - this is why the numbers and sizes are included. Also, new capabilities must always be added at the end of the lists of Boolean, number, and string capabilities.

As an example, an octal dump of the description for the Microterm ACT 4 is included:

```
microterm|act4|microterm act iv,
cr=^M, cud1=^J, ind=^J, bel=^G, am, cub1=^H,
ed=^_, el=^^, clear=^L, cup=^T%p1%c%p2%c,
cols#60, lines#24, cuf1=^X, cuu1=^Z, home=^],

000 032 001  \0 025 \0 \b \0 212 \0 " \0 m i c r
020 o t e r m | a c t 4 | m i c r o
040 t e r m   a c t   i v \0 \0 001 \0 \0
080 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0
100 \0 \0 P \0 377 377 030 \0 377 377 377 377 377 377 377
120 377 377 377 377 \0 \0 002 \0 377 377 377 377 004 \0 006 \0
140 \b \0 377 377 377 377 \n \0 026 \0 030 \0 377 377 032 \0
160 377 377 377 377 034 \0 377 377 036 \0 377 377 377 377 377
200 377 377 377 377 377 377 377 377 377 377 377 377 377 377
*

520 377 377 377 377 \0 377 377 377 377 377 377 377 377 377
540 377 377 377 377 377 007 \0 \r \0 \f \0 036 \0 037 \0
560 024 % p 1 % c % p 2 % c \0 \n \0 035 \0
600 \b \0 030 \0 032 \0 \n \0
```

Some limitations: total compiled entries cannot exceed 4096 bytes. The name field cannot exceed 128 bytes.

## Files

`/usr/lib/terminfo/*/*` - compiled terminal capability data base

## See Also

**curses** in Section 3; **terminfo**.

# termcap

## Name

termcap - terminal capability data base

## Format

`/etc/termcap`

## Description

This entry describes terminal-independent programming conventions that originate at UC Berkeley. UNIX System V initially borrowed termcap but has since changed to the terminfo convention. CENTIX continues to support termcap so as to be compatible with the Berkeley version of the UNIX System, but use terminfo in new programs.

Termcap programs work from information supplied through the TERM and TERMCAP environment variables. The location of the description depends on the value of TERMCAP.

- If TERMCAP is not set or is empty, TERM is the name of a description in `/etc/termcap`.
- If TERMCAP has a value that begins with a `/`, TERM is the name of a description in the file named by TERMCAP.
- If TERMCAP begins with any character except `/`, TERMCAP contains the description.

A description begins with a list of its names, separated by vertical bars. The rest of the description is a list of capabilities, separated by colons. If you use more than one line, precede each new-line except the last with `:\`. Here's a simple example.

```
d5 vt50 dec vt5:\
:bs:cd=\EJ:ce=\EK:cl=\EH\EJ:co#80:li#12:nd=\EC:pt:up=/EA:
```

## termcap

There are three kinds of capabilities:

- Boolean. These indicate the presence or absence of a terminal feature by their presence or absence. Boolean capabilities consist of two characters (the capability name).
- Numeric. These indicate some numeric value for the terminal, such as screen size or delay required by a standard character. Numeric capabilities consist of two characters (the capability name), followed by a #, followed by a decimal number.
- String. These indicate a sequence that performs some operation on the terminal. String capabilities consist of two characters (the capability name), optionally followed by a delay, followed by a string.

The delay is the number of milliseconds the program must wait after using the sequence; specify no more than one decimal place. If the delay is proportional to the number of lines affected, end it with a \*.

The string is a sequence of characters. The following subsequences are specially interpreted.

|                   |  |
|-------------------|--|
| <code>\E</code>   | Escape Character                       |
| <code>^x</code>   | Control-x                              |
| <code>\n</code>   | Newline                                |
| <code>\r</code>   | Return                                 |
| <code>\t</code>   | Tab                                    |
| <code>\b</code>   | Backspace                              |
| <code>\f</code>   | Formfeed                               |
| <code>\xxx</code> | Octal value of xxx                     |
| <code>\072</code> | in string                              |
| <code>\200</code> | null ( <code>\000</code> doesn't work) |

Octal numbers must be three digits long.

Some strings are interpreted further, such as `cm`. See below.

## termcap

You can follow any capability name with @ to indicate that the terminal lacks the capability. This is only useful in conjunction with the `tc` capability; see "Similar Terminals," below.

Table 4-1 is a list of standard capabilities. (P) indicates a string that might require padding; (P\*) indicates a string that might require proportional padding.

Table 4-1 Standard Terminal Capabilities

| Name | Type | Pad? | Description   |
|------|------|------|---|
| ae   | str  | (P)  | Ends alternate character set.                           |
| al   | str  | (P*) | Adds new blank line.                                    |
| am   | bool |      | Terminal has automatic margins.                         |
| as   | str  | (P)  | Starts alternate character set.                         |
| bc   | str  |      | Backspace if not control-h.                             |
| bs   | bool |      | Terminal can backspace with control-h.                  |
| bt   | str  | (P)  | Back tab.   |
| bw   | bool |      | Backspace wraps from column 0 to last column.           |
| CC   | str  |      | Command character in prototype if terminal is settable. |
| cd   | str  | (P*) | Clears to end of display.                               |
| ce   | str  | (P)  | Clears to end of line.                                  |
| ch   | str  | (P)  | Moves cursor horizontally to specified column.          |
| cl   | str  | (P*) | Clears screen.  |
| cm   | str  | (P)  | Moves cursor to specified row and column.               |
| co   | num  |      | Number of columns in a line.                            |
| cr   | str  | (P*) | Carriage return if not control-m.                       |
| cs   | str  | (P)  | Change scrolling region.                                |
| cv   | str  | (P)  | Moves cursor vertically to a specified row.             |
| da   | bool |      | Display can be retained above.                          |
| dB   | num  |      | Delay after backspace, in milliseconds.                 |
| db   | bool |      | Display can be retained below.                          |
| dC   | num  |      | Delay after carriage return, in milliseconds.           |
| dc   | str  | (P*) | Delete character.                                       |
| dF   | num  |      | Delay after form feed, in milliseconds.                 |
| dl   | str  | (P*) | Deletes line.   |
| dm   | str  |      | Enters delete mode.                                     |
| dN   | num  |      | Delay after new-line, in milliseconds.                  |

# termcap

Table 4-1 Standard Terminal Capabilities (Cont.)

| Name  | Type | Pad? | Description   |
|-------|------|------|---|
| do    | str  |      | Goes down one line.   |
| dT    | num  |      | Delay after tab, in milliseconds.   |
| ed    | str  |      | Ends delete mode.   |
| ei    | str  |      | Ends insert mode; give an empty string if you've defined ic.                                  |
| eo    | str  |      | Can erase overstrikes with a blank.   |
| ff    | str  | (P*) | Hardcopy terminal page eject if not form feed.  |
| hc    | bool |      | Hardcopy terminal.  |
| hd    | str  |      | Half-line down (forward 1/2 linefeed).  |
| ho    | str  |      | Move cursor to upper left corner (home).  |
| hu    | str  |      | Half-line up (reverse 1/2 linefeed).  |
| hz    | str  |      | Hazeltine or other terminal that can't print ~s.  |
| ic    | str  | (P)  | Insert character.   |
| if    | str  |      | Name of file containing terminal initialization.  |
| im    | bool |      | Starts insert mode; give an empty string if you've defined ic.                                |
| in    | bool |      | Insert mode distinguishes nulls on display.   |
| ip    | str  | (P*) | Pad after insertion.  |
| is    | str  |      | Terminal initialization.  |
| k0-k9 | str  |      | Sent by special (usually numeric) function keys. If programmable, set with is, if, vs, or ti. |
| kb    | str  |      | Sent by backspace key.  |
| kd    | str  |      | Sent by terminal down arrow key.  |
| ke    | str  |      | Ends keypad transmit code.  |
| kh    | str  |      | Sent by home key.   |
| kl    | str  |      | Sent by terminal left arrow key.  |
| kn    | num  |      | Number of special function keys.  |
| ko    | str  |      | Terminal capabilities that have keys.   |
| kr    | str  |      | Sent by terminal right arrow key.   |
| ks    | str  |      | Begin keypad transmit mode.   |
| ku    | str  |      | Sent by terminal up arrow key.  |
| l0-l9 | str  |      | Labels on special function keys.  |
| li    | str  |      | Last line, first column.  |
| ma    | str  |      | Command key map; used by ex version 2.  |
| mi    | bool |      | Safe to move while in insert mode.  |
| ml    | str  |      | Memory lock on above cursor.  |
| ms    | bool |      | Safe to move while in standout or underline mode.   |
| mu    | str  |      | Memory unlock (turn off memory lock).   |
| nc    | bool |      | No correctly working carriage return.   |
| nd    | str  |      | Non-destructive space (cursor right).   |
| nl    | str  | (P*) | Begin a new line if not new-line.   |
| ns    | bool |      | A video terminal that doesn't scroll.   |
| os    | bool |      | Terminal overstrikes.   |

## termcap

Table 4-1 Standard Terminal Capabilities (Cont.)

| Name | Type | Pad? | Description  |
|------|------|------|--|
| pc   | str  |      | Pad character if not null.   |
| pt   | bool |      | Has hardware tabs; if they need to be set, put sequence in is or if.                     |
| se   | str  |      | Ends stand out mode.   |
| sf   | str  | (P)  | Scrolls forward.   |
| sg   | num  |      | Number of blank characters left by so or se.   |
| so   | str  |      | Begins stand out mode.   |
| sr   | str  | (P)  | Scroll reverse (backwards).  |
| ta   | str  | (P)  | Tab if not control-i or with padding.  |
| tc   | str  |      | Name of terminal that has some of the same capabilities; tc must be the last capability. |
| te   | str  |      | Ends programs that do cursor motion.   |
| ti   | str  |      | Initializes programs that do cursor motion.  |
| uc   | str  |      | Underscores and moves past one character.  |
| ue   | str  |      | Ends underscore mode.  |
| ug   | num  |      | Number of blank spaces that surround underscore mode.                                    |
| ul   | bool |      | Terminal underlines automatically even though it can't overstrike.                       |
| up   | str  |      | Upline (cursor up).  |
| us   | str  |      | Start underscore mode.   |
| vb   | str  |      | Visible bell (must not move cursor).   |
| ve   | str  |      | Ends open and visual modes.  |
| vs   | str  |      | Initializes open and visual modes.   |
| xb   | bool |      | Beehive (f1=escape, f2=ctrl C).  |
| xn   | bool |      | Terminal ignoresc new-line after wrap (Concept).   |
| xr   | bool |      | Returns clears to end of line and goes to beginning of next line (Delta Data).           |
| xs   | bool |      | Writing on standout mode text produces standout mode text (HP 264?)                      |
| xt   | bool |      | Destructive tabs, magic standout character (Teleray 1061).                               |

### Pointers on Preparing Descriptions

- You may want to copy the description of a similar terminal.
- Build up a description gradually, checking partial descriptions with `ex`.
- Be aware that an unusual terminal may expose bugs in `ex` limitations in the termcap convention.

# termcap

## Basic Capabilities

The following capabilities are common to most terminals. The **co** capability gives the number of columns per line. The **li** gives the number of lines on a video terminal. The **am** capability indicates that writing off the right edge takes the cursor to the beginning of the next screen. The **cl** capability tells how the terminal clears its screen. The **bs** indicates that the terminal can backspace; but if the terminal doesn't use control-h, specify **bc** instead of **bs**. The **os** capability indicates that printing a character at an occupied position doesn't destroy the existing character.

A couple of notes on moving off the edge. Programs that use this convention never move the cursor off the top or the left edge of the screen. On the other hand, they assume that moving off the bottom edge scrolls the display up.

These capabilities suffice to describe hardcopy and very dumb terminals.

## Cursor Addresses and Other Variables

If a string capability includes a variable value, use a % escape to indicate the value. By default, programs take these values to be zero origin (that is, the first possible value is 0) and that the **cm** capability specifies two values: row, then column. Use the **%r** or **%i** capability if either assumption is incorrect.

These are the valid % escapes.

|                |  |
|----------------|--|
| <b>%d</b>      | Print the values as a decimal number.  |
| <b>%2</b>      | Print the values as a two-digit decimal number.  |
| <b>%3</b>      | Print the values as a three-digit decimal number.  |
| <b>%.</b>      | Print the value in binary (but see below).   |
| <b>%+x</b>     | Add ASCII value of <i>x</i> to value, then print in binary.  |
| <b>%&gt;xy</b> | If the next value is greater than the ASCII value of <i>x</i> , add the ASCII value of <i>y</i> before using the value's % escape. |

## termcap

|    |   |
|----|---|
| %r | Row is the first value in this <b>cm</b> .  |
| %i | Values are 1-origin.  |
| %% | Print a %.  |
| %n | In this capability, exclusive or the values with 01400 before using the values' % escapes (DM2500).                       |
| %B | Change the next value to binary coded decimal ( $(16 * (x/10) + (x\%10))$ where $x$ is the value) before interpreting it. |
| %D | The next value is reverse-coded ( $x - 2 * (x\%16)$ where $x$ is the value; Delta Data)                                   |

A program should avoid using a **cm** sequence that includes a tab, new-line, control-d, or return, because the terminal interface may misinterpret these characters. If possible, use the **cm** sequence to move to the row or column after the destination, then use local motion to get to the destination.

Here are some examples of **cm** definitions. To position the cursor of an HP2645 on row 3, column 12, you must send the terminal "\E&a12c03Y," followed by a 6 millisecond delay; the HP2645 description includes :cm=6\E&%r%2c%2Y:. To position the cursor of an ACT-IV, you send it a control-t, followed by the row and column in binary; the ACT-IV description includes :cm=^T%.%:. The LSI ADM3a uses the set of printable ASCII characters to represent row and column values; its description includes :cm\x=%+%+:. .

### Local and General Cursor Motions

Most terminals have short strings that trigger commonly-used cursor motions. A non-destructive space (BR nd) moves the cursor one position right. An upline sequence (up) moves the cursor one position up. A home sequence (ho) moves the cursor to the upper left hand corner. A lower-left (ll) goes to the other left hand corner. The ll capability may be a sequence that moves the cursor home, then up; but otherwise programs never do this.

## termcap

### Area Clears

Some terminals have short sequences that clear all or part of a display. Clear (**cl**) clears the screen and homes the cursor; if clearing the screen does not restore the terminal's normal modes, **cl** should include the strings that do. Clear to end of line (**ce**) clears from the current cursor position to the right. Clear to end of display (**cd**) clears from the current cursor position to the bottom of the display; programs always move the cursor to the beginning of the line before using **cd**.

### Insert/Delete Line

Many terminals have strings that shift text starting at the current cursor position. Programs always move the cursor to the beginning of the line before using these strings. Add line (**al**) shifts the current line and all below it down a position leaving the cursor on the newly-blanked line. Delete line (**dl**) deletes the line the cursor is on without moving the cursor. If a terminal description has an **al** capability, you do not really need to specify **sb**.

If deleting a line might produce a non-blank line at the bottom of the screen, specify **db**. If scrolling backwards might produce a non-blank line at the top of the screen, specify **da**.

### Insert/Delete Character

The termcap convention recognizes two kinds of terminal insert/delete string.

- The first convention is by far more common. Using insert or delete modes only affect characters on the current line. Inserting a single character shifts all characters, including all blanks, to the right; the character on the right edge of the screen is lost. No special capability is required to describe this kind of terminal.

## termcap

- The second convention is rarer and more complicated. The terminal distinguishes between blank spaces created by output tabs (O11) or spaces (O40) from all other blanks; other blanks are known as nulls. Inserting a character eliminates the first null to the right of the cursor; deleting a character doubles the first null. If there are no nulls on the current line, inserting a character inserts the line's rightmost character at the beginning of the next line. Use the **in** capability to describe this kind of terminal.

A simple experiment shows what type you have. Set the terminal to its "local" mode. Clear the screen, then type a short sequence of text. Move the cursor to the right several spaces without using the space or tab characters. Type a second short sequence of text. Move the cursor back to the beginning of the first text. Start the terminal's insert mode and begin tapping the space bar. If you have the first kind of terminal, both sequences of text will move at once; whatever character is at the right edge of the screen will be lost. If you have the second kind of terminal, at first only the first sequence of text will move; when the first sequence hits the second sequence, it will push the second onto the next line.

A terminal can have either an insert mode or the ability to insert a single character. Specify insert mode with **im** and **ei**. To specify that the terminal can insert a single character, specify **ic** and specify empty strings for **im** and **ei**. If you must delay or output more control text after inserting a single character, specify **ip**.

If a terminal has both an insert mode and the ability to insert a single character, it is usually best not to specify **ic**.

Some programs operate more quickly if they are allowed to move the cursor around randomly while in insert mode. For example, **vi** has to delete a character when you insert a character before a tab. If your terminal permits this, specify move on insert **mi**. Beware of terminals that foul up in subtle ways when you do this.

Delete mode (**dm**), end delete mode (**ed**), and delete character (**dc**) work like **im**, **ei** and **ic**.

## termcap

### Highlighting, Underlining, and Visible Bells

Specify the terminals most distinctive display mode with **so**. Half intensity is usually not a good choice unless the terminal is normally in reverse video.

The convention provides for underline mode and for single character underlining. Specify underline mode with **us** and **ue**. Specify a way to underline and move past a character with **uc**; if your terminal can underline a single character but doesn't automatically move on, add a nondestructive space to the **uc** string.

Some terminals can't overstrike but still correctly underline text without special help from the host computer. If yours is one, specify **ul**.

If your terminal spaces before and after entering standout and underline mode, specify **ug**.

Programs leave standout and underline mode before moving the cursor or printing a new-line.

If the terminal can flash the screen without moving the cursor, specify **vb** (visual bell).

If the terminal needs to change working modes before entering the open and visual modes of **ex** and **vi**, specify **vs** and **ve**, respectively. These can be used to change, for example, from an underline to a block cursor and back.

If the terminal needs to be in a special mode when running a program that addresses the cursor, specify **ti** and **te**. This may be important if a terminal has more than one page of memory. If the terminal has memory-relative cursor addressing but not screen relative cursor addressing, use **ti** to fix a screen-sized window into the terminal.

If a terminal can overstrike, programs assume that printable spaces don't destroy anything, unless you specify **eo**.

## termcap

### Keypad

Some terminals have keypads that transmit special codes. If the keypad can be turned on and off, specify **ks** and **ke**; if you don't, programs assume that the keypad is always on. Specify the codes sent by cursor motion keys with **kl**, **kr**, **ku**, **kd**, and **kh**. If there are function keys, specify the codes they send with **f1**, **f2**, **f3**, **f4**, **f5**, **f6**, **f7**, **f8**, and **f9**. If these keys have labels other than the usual "f0 through f9," specify the labels **l1**, **l2**, **l3**, **l4**, **l5**, **l6**, **l7**, **l8**, and **l9**. If there are other keys that transmit the same code that the terminal expects for a function, such as clear screen, mention the affected capabilities in the **ko** capability. For example, `":ko=cl,ll,sf,sb:"` says that the terminal has clear, home down, scroll down, and scroll up keys that transmit the same thing as the cl, ll, sf, and sb capabilities.

### Terminal Initialization

If a terminal must be initialized, on login for example, specify a short string with **is** or a file containing initialization strings with **if**. Other capabilities include **is**, and initialization string for the terminal, and **if**, the name of a file containing long initialization strings. If both are given, **is** is printed before **if**. If the terminal has tab stops, these strings should first clear all stops, then set new stops at the 9 column and every 8 column thereafter.

### Similar Terminals

If a new terminal strongly resembles an existing terminal, you can write a description of the new terminal that only mentions the old terminal and the capabilities that differ. The **tc** capability describes the old terminal; it must be the last capability in the description. If the old terminal has capabilities that the new one lacks, specify an **@** after the capability name.

## termcap

The different entries you create with **tc** need not represent terminals that are actually different. They can represent different uses for a single terminal, or user preferences as to which terminal features are desirable.

The following example defines and describes a variant of the 2621 that never turns on the keypad.

```
hn 2621nl:ks@:ke@:tc=2621:
```

## Files

/etc/termcap - standard data base

## Known Problems

The **ex** command allows only 256 characters for string capabilities, and the routines in the termcap library function do not check for overflow of this buffer.

The total length of a single description (excluding only escaped new-lines) may not exceed 1024 characters. If you use **tc**, the combined description may not exceed 1024 characters.

The **vs**, and **ve** entries are specific to the **vi** program.

Not all programs support all entries. There are entries that are not supported by any program.

The **ma** capability is obsolete and serves no function in our database; Berkeley includes it for the benefit of systems that cannot run version 3 of **vi**.

## See Also

**ex**, **tset**, **vi**, **ul**, **more** in Section 1; **curses**, **termcap** in Section 3.

# terminfo

## Name

terminfo - terminal capability data base

## Format

```
/usr/lib/terminfo/*/*
```

## Description

Terminfo is a data base describing terminals used, for example, by the **vi** command and the **curses** library function. Terminals are described in terminfo by giving a set of capabilities that they have, and by describing how operations are performed. Padding requirements and initialization sequences are included in terminfo.

Entries in terminfo consist of a number of ',' separated fields. White space after ',' is ignored. The first entry for each terminal gives the names that are known for the terminal, separated by '|' characters. The first name given is the most common abbreviation for the terminal, the last name given should be a long name fully identifying the terminal, and all others are understood as synonyms for the terminal name. All names but the last should be in lower case and contain no blanks; the last name may well contain upper case and blanks for readability.

Terminal names (except for the last, verbose entry) should be chosen using the conventions shown in Table 4-2. The particular piece of hardware making up the terminal should have a root name chosen, thus "hp2621." This name should not contain hyphens, except that synonyms may be chosen that do not conflict with other names. Modes that the hardware can be in, or user preferences, should be indicated by appending a hyphen and an indicator of the mode. Thus, a vt100 in 132 column mode would be vt100-w. The following suffixes should be used where possible:

## terminfo

Table 4-2 Terminal Name Suffixes

| Suffix | Meaning                              | Example   |
|--------|--------------------------------------|-----------|
| -w     | Wide mode (more than 80 columns)     | vt100-w   |
| -am    | With auto. margins (usually default) | vt100-am  |
| -nam   | Without automatic margins            | vt100-nam |
| -n     | Number of lines on the screen        | aaa-60    |
| -na    | No arrow keys (leave them in local)  | c100-na   |
| -np    | Number of pages of memory            | c100-4p   |
| -rv    | Reverse video                        | c100-rv   |

### Capabilities

The variable is the name by which the programmer (at the terminfo level) accesses the capability. The capname is the short name used in the text of the database, and is used by a person updating the database. The i.code is the two letter internal code used in the compiled database, and always corresponds to the old termcap capability name.

Capability names have no hard length limit, but an informal limit of 5 characters has been adopted to keep them short and to allow the tabs in the source file caps to line up nicely. Whenever possible, names are chosen to be the same as or similar to the ANSI X3.64-1979 standard. Semantics are also intended to match those of the specification. For the capnames and i.codes listed in Table 4-3:

- (P) Indicates that padding may be specified.
- (G) Indicates that the string is passed through tparm withparms as given (#i).
- (\*) Indicates that padding may be based on the number of lines affected.
- (#i) Indicates the *i*th parameter.

## terminfo

Table 4-3 Capnames and l.codes

| Variable Booleans  | Cap-name        | l. code        | Description  |
|--|-----------------|----------------|--|
| auto_left_margin,  | bw              | bw             | cut1 wraps from column 0 to last column  |
| auto_right_margin,<br>beehive_glitch,                    | am<br>xsb       | am<br>xb       | Terminal has automatic margins<br>Beehive (f1=escape, f2=ctrl C)                                       |
| ceol_standout_glitch,                                    | xhp             | xs             | Standout not erased by overwriting (hp)  |
| eat_newline_glitch,                                      | xenl            | xn             | new-line ignored after 80 cols (Concept)   |
| erase_overstrike,  | eo              | eo             | Can erase overstrikes with a blank   |
| generic_type,  | gn              | gn             | Generic line type (such as dialup, switch)   |
| hard_copy,<br>has_meta_key,                              | hc<br>km        | hc<br>km       | Hardcopy terminal<br>Has a meta key (shift, sets parity bit)   |
| has_status_line,<br>insert_null_glitch,<br>memory_above, | hs<br>in<br>da  | hs<br>in<br>da | Has extra "status line"<br>Insert mode distinguishes nulls<br>Display may be retained above the screen |
| memory_below,  | db              | db             | Display may be retained below the screen   |
| move_insert_mode,<br>move_standout_mode,                 | mir<br>msgr     | mi<br>ms       | Safe to move while in insert mode<br>Safe to move in standout modes                                    |
| over_strike,<br>status_line_esc_ok,                      | os<br>eslok     | os<br>es       | Terminal overstrikes<br>Escape can be used on the status line  |
| teleray_glitch,  | xt              | xt             | Tabs ruin, magic so char (Teleray 1061)  |
| tilde_glitch,<br>transparent_underline,<br>xon_xoff,     | hz<br>ul<br>xon | hz<br>ul<br>xo | Hazeltine, can not print ~s<br>Underline character overstrikes<br>Terminal uses xon/xoff handshaking   |
| <b>Numbers:</b>  |                 |                |  |
| columns,   | cols            | co             | Number of columns in a line  |
| init_tabs,   | it              | it             | Tabs initially every # spaces  |
| lines,   | lines           | li             | Number of lines on screen or page  |

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Table 4-3 Capnames and I.codes (Cont.)

| Variable Booleans     | Cap-name | I. code | Description                                     |
|-----------------------|----------|---------|---|
| lines_of_memory,      | lm       | lm      | Lines of memory if > lines. 0 means varies.     |
| magic_cookie_glitch,  | xmc      | sg      | Number of blank characters left by smso or rmso |
| padding_baud_rate,    | pb       | pb      | Lowest baud where cr/ni padding is needed       |
| virtual_terminal,     | vt       | vt      | Virtual terminal number (CENTIX system)         |
| width_status_line,    | wsl      | ws      | Number of columns in status line                |
| <b>Strings:</b>       |          |         |   |
| back_tab,             | cbt      | bt      | Back tab (P)                                    |
| bell,                 | bel      | bl      | Audible signal (bell) (P)                       |
| carriage_return,      | cr       | cr      | Carriage return (P*)                            |
| change_scroll_region, | csr      | cs      | change to lines #1 through #2 (vt100) (PG)      |
| clear_all_tabs,       | ttc      | ct      | Clear all tab stops (P)                         |
| clear_screen,         | clear    | cl      | Clear screen and home cursor (P*)               |
| clr_eol,              | el       | ce      | Clear to end of line (P)                        |
| clr_eos,              | ed       | cd      | Clear to end of display (P*)                    |
| column_address,       | hpa      | ch      | Set cursor column (PG)                          |
| command_character,    | cmdch    | CC      | Term. settable cmd char in prototype            |
| cursor_address,       | cup      | cm      | Screen rel. cursor motion row #1 col #2 (PG)    |
| cursor_down,          | cud1     | do      | Down one line                                   |
| cursor_home,          | home     | ho      | Home cursor (if no cup)                         |
| cursor_invisible,     | civis    | vi      | Make cursor invisible                           |
| cursor_left,          | cub1     | le      | Move cursor left one space                      |
| cursor_mem_address,   | mrcup    | CM      | Memory relative cursor addressing               |
| cursor_normal,        | cnorm    | ve      | Make cursor appear normal (undo vs/vi)          |
| cursor_right,         | cuf1     | nd      | Non-destructive space (cursor right)            |
| cursor_to_ll,         | ll       | ll      | Last line, first column (if no cup)             |
| cursor_up,            | cuu1     | up      | Upline (cursor up)                              |
| cursor_visible,       | cvvis    | vs      | Make cursor very visible                        |
| delete_character,     | dch1     | dc      | Delete character (P*)                           |
| delete_line,          | dli      | dl      | Delete line (P*)                                |

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Table 4-3 Capnames and l.codes (Cont.)

| Variable Booleans       | Cap-name | l. code | Description                              |
|-------------------------|----------|---------|--|
| dis_status_line,        | dsl      | ds      | Disable status line                      |
| down_half_line,         | hd       | hd      | Half-line down (forward 1/2 linefeed)    |
| enter_alt_charset_mode, | smacs    | as      | Start alternate character set (P)        |
| enter_blink_mode,       | blink    | mb      | Turn on blinking                         |
| enter_bold_mode,        | bold     | md      | Turn on bold (extra bright) mode         |
| enter_ca_mode,          | smcup    | ti      | String to begin programs that use cup    |
| enter_delete_mode,      | smdc     | dm      | Delete mode (enter)                      |
| enter_dim_mode,         | dim      | mh      | Turn on half-bright mode                 |
| enter_insert_mode,      | smir     | im      | Insert mode (enter)                      |
| enter_protected_mode,   | prot     | mp      | Turn on protected mode                   |
| enter_reverse_mode,     | rev      | mr      | Turn on reverse video mode               |
| enter_secure_mode,      | invis    | mk      | Turn on blank mode (chars invisible)     |
| enter_standout_mode,    | smso     | so      | Begin stand out mode                     |
| enter_underline_mode,   | smul     | us      | Start underscore mode                    |
| erase_chars,            | ech      | ec      | Erase # 1 characters (PG)                |
| exit_alt_charset_mode,  | rmacs    | ae      | End alternate character set (P)          |
| exit_attribute_mode,    | sgr0     | me      | Turn off all attributes                  |
| exit_ca_mode,           | rmcup    | te      | String to end programs that use cup      |
| exit_delete_mode,       | rmdc     | ed      | End delete mode                          |
| exit_insert_mode,       | rmir     | ei      | End insert mode                          |
| exit_standout_mode,     | rmso     | se      | End stand out mode                       |
| exit_underline_mode,    | rmul     | ue      | End underscore mode                      |
| flash_screen,           | flash    | vb      | Visible bell (may not move cursor)       |
| form_feed,              | ff       | ff      | Hardcopy terminal page eject (P*)        |
| from_status_line,       | fsl      | fs      | Return from status line                  |
| init_1string,           | is1      | i1      | Terminal initialization string           |
| init_2string,           | is2      | i2      | Terminal initialization string           |
| init_3string,           | is3      | i3      | Terminal initialization string           |
| init_file,              | if       | if      | Name of file containing is               |
| insert_character,       | ich1     | ic      | Insert character (P)                     |
| insert_line,            | il1      | al      | Add new blank line (P*)                  |
| insert_padding,         | ip       | ip      | Insert pad after character inserted (P*) |
| key_backspace,          | kbs      | kb      | Sent by backspace key                    |
| key_catab,              | ktbc     | ka      | Sent by clear-all-tabs key               |
| key_clear,              | kclr     | kC      | Sent by clear screen or erase key        |

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Table 4-3 Capnames and I.codes (Cont.)

| Variable Booleans | Cap-name | I. code | Description                            |
|-------------------|----------|---------|--|
| key_ctab,         | kctab    | kt      | Sent by clear-tab key                  |
| key_dc,           | kdch1    | kD      | Sent by delete character key           |
| key_dl,           | kdll     | kL      | Sent by delete line key                |
| key_down,         | kcud1    | kd      | Sent by terminal down arrow key        |
| key_eic,          | krmir    | kM      | Sent by rmir or smir in insert mode    |
| key_eol,          | kel      | kE      | Sent by clear-to-end-of-line key       |
| key_eos,          | ked      | kS      | Sent by clear-to-end-of-screen key     |
| key_f0,           | kf0      | k0      | Sent by function key f0                |
| key_f1,           | kf1      | k1      | Sent by function key f1                |
| key_f10,          | kf10     | ka      | Sent by function key f10               |
| key_f2,           | kf2      | k2      | Sent by function key f2                |
| key_f3,           | kf3      | k3      | Sent by function key f3                |
| key_f4,           | kf4      | k4      | Sent by function key f4                |
| key_f5,           | kf5      | k5      | Sent by function key f5                |
| key_f6,           | kf6      | k6      | Sent by function key f6                |
| key_f7,           | kf7      | k7      | Sent by function key f7                |
| key_f8,           | kf8      | k8      | Sent by function key f8                |
| key_f9,           | kf9      | k9      | Sent by function key f9                |
| key_home,         | khome    | kh      | Sent by home key                       |
| key_ic,           | kich1    | kl      | Sent by ins char/enter ins mode key    |
| key_il,           | kil1     | kA      | Sent by insert line                    |
| key_left,         | kcub1    | k1      | Sent by terminal left arrow key        |
| key_ll,           | kll      | kH      | Sent by home-down key                  |
| key_npage,        | knp      | kN      | Sent by next-page key                  |
| key_ppage,        | kpp      | kP      | Sent by previous page key              |
| key_right,        | kcuf1    | kr      | Sent by terminal right arrow key       |
| key_sf,           | kind     | kF      | Sent by scroll-forward /down key       |
| key_sr,           | kri      | kR      | Sent by scroll-backward /up key        |
| key_stab,         | khts     | kT      | Sent by set-tab key                    |
| key_up,           | kcuu1    | ku      | Sent by terminal up arrow key          |
| keypad_local,     | rmkx     | ke      | Out of "keypad transmit" mode          |
| keypad_xmit,      | smkx     | ks      | Put terminal in "keypad transmit" mode |
| lab_f0,           | lf0      | l0      | Labels on function key f0 if not f0    |
| lab_f1,           | lf1      | l1      | Labels on function key f1 if not f1    |
| lab_f10,          | lf10     | la      | Labels on function key f10 if not f10  |

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Table 4-3 Capnames and l.codes (Cont.)

| Variable Booleans  | Cap-name | l. code | Description                               |
|--------------------|----------|---------|---|
| lab_f2,            | lf2      | l2      | Labels on function key f2 if not f2       |
| lab_f3,            | lf3      | l3      | Labels on function key f3 if not f3       |
| lab_f4,            | lf4      | l4      | Labels on function key f4 if not f4       |
| lab_f5,            | lf5      | l5      | Labels on function key f5 if not f5       |
| lab_f6,            | lf6      | l6      | Labels on function key f6 if not f6       |
| lab_f7,            | lf7      | l7      | Labels on function key f7 if not f7       |
| lab_f8,            | lf8      | l8      | Labels on function key f8 if not f8       |
| lab_f9,            | lf9      | l9      | Labels on function key f9 if not f9       |
| meta_on,           | smm      | mm      | Turn on "meta mode" (8th bit)             |
| meta_off,          | rmm      | mo      | Turn off "meta mode"                      |
| newline,           | nel      | nw      | New-line (behaves like cr followed by lf) |
| pad_char,          | pad      | pc      | Pad character (rather than null)          |
| parm_dch,          | dch      | DC      | Delete #1 chars (PG*)                     |
| parm_delete_line,  | dl       | DL      | Delete #1 lines (PG*)                     |
| parm_down_cursor,  | cud      | DO      | Move cursor down #1 lines (PG*)           |
| parm_ich,          | ich      | IC      | Insert #1 blank chars (PG*)               |
| parm_index,        | indn     | SF      | Scroll forward #1 lines (PG)              |
| parm_insert_line,  | il       | AL      | Add #1 new blank lines (PG*)              |
| parm_left_cursor,  | cub      | LE      | Move cursor left #1 spaces (PG)           |
| parm_right_cursor, | cuf      | RI      | Move cursor right #1 spaces (PG*)         |
| parm_rindex,       | rin      | SR      | Scroll backward #1 lines (PG)             |
| parm_up_cursor,    | cuu      | UP      | Move cursor up #1 lines (PG*)             |
| pkey_key,          | pfkey    | pk      | Prog funct key #1 to type string #2       |
| pkey_local,        | pfloc    | pl      | Prog funct key #1 to execute string #2    |
| pkey_xmit,         | px       | px      | Prog funct key #1 to xmit string #2       |
| print_screen,      | mc0      | ps      | Print contents of the screen              |
| prtr_off,          | mc4      | pf      | Turn off the printer                      |
| prtr_on,           | mc5      | po      | Turn on the printer                       |
| repeat_char,       | rep      | rp      | Repeat char #1 #2 times (PG*)             |
| reset_1string,     | rs1      | r1      | Reset terminal completely to sane modes   |
| reset_2string,     | rs2      | r2      | Reset terminal completely to sane modes   |

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Table 4-3 Capnames and I.codes (Cont.)

| Variable Booleans | Cap-name | I. code | Description                               |
|-------------------|----------|---------|---|
| reset_3string,    | rs3      | r3      | Reset terminal completely to sane modes   |
| reset_file,       | rf       | rf      | Name of file containing reset string      |
| restore_cursor,   | rc       | rc      | Restore cursor to position of last sc     |
| row_address,      | vpa      | cv      | Vertical position absolute (set row) (PG) |
| save_cursor,      | sc       | sc      | Save cursor position (P)                  |
| scroll_forward,   | ind      | sf      | Scroll text up (P)                        |
| scroll_reverse,   | ri       | sr      | Scroll text down (P)                      |
| set_attributes,   | sg       | sa      | Define the video attributes (PG9)         |
| set_tab,          | hts      | st      | Set a tab in all rows, current column     |
| set_window,       | wind     | wi      | Current window is lines #1-#2 cols #3-#4  |
| tab,              | ht       | ta      | Tab to next 8 space hardware tab stop     |
| to_status_line,   | tsl      | ts      | Go to status line, column # 1             |
| underline_char,   | uc       | uc      | Underscore one char and move past it      |
| up_half_line,     | hu       | hu      | Half-line up (reverse 1/2 linefeed)       |
| init_prog,        | iprog    | iP      | Path name of program for init             |
| key_a1,           | ka1      | K1      | Upper left of keypad                      |
| key_a3,           | ka3      | K3      | Upper right of keypad                     |
| key_b2,           | kb2      | K2      | Center of keypad                          |
| key_c1,           | kc1      | K4      | Lower left of keypad                      |
| key_c3,           | kc3      | K5      | Lower right of keypad                     |
| prtr_non,         | mc5p     | p0      | Turn on the printer for # 1 bytes         |

## terminfo

### A Sample Entry

The following entry, which describes the Concept-100, is among the more complex entries in the terminfo file as of this writing.

```
concept100 | c100 | concept | c104 | c100-4p | concept 100,
am, bel=^G, blank=\EH, blink=\EC, clear=^L$<2^>, cnorm=\Ew,
cols#80, cr=^M$<9>, cub1=^H, cud1=^J, cufl1=\E,
cup=\Ea%p1%''+%c%p2%''+%c,
cuu1=\E; cvvis=\EW, db, dch1=\E^A$<16^>,
dlm=\EE, dl1=\E^B$<3^>,
ed=\E^C$<16^>, el=\E^U$<16^>, eo, flash=\Ek$<20>\EK,
ht=\t$<8>,
il1=\E^R$<3^>, in, ind=^J, ind=^J$<9>, ip=$<16^>,
is2=\EU\EI\E7\E5\E8\EI\ENH\EK\E\200\Eo&\200\Eo\47\E,
kbs=^h, kcuB1=\E>, kcud1=\E<, kcufl1=\E=, kcuu1=\E; ,
kf1=\E5, kf2=\E6, kf3=\E7, khome=\E?
lines#24, mir, pb#9800, prot=\EI, rep=\Er%p1%c%p2%''+%c$<.2^>,
rev=\ED, rmcup=\Ev $<8>\Ep\r\n, rmir=\E\200, rmkx=\Ex,
rmso=\Ed\Ee, rmul=\Eg, rmul=\Eg, sgr0=\EN\200,
smcup=\EU\Ev 8p\Ep\r, smir=\E^P, smkx=\EX, smso=\EE\ED,
smul=\EG, tabs, ul, vt#8, xenl,
```

Entries may continue onto multiple lines by placing white space at the beginning of each line except the first. Comments may be included on lines beginning with “#.” Capabilities in terminfo are of three types: Boolean capabilities, which indicate that the terminal has some particular feature; numeric capabilities giving the size of the terminal or the size of particular delays; and string capabilities, which give a sequence that can be used to perform particular terminal operations.

### Types of Capabilities

All capabilities have names. For instance, the fact that the Concept has automatic margins (that is, an automatic return and linefeed when the end of a line is reached) is indicated by the capability **am**. Hence the description of the Concept includes **am**. Numeric capabilities are followed by the character ‘#’ and then the value. Thus **cols**, which indicates the number of columns the terminal has, gives the value ‘80’ for the Concept.

## terminfo

Finally, string valued capabilities, such as `el` (clear to end of line sequence) are given by the two-character code, an '=', and then a string ending at the next following ';'. A delay in milliseconds may appear anywhere in such a capability, enclosed in `$<...>` brackets, as in `el=\EK$<3>`, and padding characters are supplied by `tputs` to provide this delay. The delay can be either a number (such as '20'), or a number followed by '\*' (such as '3\*'). '\*' indicates that the padding required is proportional to the number of lines affected by the operation, and the amount given is the per-affected-unit padding required. (In the case of insert character, the factor is still the number of lines affected. This is always 1 unless the terminal has `xenl` and the software uses it.) When '\*' is specified, it is sometimes useful to give a delay of the form '3.5' to specify a delay per unit to tenths of milliseconds. (Only one decimal place is allowed.)

A number of escape sequences are provided in the string valued capabilities for easy encoding of characters there. Both `\E` and `\e` map to an ESCAPE character, `^x` maps to a control-x for any appropriate x, and the sequences `\n`, `\r`, `\t`, `\b`, `\f`, `\s` gives a new-line, linefeed, return, tab, backspace, formfeed, and space. Other escapes include `\^` for `^`, `\\` for `\`, `\,` for comma, `\:` for `:`, and `\0` for null. (`\0` will produce `\200`, which does not terminate a string but behaves as a null character on most terminals.) Finally, characters may be given as three octal digits after a `\`.

Sometimes individual capabilities must be commented out. To do this, put a period before the capability name. For example, see the second `ind` in the example above.

## terminfo

### Preparing Descriptions

We now outline how to prepare descriptions of terminals. The most effective way to prepare a terminal description is by imitating the description of a similar terminal in terminfo and to build up a description gradually, using partial descriptions with **vi** to check that they are correct. Be aware that a very unusual terminal may expose deficiencies in the ability of the terminfo file to describe it or bugs in it in **vi**. To easily test a new terminal description, you can set the environment variable **TERMINFO** to a pathname of a directory containing the compiled description you are working on and programs will look there rather than in **/usr/lib/terminfo**. To get the padding for insert line right (if the terminal manufacturer did not document it) a severe test is to edit **/etc/passwd** at 9600 baud, delete 16 or so lines from the middle of the screen, then hit the 'u' key several times quickly. If the terminal messes up, more padding is usually needed. A similar test can be used for insert character.

### Basic Capabilities

The number of columns on each line for the terminal is given by the **cols** numeric capability. If the terminal is a CRT, then the number of lines on the screen is given by the **lines** capability. If the terminal wraps around to the beginning of the next line when it reaches the right margin, then it should have the **am** capability. If the terminal can clear its screen, leaving the cursor in the home position, then this is given by the **clear** string capability. If the terminal overstrikes (rather than clearing a position when a character is struck over) then it should have the **os** capability. If the terminal is a printing terminal, with no soft copy unit, give it both **hc** and **os**. (**os** applies to storage scope terminals, such as TEKTRONIX 4010 series, as well as hard copy and APL terminals.) If there is a code to move the cursor to the left edge of the current row, give this as **cr**. (Normally this will be carriage return, control M.) If there is a code to produce an audible signal (bell, beep, and so on) give this as **bel**.

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If there is a code to move the cursor one position to the left (such as backspace) that capability should be given as **cub1**. Similarly, codes to move to the right, up, and down should be given as **cuf1**, **cuu1**, and **cud1**. These local cursor motions should not alter the text they pass over (for example, you would not normally use '**cuf1=**' because the space would erase the character moved over).

A very important point here is that the local cursor motions encoded in terminfo are undefined at the left and top edges of a CRT terminal. Programs should never attempt to backspace around the left edge, unless **bw** is given, and never attempt to go up locally off the top. In order to scroll text up, a program will go to the bottom left corner of the screen and send the **ind** (index) string.

To scroll text down, a program goes to the top left corner of the screen and sends the **ri** (reverse index) string. The strings **ind** and **ri** are undefined when not on their respective corners of the screen.

Parameterized versions of the scrolling sequences are **indn** and **rin**, which have the same semantics as **ind** and **ri** except that they take one parameter, and scroll that many lines. They are also undefined except at the appropriate edge of the screen.

The **am** capability tells whether the cursor sticks at the right edge of the screen when text is output, but this does not necessarily apply to a **cuf1** from the last column. The only local motion that is defined from the left edge is if **bw** is given, then a **cub1** from the left edge will move to the right edge of the previous row. If **bw** is not given, the effect is undefined. This is useful for drawing a box around the edge of the screen, for example. If the terminal has switch selectable automatic margins, the terminfo file usually assumes that this is on; that is, **am**. If the terminal has a command that moves to the first column of the next line, that command can be given as **nel** (newline). It does not matter if the command clears the remainder of the current line, so if the terminal has no **cr** and **lf** it may still be possible to craft a working **nel** out of one or both of them.

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These capabilities suffice to describe hardcopy and glass-tty terminals. Thus the model 33 teletype is described as

```
33    tty33    tty    model 33 teletype,
      bel=^G, cols#72, cr=^M, cud1=^J, hc, ind=^J, os,
```

while the Lear Siegler ADM-3 is described as

```
adm3    3    lsi adm3,
      am, bel=^G, clear=^Z, cols#80, cr=^M, cub1=^H, cud1=^J,
      ind=^J, lines #24,
```

## Parameterized Strings

Cursor addressing and other strings requiring parameters in the terminal are described by a parameterized string capability, with `printf` like escapes `%x` in it (see Section 3). For example, to address the cursor, the `cup` capability is given, using two parameters: the row and column to address to. (Rows and columns are numbered from zero and refer to the physical screen visible to the user, not to any unseen memory.) If the terminal has memory relative cursor addressing, that can be indicated by `mrcup`.

The parameter mechanism uses a stack and special `%` codes to manipulate it. Typically a sequence will push one of the parameters onto the stack and then print it in some format. Often more complex operations are necessary.

The `%` encodings have the following meanings:

|                           |   |
|---------------------------|---|
| <code>%%</code>           | outputs <code>'%'</code>  |
| <code>%d</code>           | print <code>pop()</code> as in <code>printf</code>                                      |
| <code>%2d</code>          | print <code>pop()</code> like <code>%2d</code>  |
| <code>X3d</code>          | print <code>pop()</code> like <code>%3d</code>  |
| <code>%02d</code>         |   |
| <code>%03d</code>         | as in <code>printf</code>   |
| <code>%c</code>           | print <code>pop()</code> gives <code>%c</code>  |
| <code>%s</code>           | print <code>pop()</code> gives <code>%s</code>  |
| <code>%p[1-9]</code>      | push <i>i</i> th parm   |
| <code>%P[a-z]</code>      | set variable [a-z] to <code>pop()</code>  |
| <code>%g[a-z]</code>      | get variable [a-z] and push it  |
| <code>%c'</code>          | char constant <i>c</i>  |
| <code>%{nn}</code>        | integer constant <i>nn</i>  |
| <code>%+%--%*%/ %m</code> | arithmetic ( <code>%m</code> is mod): push ( <code>pop()</code> op <code>pop()</code> ) |

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|             |   |
|-------------|---|
| %&%   %^    | bit operations: push (pop() op pop())   |
| %=%>%<      | logical operations; push (pop() op pop())   |
| %!%~        | unary operations push (op pop())  |
| %i          | add 1 to first two parms (for ANSI terminals)   |
| %? expr %t  | if-then-else, %e elsepart is optional.  |
| thenpart %e | else-if's are possible ala Algol 68:  |
| elsepart %; | %? c <sub>1</sub> %t b <sub>1</sub> %e c <sub>2</sub> %t b <sub>2</sub> %e c <sub>3</sub> %t b <sub>3</sub> %e c <sub>4</sub> %t b <sub>4</sub> %e %; |
|             | c <sub>i</sub> are conditions, b <sub>i</sub> are bodies.   |

Binary operations are in postfix form with the operands in the usual order. That is, to get x-5 you use "%gx%{5}%-".

Consider the HP2645, which, to get to row 3 and column 12, needs to be sent \E&a12c03Y padded for 6 milliseconds. Note that the order of the rows and columns is inverted here, and that the row and column are printed as two digits. Thus its **cup** capability is  
cup=6\E&%p2%2dc%p1%2dY.

The Microterm ACT-IV needs the current row and column sent preceded by a ^T, with the row and column simply encoded in binary, cup=^T%p1%c%p2%c. Terminals that use %c need to be able to backspace the cursor ( **cub1**), and to move the cursor up one line on the screen ( **cuu1**). This is necessary because it is not always safe to transmit \n ^D and \r, as the system may change or discard them. (The library routines dealing with terminfo set tty modes so that tabs are never expanded, so \t is safe to send. This turns out to be essential for the Ann Arbor 4080.)

A final example is the LSI ADM-3a, which uses row and column offset by a blank character, thus  
cup=\E=%p1''%+%c%p2''%+%c. After sending '\E=', this pushes the first parameter, pushes the ASCII value for a space (32), adds them (pushing the sum on the stack in place of the two previous values) and outputs that value as a character. Then the same is done for the second parameter. More complex arithmetic is possible using the stack.

## terminfo

If the terminal has row or column absolute cursor addressing, these can be given as single parameter capabilities **hpa** (horizontal position absolute) and **vpa** (vertical position absolute). Sometimes these are shorter than the more general two parameter sequence (as with the hp2645) and can be used in preference to **cup**. If there are parameterized local motions (for example, move *n* spaces to the right) these can be given as **cud**, **cub**, **cuf**, and **cuu** with a single parameter indicating how many spaces to move. These are primarily useful if the terminal does not have **cup**, such as the TEKTRONIX 4025.

### Cursor Motions

If the terminal has a fast way to home the cursor (to very upper left corner of screen), then this can be given as **home**; similarly a fast way of getting to the lower left-hand corner can be given as **ll**; This may involve going up with **cuu1** from the home position, but a program should never do this itself (unless **ll** does) because it can make no assumption about the effect of moving up from the home position. Note that the home position is the same as addressing to (0,0): to the top left corner of the screen, not of memory. (Thus, the **\EH** sequence on HP terminals cannot be used for **home**.)

### Area Clears

If the terminal can clear from the current position to the end of the line, leaving the cursor where it is, this should be given as **el**. If the terminal can clear from the current position to the end of the display, then this should be given as **ed**. **Ed** is only defined from the first column of a line. (Thus, it can be simulated by a request to delete a large number of lines if a true **ed** is not available.)

## terminfo

### Insert/Delete Line

If the terminal can open a new blank line before the line where the cursor is, this should be given as **il1**; this is done only from the first position of a line. The cursor must then appear on the newly blank line. If the terminal can delete the line that the cursor is on, then this should be given as **dl1**; this is done only from the first position on the line to be deleted. Versions of **il1** and **dl1** which take a single parameter and insert or delete that many lines can be given as **il** and **dl**. If the terminal has a settable scrolling region (like the vt100), the command to set this can be described with the **csr** capability, which takes two parameters: the top and bottom lines of the scrolling region. The cursor position is undefined after using this command. It is possible to get the effect of insert or delete line using this command; the **sc** and **rc** (save and restore cursor) commands are also useful. Inserting lines at the top or bottom of the screen can also be done using **ri** and **ind** on many terminals without a true insert/delete line, which is often faster even on terminals with those features.

If the terminal has the ability to define a window as part of memory, which all commands affect, it should be given as the parameterized string **wind**. The four parameters are the starting and ending lines in memory and the starting and ending columns in memory, in that order.

If the terminal can retain display memory above, then the **da** capability should be given; if display memory can be retained below, then **db** should be given. These indicate that deleting a line or scrolling may bring non-blank lines up from below or that scrolling back with **ri** may bring down non-blank lines.

## terminfo

### Insert/Delete Character

There are two basic kinds of intelligent terminals (with respect to insert/delete character) that can be described using terminfo. The most common insert/delete character operations affect only the characters on the current line and shift characters off the end of the line rigidly. Other terminals, such as the Concept 100 and the Perkin Elmer Owl, make a distinction between typed and untyped blanks on the screen, shifting upon an insert or delete only to an untyped blank, which is either eliminated, or expanded to two untyped blanks.

You can determine the kind of terminal you have by clearing the screen and then typing text separated by cursor motions. Type `abc def` using local cursor motions (not spaces) between the `abc` and the `def`. Then position the cursor before the `abc` and put the terminal in insert mode. If typing characters causes the rest of the line to shift rigidly and characters to fall off the end, then your terminal does not distinguish between blanks and untyped positions. If the `abc` shifts over to the `def`, which then move together around the end of the current line and onto the next as you insert, you have the second type of terminal; you should give the capability `in`, which stands for insert null. While these are two logically separate attributes (one line vs. multi-line insert mode, and special treatment of untyped spaces) we have seen no terminals whose insert mode cannot be described with the single attribute.

Terminfo can describe both terminals that have an insert mode, and terminals that send a simple sequence to open a blank position on the current line. Give as `smir` the sequence to get into insert mode. Give as `rmir` the sequence to leave insert mode. Now give as `ich1` any sequence needed to be sent just before sending the character to be inserted. Most terminals with a true insert mode will not give `ich1`; terminals that send a sequence to open a screen position should give it here. (If your terminal has both, insert mode is usually preferable to `ich1`. Do not give both unless the terminal

## terminfo

actually requires both to be used in combination.) If post insert padding is needed, give this as a number of milliseconds in **ip** (a string option). Any other sequence that may need to be sent after an insert of a single character may also be given in **ip**. If your terminal needs both to be placed into an 'insert mode' and a special code to precede each inserted character, then both **smir/rmir** and **ich1** can be given, and both will be used. The **ich** capability, with one parameter, *n*, will repeat the effects of **ich1** *n* times.

It is occasionally necessary to move around while in insert mode to delete characters on the same line (for example, if there is a tab after the insertion position). If your terminal allows motion while in insert mode you can give the capability **mir** to speed up inserting in this case. Omitting **mir** will affect only speed. Some terminals (notably Datamedia's) must not have **mir** because of the way their insert mode works.

Finally, you can specify **dch1** to delete a single character, **dch** with one parameter, *n*, to delete *n* characters, and delete mode by giving **smdc** and **rmdc** to enter and exit delete mode (any mode the terminal needs to be placed in for **dch1** to work).

A command to erase *n* characters (equivalent to outputting *n* blanks without moving the cursor) can be given as **ech** with one parameter.

### Highlighting, Underlining, and Visible Bells

If your terminal has one or more kinds of display attributes, these can be represented in a number of different ways. You should choose one display form as standout mode, representing a good, high contrast, easy-on-the-eyes, format for highlighting error messages and other attention getters. (If you have a choice, reverse video plus half-bright is good, or reverse video alone.) The sequences to enter and exit standout mode are given as **sms0** and **rms0**, respectively. If the code to change into or out of standout mode leaves one or even two blank spaces on the screen, as the TVI 912 and Teleray 1061 do, then **xmc** should be given to tell how many spaces are left.

## terminfo

Codes to begin underlining and end underlining can be given as **smul** and **rmul**, respectively. If the terminal has a code to underline the current character and move the cursor one space to the right, such as the Microterm Mime, this can be given as **uc**.

Other capabilities to enter various highlighting modes include **blink** (blinking), **bold** (bold or extra bright), **dim** (dim or half\_bright), **invis** (blinking or invisible text), **prot** (protected), **rev** (reverse video), **sgr0** (turn off all attribute modes), **smacs** (enter alternate character set mode), and **rmacs** (exit alternate character set mode). Turning on any of these modes singly may or may not turn off other modes.

If there is a sequence to set arbitrary combinations of modes, this should be given as **sgr** (set attributes), taking 9 parameters. Each parameter is either 0 or 1, as the corresponding attribute is on or off. The 9 parameters are, in order: standout, underline, reverse, blink, dim, bold, blank, protect, alternate character set. Not all modes need be supported by **sgr**, only those for which corresponding separate attribute commands exist.

Terminals with the "magic cookie" glitch (**xmc**) deposit special "cookies" when they receive mode-setting sequences, which affect the display algorithm rather than having extra bits for each character. Some terminals, such as the HP2621, automatically leave standout mode when they move to a new line or the cursor is addressed. Programs using standout mode should exit standout mode before moving the cursor or sending a new-line, unless the **msgsr** capability, asserting that it is safe to move in standout mode, is present.

If the terminal has a way of flashing the screen to indicate an error quietly (a bell replacement), this can be given as **flash**; it must not move the cursor.

## terminfo

If the cursor needs to be made more visible than normal when it is not on the bottom line (to make, for example, a non-blinking underline into an easier to find block or blinking underline) give this sequence as **cvvis**. If there is a way to make the cursor completely invisible, give that as **civis**. The capability **cnorm** should be given, which undoes the effects of both of these modes.

If the terminal needs to be in a special mode when running a program that uses these capabilities, the codes to enter and exit this mode can be given as **smcup** and **rmcup**. This arises, for example, from terminals like the Concept with more than one page of memory. If the terminal has only memory relative cursor addressing and not screen relative cursor addressing, a one screen-sized window must be fixed into the terminal for cursor addressing to work properly. This is also used for the TEKTRONIX 4025, where **smcup** sets the command character to be the one used by terminfo.

If your terminal correctly generates underlined characters (with no special codes needed) even though it does not overstrike, then you should give the capability **ul**. If overstrikes are erasable with a blank, then this should be indicated by giving **eo**.

## Keypad

If the terminal has a keypad that transmits codes when the keys are pressed, this information can be given. Note that it is not possible to handle terminals where the keypad only works in local (this applies, for example, to the unshifted HP2621 keys). If the keypad can be set to transmit or not transmit, give these codes as **smkx** and **rmkx**. Otherwise the keypad is assumed to always transmit. The codes sent by the left arrow, right arrow, up arrow, down arrow, and home keys can be given as **kcub1**, **kcuf1**, **kcuu1**, **kcud1**, and **khome**, respectively. If there are function keys such as **f0**, **f1**, ..., **f10**, the codes they send can be given as **kf0**, **kf1**, ..., **kf10**. If these keys have labels other than the default **f0** through **f10**, the labels can be given as **lf0**, **lf1**, ..., **lf10**. The codes transmitted by certain other special keys can be

## terminfo

given: **kll** (home down), **kbs** (backspace), **ktbc** (clear all tabs), **kctab** (clear the tab stop in this column), **kclr** (clear screen or erase key), **kdch1** (delete character), **kdl1** (delete line), **krmir** (exit insert mode), **kel** (clear to end of line), **ked** (clear to end of screen), **kich1** (insert character to enter insert mode), **kill1** (insert line), **knp** (next page), **kpp** (previous page), **kind** (scroll forward/down), **kri** (scroll backward/up), **khts** (set a tab stop in this column). In addition, if the keypad has a 3 by 3 array of keys including the four arrow keys, the other five keys can be given as **ka1**, **ka3**, **kb2**, **kc1**, and **kc3**. These keys are useful when the effects of a 3 by 3 directional pad are needed.

### Tabs and Initialization

If the terminal has hardware tabs, the command to advance to the next tab stop can be given as **ht** (usually control I). A "backtab" command, which moves leftward to the next tab stop, can be given as **cbt**. By convention, if the teletype modes indicate that tabs are being expanded by the computer rather than being sent to the terminal, programs should not use **ht** or **cbt** even if they are present, since the user may not have the tab stops properly set. If the terminal has hardware tabs that are initially set every *n* spaces when the terminal is powered up, the numeric parameter **it** is given, showing the number of spaces the tabs are set to. This is normally used by the **tset** command to determine whether to set the mode for hardware tab expansion, and whether to set the tab stops. If the terminal has tab stops that can be saved in nonvolatile memory, the terminfo description can assume that they are properly set.

Other capabilities include **is1**, **is2** and **is3**, initialization strings for the terminal; **ipro**, the path name of a program to be run to initialize the terminal; and **if**, the name of a file containing long initialization strings. These strings are expected to set the terminal into modes consistent with the rest of the terminfo description. They are normally sent to the terminal, by the **tset** program, each time the user logs in. They will be printed in the following order: **is1**, **is2**; setting tabs using **tbc** and **hts**; **if**; running the program **ipro**; and finally **is**. Most initialization is done with **is2**. Special terminal modes can be set up without duplicating strings by putting the common

## terminfo

sequences in **is2** and special cases in **is1** and **is3**. A pair of sequences that does a harder reset from a totally unknown state can be analogously given as **rs1**, **rs2**, **rf**, and **rs3**, analogous to **is2** and **if**. These strings are output by the **reset** program, which is used when the terminal gets into a wedged state. Commands are normally placed in **rs2** and **rf** only if they produce annoying effects on the screen and are not necessary when logging in. For example, the command to set the vt100 into 80-column mode would normally be part of **is2**, but it causes an annoying glitch of the screen and is not normally needed since the terminal is usually already in 80 column mode.

If there are commands to set and clear tab stops, they can be given as **tbc** (clear all tab stops) and **hts** (set a tab stop in the current column of every row). If a more complex sequence is needed to set the tabs than can be described by this, the sequence can be placed in **is2** or **if**.

## Delays

Certain capabilities control padding in the teletype driver. These are primarily needed by hard copy terminals, and are used by the **tset** program to set teletype modes appropriately. Delays embedded in the capabilities **cr**, **ind**, **cub1**, **ff**, and **tab** will cause the appropriate delay bits to be set in the teletype driver. If **pb** (padding baud rate) is given, these values can be ignored at baud rates below the value of **pb**.

## Miscellaneous

If the terminal requires other than null (zero) character as a pad, then this can be given as **pad**. Only the first character of the **pad** string is used.

## terminfo

If the terminal has an extra "status line" that is not normally used by software, this fact can be indicated. If the status line is viewed as an extra line below the bottom line, into which one can cursor address normally (such as the Heathkit h19's 25th line, or the 24th line of a vt100 that is set to a 23-line scrolling region), the capability **hs** should be given. Special strings to go to the beginning of the status line and to return from the status line can be given as **tsl** and **fsl**. (**fsl** must leave the cursor position in the same place it was before **tsl**. If necessary, the **sc** and **rc** strings can be included in **tsl** and **fsl** to get this effect.) The parameter **tsl** takes one parameter, which is the column number of the status line the cursor is to be moved to. If escape sequences and other special commands, such as **tab**, work while in the status line, the flag **eslok** can be given. A string that turns off the status line (or otherwise erases its contents) should be given as **dsl**. If the terminal has commands to save and restore the position of the cursor, give them as **sc** and **rc**. The status is normally assumed to be the same width as the rest of the screen (**cols**). If the status line is a different width (possibly because the terminal does not allow an entire line to be loaded), the width, in columns, can be indicated with the numeric parameter **wsl**.

If the terminal can move up or down half a line, this can be indicated with **hu** (half-line up) and **hd** (half-line down). This is primarily useful for superscripts and subscripts on hardcopy terminals. If a hardcopy terminal can eject to the next page (form feed), give this as **ff** (usually control L).

If there is a command to repeat a given character a given number of times (to save time transmitting a large number of identical characters), this can be indicated with the parameterized string **rep**. The first parameter is the character to be repeated and the second is the number of times to repeat it. Thus, **tparam** (**repeat\_char**, 'x', 10) is the same as "xxxxxxxxxx".

## terminfo

If the terminal has a settable command character, such as the TEKTRONIX 4025, this can be indicated with **cmdch**. A prototype command character is chosen which is used in all capabilities. This character is given in the **cmdch** capability to identify it. The following convention is supported on CENTIX: The environment is to be searched for a **CC** variable, and if found, all occurrences of the prototype character are replaced with the character in the environment variable.

Terminal descriptions that do not represent a specific kind of known terminal, such as switch, dialup, patch, and network, should include the **gn** (generic) capability so that programs can complain that they do not know how to talk to the terminal. (This capability does not apply to virtual terminal descriptions for which the escape sequences are known.)

If the terminal uses xon/xoff handshaking for flow control, give **xon**. Padding information should still be included so that routines can make better decisions about costs, but actual characters will not be transmitted.

If the terminal has a "meta key" that acts as a shift key, setting the 8th bit of any character transmitted, this fact can be indicated with **km**. Otherwise, software will assume that the 8th bit is parity and it will usually be cleared. If strings exist to turn this "meta mode" on and off, they can be given as **smm** and **rmm**.

If the terminal has more lines of memory than will fit on the screen at once, the number of lines of memory can be indicated with **lm**. A value of **lm#0** indicates that the number of lines is not fixed, but that there is still more memory than fits on the screen.

If the terminal is one of those supported by the CENTIX virtual terminal protocol, the terminal number can be given as **vt**.

## terminfo

Media copy strings that control an auxiliary printer connected to the terminal can be given as **mc0**: print the contents of the screen; **mc4**: turn off the printer; and **mc5**: turn on the printer. When the printer is on, all text sent to the terminal will be sent to the printer. It is undefined whether the text is also displayed on the terminal screen when the printer is on. A variation **mc5p** takes one parameter and leaves the printer on for as many characters as the value of the parameter, then turns the printer off. The parameter should not exceed 255. All text, including **mc4**, is transparently passed to the printer while an **mc5p** is in effect.

Strings to program function keys can be given as **pfkey**, **pfloc**, and **pfx**. Each of these strings takes two parameters: the function key number to program (from 0 to 10) and the string to program it with. Function key numbers out of this range may program undefined keys in a terminal dependent manner. The difference between the capabilities is that **pfkey** causes pressing the given key to be the same as the user typing the given string; **pfloc** causes the string to be executed by the terminal in local; and **pfx** causes the string to be transmitted to the computer.

### Similar Terminals

If there are two very similar terminals, one can be defined as being just like the other with certain exceptions. The string capability **use** can be given with the name of the similar terminal. The capabilities given before **use** override those in the terminal type invoked by **use**. A capability can be cancelled by placing **xx@** to the left of the capability definition, where **xx** is the capability. For example, the entry

```
2621-nl, smkx@, rmkx@, use=2621,
```

defines a 2621-nl that does not have the **smkx** or **rmkx** capabilities, and hence does not turn on the function key labels when in visual mode. This is useful for different modes for a terminal, or for different user preferences.

# terminfo

## Files

`/usr/lib/terminfo/?/*` - files containing terminal descriptions

## See Also

**curses**, **printf** in Section 3; **term** in Section 5.

# utmp

## Name

utmp, wtmp - utmp and wtmp entry formats

## Format

```
#include <sys/types.h>
#include <utmp.h>
```

## Description

These files hold user and accounting information for such commands as **who**, **write**, and **login**. Each Application Processor has its own utmp and wtmp files; the two digit AP number is appended to the file name.

The files have the following structure as defined by <utmp.h>:

```
#define UTMP_FILE "/etc/utmp"
#define WTMP_FILE "/etc/wtmp"
#define ut_name ut_user

struct utmp {
    char ut_user[8]; /*User login name*/
    char ut_id[4]; /*/etc/inittab id*/
    char ut_line[12]; /*device name (console, lnx)*/
    short ut_pid; /*process id*/
    short ut_type; /*type of entry*/
    struct exit_status {
        short e_termination; /*Proc. terminat. status*/
        short e_exit; /*Process exit status*/
    } ut_exit; /*The exit status of a process
               *marked as DEAD_PROCESS.*/
    time_t ut_time; /*time entry was made*/
};

/*Definitions for ut_type*/
#define EMPTY 0
#define RUN_LVL 1
#define BOOT_TIME 2
#define OLD_TIME 3
#define NEW_TIME 4
#define INIT_PROCESS 5 /*Process spawned by "init"*/
#define LOGIN_PROCESS 6 /*A "getty" process waiting
                        *for login*/
```

## utmp

```
#define USER_PROCESS      7      /*A user process*/
#define DEAD_PROCESS      8
#define ACCOUNTING        9
#define UTMAXTYPE         ACCOUNTING /*Largest legal value
                                     of ut_type*/

/* Special strings or formats used in the "ut_line" field */
/* when accounting for something other than a process */
/* No string for the ut_line field can be more than 11 */
/* chars + a NULL in length */
#define RUNLVL_MSG        "run-level%c"
#define BOOT_MSG          "system boot"
#define OTIME_MSG         "old time"
#define NTIME_MSG         "new time"
```

## Files

```
/usr/include/utmp.h
/etc/utmp??
/etc/wtmp??
```

## See Also

login, who, write in Section 1; getut in Section 3.

## Miscellaneous Facilities

### intro

#### Name

intro - introduction to miscellany

#### Description

This section describes miscellaneous facilities such as macro packages, character set tables, and so on.

# environ

## Name

environ - user environment

## Description

An array of strings called the "environment" is made available by the **exec** system call when a process begins. By convention, these strings have the form "name=value." The following names are used by various commands.

|             |  |
|-------------|--|
| <b>PATH</b> | The sequence of directory prefixes that <b>sh</b> , <b>time</b> , <b>nice</b> , <b>nohup</b> , and so on, apply in searching for a file known by an incomplete path name. The prefixes are separated by colons(:). <b>login</b> sets <b>PATH=:/bin:/usr/bin</b> .              |
| <b>HOME</b> | Name of the user's login directory, set by <b>login</b> from the password file <b>passwd</b> .   |
| <b>TERM</b> | The kind of terminal for which output is to be prepared. This information is used by commands such as <b>mm</b> , which may exploit special capabilities of that terminal.   |
| <b>TZ</b>   | Time zone information. The format is <b>xxx/zzz</b> where <b>xxx</b> is standard local time zone abbreviation, <b>n</b> is the difference in hours from GMT, and <b>zzz</b> is the abbreviation for the daylight-saving local time zone, if any; for example, <b>EST5EDT</b> . |

Further names may be placed in the environment by the **export** command and "name=value" arguments in **sh**, or by **exec**. It is unwise to conflict with certain shell variables that are frequently exported by .profile files: **MAIL**, **PS1**, **PS2**, **IFS**.

## See Also

**env**, **login**, **sh** in Section 1; **exec** in Section 2; **getenv** in Section 3; **profile** in Section 4; **term**.

# fcntl

## Name

fcntl - file control options

## Format

```
#include <fcntl.h>
```

## Description

The `fcntl` function provides for control over open files. The include file describes *requests* and *arguments* to `fcntl` and `open` (see Section 2).

```
/*Flag values accessible to open and fcntl*/
/*(The first three can only be set by open)*/
#define O_RDONLY 0
#define O_WRONLY 1
#define O_RDWR 2
#define O_NDELAY 04 /*Non-blocking I/O*/
#define O_APPEND 010 /*append (writes guaranteed*/
/*at the end)*/
#define O_SYNC 020 /*synchronous write option*/
#define O_DIRECT 020000 /*perform direct I/O*/
#define O_NODIRECT 040000

/*Flag values accessible only to open*/
#define O_CREAT 00400 /*open with file create*/
/*uses third open arg*/
#define O_TRUNC 01000 /*open with truncation*/
#define O_EXCL 02000 /*exclusive open*/

/*fcntl requests*/
#define F_DUPFD 0 /*Duplicate fildes*/
#define F_GETFD 1 /*Get fildes flags*/
#define F_SETFD 2 /*Set fildes flags*/
#define F_GETFL 3 /*Get file flags*/
#define F_SETFL 4 /*Set file flags*/
#define F_GETLK 5 /*Get blocking file locks*/
#define F_SETLK 6 /*Set or clear file locks*/
/*and fall on busy*/
#define F_SETLKW 7 /*Set or clear file locks*/
/*and wait on busy*/
```

## fcntl

```
/*file segment locking control structure*/
struct flock {
    short   l_type;
    short   l_whence;
    long    l_start;
    long    l_len;    /*if 0 then until EOF*/
    int     l_pid;    /*returned with F_GETLK*/

/*file segment locking types*/
#define F_RDLCK    01    /*Read lock*/
#define F_WRLCK    02    /*Write lock*/
#define F_UNLCK    03    /*Remove locks*/
```

## See Also

`fcntl`, `open` in Section 2.

# math

## Name

math - math functions and constants

## Format

```
#include <math.h>
```

## Description

This file contains declarations of all the functions in the Math Library, as well as various functions in the C Library (see Section 3, Library Functions) that return floating-point values.

It defines the structure and constants used by the `matherr` error-handling mechanisms, including the following constant used as an error-return value:

**HUGE**                      The maximum value of a single-precision floating-point number.

The following mathematical constants are defined for user convenience:

|                  |   |
|------------------|---|
| <b>M_E</b>       | The base of natural logarithms ( $e$ ).   |
| <b>M_LOG2E</b>   | The base-2 logarithm of $e$ .   |
| <b>M_LOG10E</b>  | The base-10 logarithm of $e$ .  |
| <b>M_LN2</b>     | The natural logarithm of 2.   |
| <b>M_LN10</b>    | The natural logarithm of 10.  |
| <b>M_PI</b>      | The ratio of the circumference of a circle to its diameter. (There are also several fractions of its reciprocal and its square root.) |
| <b>M_SQRT2</b>   | The positive square root of 2.  |
| <b>M_SQRT1_2</b> | The positive square root of 1/2.  |

For the definitions of various machine-dependent "constants," see the description of the `<values.h>` header file.

# math

## Files

`/usr/include/math.h`

## See Also

`intro`, `matherr` in Section 3; `values`.

# modemcap

## Name

modemcap - smart modem capability data base

## Format

```
/usr/lib/uucp/modemcap
```

## Description

Modemcap describes the call placing protocol of smart modems. CENTIX **uucp** and **dial** accept a reference to a modemcap entry in place of an automatic call unit reference in `/usr/lib/uucp/L-devices`. Each entry describes a single modem in a specific configuration.

Modemcap is a text file. Lines that begin with a pound sign (#) are ignored. Other lines make up descriptions.

Each description begins on a new line. The beginning of the description is a list of its names, separated by vertical bars(|). Any of the names, which must not begin with **cu**, can be used in place of the call unit name in `/usr/lib/uucp/L-devices`.

The rest of the description is a list of capabilities, separated by colons(:). If a description extends over more than one line, each line except the last must end with a backslash(\). (The continuation is normally entered as colon-backslash-newline-tab-colon: this produces a single invalid capability, which is ignored.) Here is an example:

```
#bizcomp 1012 - option switch 9 down
bz | bizcomp bizcomp 1012:
:a1=NO ANSWER:b1=NO DIAL TONE:b2=NO ANSWER:c1=1:c2=2:\
:c7=7:d1#1:d5#5:eh=\r:ph=\02D:ps=\02:pw=72:\
:sa=A:sq=Q:sv=V:sx=X:sz=Z:wp=\r:\
:p1=szd5wpd1svwpsqwpsxwpd1phwpc7b1wpc2a1c1b2d1:
```

## modemcap

Each capability has three parts:

- 1 The two-character name of the capability.
- 2 A pound sign (#) or equal sign (=). A pound sign indicates a numeric capability. An equal sign indicates a string capability.
- 3 The capability value. For a numeric capability, the value is the number that immediately follows the pound sign. For a string capability, the value is the string of characters, including blanks, between the equal sign and the colon that ends the capability. (If a colon is part of the value, it must be expressed as an octal sequence; see below.) In a string capability, the following sequences stand for single characters:

|                   |   |
|-------------------|---|
| <code>\xxx</code> | (where <i>xxx</i> is one to three octal digits) The character whose octal value is <i>xxx</i> . |
| <code>\072</code> | Colon (:).  |
| <code>\200</code> | Null ( <code>\000</code> doesn't work).   |
| <code>\E</code>   | Escape ( <code>\033</code> ).   |
| <code>\n</code>   | Newline ( <code>\012</code> ).  |
| <code>\r</code>   | Return ( <code>\015</code> ).   |
| <code>\t</code>   | Tab ( <code>\011</code> ).  |
| <code>\b</code>   | Backspace ( <code>\010</code> ).  |
| <code>\f</code>   | Formfeed ( <code>\014</code> ).   |
| <code>^x</code>   | Control- <i>x</i> .   |

There are four kinds of capabilities: the place call capability, basic features capabilities, the send phone number capability, and send/receive capabilities. Only the place call capability is mandatory.

### Place Call Capability

- pl** String capability. Controls the use of the other capabilities. The value of the string is a procedure made up of the other capabilities. A communication program works through `pl`'s value, using each capability as it is encountered; a limited control of execution flow is provided by some special capabilities.

# modemcap

## Basic Features Capabilities

Basic features capabilities specify strings used to command basic features of the modem. These capabilities never appear in the **pl** value, but are implied by other capabilities. The capability descriptions indicate which capabilities use basic features capabilities and what happens when basic features capabilities are undefined.

|           |   |
|-----------|---|
| <b>ps</b> | Primary command start; string capability. The <b>ps</b> capability specifies the characters that precede modem commands, if required. Used by <b>sx</b> capability.   |
| <b>pe</b> | Primary command end; string capability. The <b>pe</b> capability specifies the characters that must follow modem commands, if required. Used by <b>sx</b> capability. |
| <b>eh</b> | End phone number; string capability. Used by <b>ph</b> capability.  |
| <b>pa</b> | Pause in phone number; string capability. Used by <b>ph</b> capability.   |
| <b>pw</b> | Pause in phone number and wait for dial tone; string capability. Used by <b>ph</b> capability.  |

## Send Phone Number Capability

|           |  |
|-----------|--|
| <b>ph</b> | String capability. In a single <b>write</b> system call, send a string with three parts: <ol style="list-style-type: none"><li>1 The <b>ph</b> capability's own value.</li><li>2 The phone number as ASCII digits. Whenever the modem should pause, send the value of the <b>pa</b> capability, if defined. Whenever the modem should pause and wait for a dial tone, send the value of the <b>pw</b> capability, if defined.</li><li>3 The value of the <b>eh</b> capability, if defined.</li></ol> |
|-----------|--|

# modemcap

## Send/Receive Capabilities

Send/receive capabilities are different from other capabilities in their naming convention. The first character of the capability name tells the kind of capability. The second character of the name is chosen arbitrarily from the lowercase letters and digits and identifies the particular capability from others of the same kind.

- tx** String capability. Send the value to the modem.
- sx** String capability. In a single write, send a command to the modem. The command has three parts:

- 1 The value of the **ps** capability, if defined.
- 2 The **sx**'s capability's own value.
- 3 The value of the **pe** capability, if defined.

- dx** Numeric capability. Delay for the number of seconds specified in the value.
- wx** String capability; value must be a single character. Wisk through input from modem until the value is read. Put input, up to but not including the terminating character, in the wisk buffer, replacing the previous contents.
- cx** String capability. Compare value with contents of the wisk buffer. Set the comparison flag to EQUAL if they match, NOT\_EQUAL otherwise. Do not modify the comparison flag until you execute another **cx**.
- mx** Numeric capability. Skip on EQUAL. If the comparison flag is EQUAL, the next *n* instructions in the **pl** value are skipped, where *n* is the value of **mx**.
- nx** Numeric capability. Skip on NON\_EQUAL. If the comparison flag is NOT\_EQUAL, the next *n* instructions in the **pl** value are skipped, where *n* is the value of **nx**.
- ax** String capability. Abort on EQUAL. If the comparison flag is EQUAL, abort the phone call. If debug output is specified, print the value of the **ax** capability.
- bx** String capability. Abort on NOT\_EQUAL. If the comparison flag is NOT\_EQUAL, abort the phone call. If debug output is specified, print the value of the **bx** capability.

## modemcap

### Example

The Bizcomp 1012 example above assumes that the modem's switch 9 (configuration: TERMINAL/COMPUTER) is down (COMPUTER). With this setting, the modem has the following characteristics:

- Commands to the modem must be preceded by an STX (\002) and followed by a CR (\r). This prevents normal data transmissions from being taken for modem commands.
- The modem's messages to the computer are terse. The following two-character sequences are diagnostics.

|      |                            |
|------|----------------------------|
| 1 CR | connection made            |
| 2 CR | no connection or no answer |
| 7 CR | dial tone detected         |

A CR is a command prompt. A communication program that uses the Bizcom 1012 modemcap entry follows the following procedure:

- 1 (szd5wpd1) Send an STX-Z-CR, resetting the modem. Wait five seconds, then read the resulting CR. Wait another one second.
- 2 (svwpsqwpsxwpd1) Send an STX-V-CR (select tone dialing); read the resulting CR. Send an STX-Q-CR (toggle busy detection); read the resulting CR. Send an STX-X-CR (select transparent data mode); read the resulting CR. Wait one second.
- 3 (ph) Send an STX-D, then the phone number. The phone number should include a colon (:) whenever the modem should pause to listen for another dial tone. The description lacks a **pa** capability, so there is no way to pause without waiting for a dial tone.
- 4 (wpc7b1) Read until the next CR. If the input isn't "7," abort with the debug message "NO DIAL TONE."

## modemcap

- 5 (wpc2a1c1b2) Read until the next CR. If the input is "2," abort with the debug message "NO ANSWER." Otherwise, if the input isn't "1," abort with the debug message "NO ANSWER."
- 6 (d1) Wait one second. The connection is established.

## See Also

**dial** in Section 3; **uucp** in Section 1.

# pilf

## Name

pilf, dio - performance improvement in large files and direct I/O

## Description

A PILF file system supports the input or output of large amounts of data with a single physical read or write. This requires special strategies for I/O; when standard I/O operations are applied to a PILF file system, it behaves like a standard 1K file system. A PILF file system is created with the **-P** option of **mkfs** (see Section 1).

A file on a PILF file system is allocated by clusters, each of which is equal in size and consists of contiguous blocks. Performance improvement is seen when the DIO (Direct Input/Output) mechanism is used and no read or write crosses a cluster boundary.

A field in the *i*-node determines the file's cluster size. A cluster consists of  $2^c$  1K blocks, where *c* is the value in the *i*-node. The process that creates a PILF file specifies its cluster size using the **syslocal** system call; if a process has not yet specified a cluster size, the default cluster size, in the superblock, is used. A file's cluster size is determined when it is created; it cannot be changed.

DIO transfers data directly between the process's address space and the disk, bypassing the kernel buffer cache. It is specifically meant to be used on PILF files. DIO is automatically used for reads or writes of multiples of 1K to regular files that are greater than 2K and word aligned.

## Caution

A buffer used for DIO must be on an even address. This is the same degree of alignment as a short.

## See Also

**cp**, **mkfs**, **fsck**, **fsdb** in Section 1; **fcntl**, **fork**, **open**, **syslocal** in Section 2; **fs**, **inode** in Section 4; **fcntl**.

# prof

## Name

prof - profile within a function

## Format

```
#define MARK
#include <prof.h>
void MARK (name)
```

## Description

MARK will introduce a mark called *name* that will be treated the same as a function entry point. Execution of the mark will add to a counter for that mark, and program-counter time spent will be accounted to the immediately preceding mark, or to the function if there are no preceding marks within the active function.

*Name* may be any combination of up to six letters, numbers or underscores. Each name in a single compilation must be unique, but may be the same as any ordinary program symbol.

For marks to be effective, the symbol MARK must be defined before the header file <prof.h> is included. This may be defined by a preprocessor directive as in the synopsis, or by a command line argument, such as:

```
cc -p -DMARK foo.c
```

If MARK is not defined, the MARK (*name*) statements may be left in the source files containing them and will be ignored.

## prof

### Example

In this example, marks can be used to determine how much time is spent in each loop. Unless this example is compiled with MARK defined on the command line, the marks are ignored.

```
#include <prof.h>

foo( )
{
    int i, j;
    .
    .
    .
    MARK(loop1);
    for(i = 0; i < 2000; i++) {
        ...
    }
    MARK(loop2);
    for (j = 0; j <2000; j++) {
        ...
    }
}
}
```

### See Also

**prof** in Section 1; **profil** in Section 2; **monitor** in Section 3.

# regex

## Name

regex - regular expression compile and match routines

## Format

```
#define INIT <declarations>
#define GETC( ) <getc code>
#define PEEKC( ) <peekc code>
#define UNGETC(c) <ungetc code>
#define RETURN(pointer) <return code>
#define ERROR(val) <error code>

#include <regex.h>

char *compile (instring, expbuf, endbuf, eof)
char *instring, *expbuf, *endbuf;
int eof;

int step (string, expbuf)
char *string, *expbuf;

extern char *loc1, *loc2, *locs;

extern int circf, sed, nbra;
```

## Description

This page describes general-purpose regular expression matching routines in the form of **ed**, defined in `/usr/include/regex.h`. Programs such as **ed**, **sed**, **grep**, **bs**, **expr**, and so on, which perform regular expression matching, use this source file. In this way, only this file need be changed to maintain regular expression compatibility.

The interface to this file is unpleasantly complex. Programs that include this file must have the following five macros declared before the `"#include <regex.h>"` statement. These macros are used by the **compile** routine.

## regexp

|                          |   |
|--------------------------|---|
| GETC()                   | Return the value of the next character in the regular expression pattern. Successive calls to GETC() should return successive characters of the regular expression.   |
| PEEKC()                  | Return the next character in the regular expression. Successive calls to PEEKC() should return the same character (which should also be the next character returned by GETC()).   |
| UNGETC( <i>c</i> )       | Cause the argument <i>c</i> to be returned by the next call to GETC() (and PEEKC()). No more than one character of pushback is ever needed and this character is guaranteed to be the last character read by GETC(). The value of the macro UNGETC( <i>c</i> ) is always ignored. |
| RETURN( <i>pointer</i> ) | This macro is used on normal exit of the <code>compile</code> routine. The value of the argument <i>pointer</i> is a pointer to the character after the last character of the compiled regular expression. This is useful to programs that have memory allocation to manage.      |
| ERROR( <i>val</i> )      | This is the abnormal return from the <code>compile</code> routine. The argument <i>val</i> is an error number (see Table 5-1, below, for meanings). This call should never return.  |

Table 5-1 Errors and Meanings

| Error | Meaning                               |
|-------|---------------------------------------|
| 11    | Range endpoint too large.             |
| 16    | Bad number.                           |
| 25    | "\digit" out of range.                |
| 36    | Illegal or missing delimiter.         |
| 41    | No remembered search string.          |
| 42    | \( \) imbalance.                      |
| 43    | Too many \(.                          |
| 44    | More than 2 numbers given in \{ \}.   |
| 45    | } expected after \.                   |
| 46    | First number exceeds second in \{ \}. |
| 49    | [] imbalance.                         |
| 50    | Regular expression overflow.          |

## regexp

The syntax of the **compile** routine is as follows

```
compile (instring, expbuf, endbuf, eof)
```

The first parameter *instring* is never used explicitly by the **compile** routine but is useful for programs that pass down different pointers to input characters. It is sometimes used in the INIT declaration (see below). Programs that call functions to input characters or have characters in an external array can pass down a value of ((char \*) 0) for this parameter.

The next parameter, *expbuf*, is a character pointer. It points to the place where the compiled regular expression will be placed.

The parameter *endbuf* is one more than the highest address where the compiled regular expression may be placed. If the compiled expression cannot fit in (*endbuf-expbuf*) bytes, a call to ERROR(50) is made.

The parameter *eof* is the character that marks the end of the regular expression. For example, in **ed**, this character is usually a `/`.

Each program that includes this file must have a `#define` statement for INIT. This definition will be placed right after the declaration for the function **compile** and the opening brace(`{}`). It is used for dependent declarations and initializations. Most often it is used to set a register variable to point to the beginning of the regular expression so that this register variable can be used in the declarations for `GETC()`, `PEEKC()`, and `UNGETC()`. Otherwise, it can be used to declare external variables that might be used by `GETC()`, `PEEKC()`, and `UNGETC()`. See the example below of the declarations taken from the **grep** shell command.

## regexp

There are other functions in this file that perform actual regular expression matching, one of which is the function **step**. The call to **step** is as follows:

```
step(string, expbuf)
```

The first parameter to **step** is a pointer to a string of characters to be checked for a match. This string should be null terminated.

The second parameter, *expbuf*, is the compiled regular expression that was obtained by a call of the function **compile**.

The function **step** returns non-zero if the given string matches the regular expression, and zero if the expressions do not match. If there is a match, two external character pointers are set as a side effect to the call to **step**. The variable set in **step** is *loc1*. This is a pointer to the first character that matched the regular expression. The variable *loc2*, which is set by the function **advance**, points to the character after the last character that matches the regular expression. Thus if the regular expression matches the entire line, *loc1* will point to the first character of string and *loc2* will point to the null at the end of string.

**Step** uses the external variable *circf* which is set by **compile** if the regular expression begins with  $\wedge$ . If this is set, **step** will try to match the regular expression to the beginning of the string only. If more than one regular expression is to be compiled before the first is executed, the value of *circf* should be saved for each compiled expression, and *circf* should be set to that saved value before each call to **step**.

The function **advance** is called from **step** with the same arguments as **step**. The purpose of **step** is to step through the string argument and call **advance** until **advance** returns non-zero, indicating a match, or until the end of string is reached. If you want to constrain *string* to the beginning of the line in all cases, **step** need not be called; simply call **advance**.

## regex

When **advance** encounters a `*` or `\{ \}` sequence in the regular expression, it will advance its pointer to the string to be matched as far as possible and will recursively call itself, trying to match the rest of the string to the rest of the regular expression. As long as there is no match, **advance** will back up along the string until it finds a match or reaches the point in the string that initially matched the `*` or `\{ \}`. It is sometimes desirable to stop this backing up before the initial point in the string is reached. If the external character pointer *locs* is equal to the point in the string at some time during the backing up process, **advance** will break out of the loop that backs up and will return zero. This is used by **ed** and **sed** for substitutions done globally (not just the first occurrence, but the whole line) so, for example, expressions like `s/y*/g` do not loop forever.

The additional external variables *sed* and *nbra* are used for special purposes.

## Examples

The following is an example of how the regular expression macros and calls look from the **grep** command:

```
#define INIT      register char *sp = instring;
#define GETC()    (*sp++)
#define PEEKC( )  (*sp)
#define UNGETC(c) (-sp)
#define RETURN(c) return;
#define ERROR(c)  regerr()

#include <regex.h>
...
        (void) compile(*argv, expbuf, &expbuf[ESIZE], '\0');
...
        if (step(linebuf, expbuf))
            succeed( );
```

# regexp

## Files

`/usr/include/regexp.h`

## Known Problems

The handling of *circf* is kludgy.

The actual code is probably easier to understand than this manual page.

## See Also

`bs`, `ed`, `expr`, `grep`, `sed` in Section 1.

# stat

## Name

stat - data returned by stat system call

## Format

```
#include <sys/types.h>
#include <sys/stat.h>
```

## Description

The system calls **stat** and **fstat** return data, the structure of which is defined by this include file. The encoding of the field *st\_mode* is defined in this file also.

```
/*
 *Structure of the result of stat
 */

struct    stat
{
    dev_t    st_dev;
    ino_t    st_ino;
    ushort   st_mode;
    short    st_nlink;
    ushort   st_uid;
    ushort   st_gid;
    dev_t    st_rdev;
    off_t    st_size;
    time_t   st_atime;
    time_t   st_mtime;
    time_t   st_ctime;
};

#define S_IFMT        0170000 /*type of file*/
#define S_IFDIR      0040000 /*directory*/
#define S_IFCHR      0020000 /*character special*/
#define S_IFBLK      0060000 /*block special*/
#define S_IFREG      0100000 /*regular*/
#define S_IFIFO      0010000 /*fifo*/
#define S_ISUID      04000    /*set user id on execution*/

#define S_ISGID      02000    /*set group id on execution*/

#define S_ISVTX      01000    /*save swapped text after use*/
```

## stat

```
#define S_IREAD    00400    /*read permission, owner*/
#define S_IWRITE   00200    /*write permission, owner*/
#define S_IEXEC    00100    /*execute/search permission,
                             *owner*/
```

## Files

/usr/include/sys/types.h

/usr/include/sys/stat.h

## See Also

stat in Section 2; types.

## term

### Name

term - conventional names for terminals

### Description

The names shown in Table 5-2 are used by certain shell commands (for example, `tabs` is maintained as part of the shell environment) in the variable `$TERM`:

Table 5-2 Terminal Names

| Name    | Description  |
|---------|--|
| pt      | Burroughs/Convergent Technologies Programmable Terminal    |
| gt      | Burroughs/Convergent Technologies Graphics Terminal        |
| freedom | Liberty Freedom 100  |
| 1520    | Datamedia 1520   |
| 1620    | DIABLO 1620 and others using the HyType II printer         |
| 1620-12 | Same as above, in 12-pitch mode                            |
| 2621    | Hewlett-Packard HP2621 series                              |
| 2631    | Hewlett-Packard 2631 line printer                          |
| 2631-c  | Hewlett-Packard 2631 line printer - compressed mode        |
| 2631-e  | Hewlett-Packard 2631 line printer - expanded mode          |
| 2640    | Hewlett-Packard 2640 series                                |
| 2645    | Hewlett-Packard HP264n series (other than the 2640 series) |
| 300     | DASI/DTC/GSI 300 and others using the HyType I printer     |
| 300-12  | Same as above, in 12-pitch mode                            |
| 300s    | DASI/DTC/GSI 300s  |
| 382     | DTC 382  |
| 300s-12 | Same as above two entries, in 12-pitch mode                |
| 3045    | Datamedia 3045   |
| 33      | TELETYPE Model 33 KSR                                      |
| 37      | TELETYPE Model 37 KSR                                      |
| 40-2    | TELETYPE Model 40/2  |
| 40-4    | TELETYPE Model 40/4  |
| 4540    | TELETYPE Model 4540  |
| 3270    | IBM Model 3270   |
| 4000a   | Trendata 4000a   |
| 4014    | TEKTRONIX 4014   |
| 43      | TELETYPE Model 43 KSR                                      |
| 450     | DASI 450 (same as Diablo 1620)                             |
| 450-12  | Same as above, in 12-pitch mode                            |
| 735     | Texas Instruments TI735 and TI725                          |

## term

| Name   | Description   |
|--------|---|
| 745    | Texas Instruments T1745   |
| dumb   | Generic name for terminals that lack reverse line-feed and other special escape sequences; likely to work when the real terminal type is not known to the program |
| sync   | Generic name for synchronous TELETYPE 4540-compatible terminals   |
| hp     | Hewlett-Packard (same as 2645)  |
| lp     | Generic name for a line printer   |
| tn1200 | User Electric TermiNet 1200   |
| tn300  | User Electric TermiNet 300  |

Up to 8 characters, chosen from -, a-z, and/or 0-9, make up a basic terminal name. Terminal sub-models and operational modes are distinguished by suffixes beginning with a -. Names should generally be based on original vendor, rather than local distributors. A terminal acquired from one vendor should not have more than one distinct basic name.

Commands whose behavior depends on the type of terminal should accept arguments of the form **-Tterm** where *term* is one of the names given above; if no such argument is present, such commands should obtain the terminal type from the environment variable \$TERM, which, in turn, should contain *term*.

## See Also

**mm**, **sh**, **stty**, **tabs** in Section 1; **profile** in Section 4; **environ**.

# types

## Name

types - primitive system data types

## Format

```
#include <sys/types.h>
```

## Description

The data types defined in the include file are used in CENTIX code; some data of these types are accessible to user code:

```
typedef struct {int r[1];}*          physadr;
typedef long                  daddr_t;
typedef char*                 caddr_t;
typedef unsigned int          uint;
typedef unsigned short        ushort;
typedef ushort                ino_t;
typedef short                 cnt_t;
typedef long                  time_t;
typedef int                   label_t[13];
typedef short                 dev_t;
typedef long                  off_t;
typedef long                  paddr_t;
typedef long                  key_t;
```

The form *daddr\_t* is used for disk addresses except in an i-node on disk. see *fs* in Section 4. Times are encoded in seconds since 00:00:00 GMT, January 1, 1970. The major and minor parts of a device code specify kind and unit number of a device. Offsets are measured in bytes from the beginning of a file. The *label\_t* variables are used to save the processor state while another process is running.

## See Also

*fs* in Section 4.

# values

## Name

values - machine-dependent values

## Format

```
#include <values.h>
```

## Description

This file contains a set of manifest constants, conditionally defined for particular processor architectures.

The model assumed for integers is binary representation (one's or two's complement), where the sign is represented by the value of the high-order bit.

|                                    |   |
|------------------------------------|---|
| <b>BITS(<i>type</i>)</b>           | The number of bits in a specified <i>type</i> (for example, int).                                       |
| <b>HIBITS</b>                      | The value of a short integer with only the high-order bit set (in most implementations, 0x8000).        |
| <b>HIBITL</b>                      | The value of a long integer with only the high-order bit set (in most implementations, 0x80000000).     |
| <b>HIBITI</b>                      | The value of a regular integer with only the high-order bit set (usually the same as HIBITS or HIBITL). |
| <b>MAXSHORT</b>                    | The maximum value of a signed short integer (in most implementations, 0x7FFF = 32767).                  |
| <b>MAXLONG</b>                     | The maximum value of a signed long integer (in most implementations, 0x7FFFFFFF = 2147483647).          |
| <b>MAXINT</b>                      | The maximum value of a signed regular integer (usually the same as MAXSHORT or MAXLONG).                |
| <b>MAXFLOAT,<br/>LN_MAXFLOAT</b>   | The maximum value of a single-precision floating-point number, and its natural logarithm.               |
| <b>MAXDOUBLE,<br/>LN_MAXDOUBLE</b> | The maximum value of a double-precision floating-point number, and its natural logarithm.               |

## values

MINFLOAT,  
LN\_MINFLOAT

The minimum positive value of a single-precision floating-point number, and its natural logarithm.

MINDOUBLE,  
LN\_MINDOUBLE

The minimum positive value of a double-precision floating-point number, and its natural logarithm.

FSIGNIF

The number of significant bits in the mantissa of a single-precision floating-point number.

DSIGNIF

The number of significant bits in the mantissa of a double-precision floating-point number.

## Files

`/usr/include/values.h`

## See Also

`intro` in Section3; `math`.

# varargs

## Name

varargs - handle variable argument list

## Format

```
#include <varargs.h>

va_alist

va_dcl

void va_start(pvar)
va_list pvar;

type va_arg(pvar, type)
va_list pvar;

void va_end(pvar)
va_list pvar;
```

## Description

This set of macros allows portable procedures that accept variable argument lists to be written. Routines that have variable argument lists (such as the **printf** library function) but do not use varargs are inherently nonportable, as different machines use different argument-passing conventions.

`va_alist` is used as the parameter list in a function header.

`va_dcl` is a declaration for `va_alist`. No semicolon should follow `va_dcl`.

`va_list` is a type defined for the variable used to traverse the list.

`va_start` is called to initialize `pvar` to the beginning of the list.

`va_arg` will return the next argument in the list pointed to by `pvar`. *Type* is the type the argument is expected to be.

Different types can be mixed, but it is up to the routine to know what type of argument is expected, as it cannot be determined at runtime.

## varargs

va\_end is used to clean up.

Multiple traversals, each bracketed by va\_start... va\_end, are possible.

### Example

This example is a possible implementation of the `exec1` system call.

```
#include <varargs.h>
#define MAXARGS      100

/*  exec1 is called by
        exec1(file, arg1, arg2, ..., (char *)0);
*/
exec1(va_alist)
va_dcl
{
    va_list ap;
    char *file;
    char *args[MAXARGS];
    int argno = 0;

    va_start(ap);
    file = va_arg(ap, char*);
    while ((args[argno++] = va_arg(ap, char*)) != (char*)0)
        ;
    va_end(ap);
    return execev(file, args);
}
```

### Known Problems

It is up to the calling routine to specify how many arguments there are, since it is not always possible to determine this from the stack frame. For example, `exec1` is passed a zero pointer to signal the end of the list. `Printf` can tell how many arguments are there by the format.

It is non-portable to specify a second argument of `char`, `short`, or `float` to `va_arg`, since arguments seen by the called function are not `char`, `short`, or `float`. C converts `char` and `short` arguments to `int` and converts `float` arguments to `double` before passing them to a function.

## **varargs**

### **See Also**

**exec** in Section 2; **printf** in Section 3.



## Device Files

### intro

#### Name

intro - introduction to device files

#### Description

This section describes various device files that refer to specific hardware peripherals and CENTIX System device drivers. The names of the entries are generally derived from names for the hardware, as opposed to the names of the files themselves. Characteristics of both the hardware device and the corresponding device driver are discussed where applicable.

To be configured into the CENTIX operating system, each peripheral (or I/O) device must be represented in the overall CENTIX file system by a device file, located in the /dev directory. The contents of a device file point to the device driver, located in the CENTIX kernel, for the device.

When you send data to, for example, a disk, you send the data to the device file in the /dev directory that has been created for that disk. The data, however, is not actually stored in the device file (in the CENTIX file system), but at the disk itself. In the same way, when you load data from a tape, you call it from the device file for the tape device, but the data is actually loaded from the tape itself.

There are two types of CENTIX device files:

- *Block* device files are used for devices that handle I/O data in 1024 bytes (1 kB) blocks. The I/O size is controlled by the operating system's buffer size and is independent of the user's I/O size. Disk and tape devices can be configured as block devices.
- *Character* device files are used for devices that handle raw data streams. The size of I/O transfers in raw data streams are determined either by the software design of the device itself (for terminals and printers) or by the program controlling the device (for disks and tapes).

## intro

For those devices that can be used as either block or character, the difference between the two is in performance. One or the other type of device may be necessary for special applications.

With the CENTIX 6.0 system software release, the device file naming conventions for tapes and disks have changed. (Device names for printers and terminals have not changed.) The system now supports both the old and new naming conventions. Old names are linked to the new names internally.

In CENTIX systems before the 6.0 release, the disk devices are named as follows:

```
/dev/[r]xp/ddn
```

where:

- *[r]* is an optional field that defines the disk as a character — rather than block — device.
- *xp* is *fp* if the disk device is connected to an FP; *dp* if the disk device is connected to a DP.
- *dd* represents the disk number. CENTIX disk numbers are the same as the BTOS disk device numbers, except that you must add a 0 in front of a one-digit BTOS disk number for CENTIX. That is, if a built-in disk is named *d4* in BTOS, *dd* is *04* in CENTIX. Or, if an SMD disk is named *s1* in BTOS, *dd* is *01* in CENTIX. (Do not add a zero in front of a two-digit BTOS disk number. For BTOS disk *s10*, *dd* is *10*.)
- *n* represents the disk partition. Each disk has a maximum of eight partitions (0 through 7).

With the CENTIX 6.0 release, the disk devices on your system are named as follows:

```
/dev/[r]dsk/cndnnsn
```

where:

- *[r]* is an optional field that defines the disk as a character — rather than block — device.
- *cn* represents the controller number. The controller number is always *c0* if the controller is a file processor (FP). The controller number is always *c1* if the controller is a disk processor (DP).

## intro

- *dnn* represents the disk number. CENTIX disk numbers are the same as the BTOS disk device numbers, except that you must add a 0 in front of a one-digit BTOS disk number for CENTIX. That is, if a built-in disk is named d4 in BTOS, *nn* is 04 in CENTIX. Or, if an SMD disk is named s1 in BTOS, *nn* is 01 in CENTIX. (Do not add a zero in front of a two-digit BTOS disk number. For BTOS disk s10, *nn* is 10).
- *sn* represents the disk partition. Each disk has a maximum of 8 partitions (0 through 7).

Table 6-1 shows the correlation between the old (pre-6.0 release) and new (6.0 release) naming conventions for built-in disks connected to FPs. Table 6-2 shows the correlation between the old and new naming conventions for storage module device (SMD) drives connected to DPs. Note that in both tables, *n* represents the partition number. Each disk can have up to eight partitions (0 through 7).

Table 6-1 Naming Conventions for Built-In Disk Drives

| Pre-60 Release        | 6.0 Release and Later       | BTOS Disk Device Name |
|-----------------------|-----------------------------|-----------------------|
| <b>FIRST FP</b>       |                             |                       |
| /dev/[r]fp00 <i>n</i> | /dev/[r]dsk/c0d00 <i>sn</i> | d0 [disk cartridge]   |
| /dev/[r]fp01 <i>n</i> | /dev/[r]dsk/c0d01 <i>sn</i> | d1                    |
| /dev/[r]fp02 <i>n</i> | /dev/[r]dsk/c0d02 <i>sn</i> | d2                    |
| /dev/[r]fp03 <i>n</i> | /dev/[r]dsk/c0d03 <i>sn</i> | d3                    |
| <b>SECOND FP</b>      |                             |                       |
| /dev/[r]fp04 <i>n</i> | /dev/[r]dsk/c0d04 <i>sn</i> | d4                    |
| /dev/[r]fp05 <i>n</i> | /dev/[r]dsk/c0d05 <i>sn</i> | d5                    |
| /dev/[r]fp06 <i>n</i> | /dev/[r]dsk/c0d06 <i>sn</i> | d6                    |
| /dev/[r]fp07 <i>n</i> | /dev/[r]dsk/c0d07 <i>sn</i> | d7                    |
| <b>THIRD FP</b>       |                             |                       |
| /dev/[r]fp08 <i>n</i> | /dev/[r]dsk/c0d08 <i>sn</i> | d8                    |
| /dev/[r]fp09 <i>n</i> | /dev/[r]dsk/c0d09 <i>sn</i> | d9                    |
| /dev/[r]fp10 <i>n</i> | /dev/[r]dsk/c0d10 <i>sn</i> | d10                   |
| /dev/[r]fp11 <i>n</i> | /dev/[r]dsk/c0d11 <i>sn</i> | d11                   |

and so on.

# intro

Table 6-2 Naming Conventions for SMD Disk Drives

| Pre-60 Release       | 6.0 Release and Later      | BTOS Disk Device Name |
|----------------------|----------------------------|-----------------------|
| <b>FIRST DP</b>      |                            |                       |
| <i>/dev/[r]dp00n</i> | <i>/dev/[r]dsk/c1d00sn</i> | s0                    |
| <i>/dev/[r]dp01n</i> | <i>/dev/[r]dsk/c1d01sn</i> | s1                    |
| <i>/dev/[r]dp02n</i> | <i>/dev/[r]dsk/c1d02sn</i> | s2                    |
| <i>/dev/[r]dp03n</i> | <i>/dev/[r]dsk/c1d03sn</i> | s3                    |
| <i>/dev/[r]dp04n</i> | <i>/dev/[r]dsk/c1d04sn</i> | s4                    |
| <i>/dev/[r]dp05n</i> | <i>/dev/[r]dsk/c1d05sn</i> | s5                    |
| <b>SECOND DP</b>     |                            |                       |
| <i>/dev/[r]dp06n</i> | <i>/dev/[r]dsk/c1d06sn</i> | s6                    |
| <i>/dev/[r]dp07n</i> | <i>/dev/[r]dsk/c1d07sn</i> | s7                    |
| <i>/dev/[r]dp08n</i> | <i>/dev/[r]dsk/c1d08sn</i> | s8                    |
| <i>/dev/[r]dp09n</i> | <i>/dev/[r]dsk/c1d09sn</i> | s9                    |
| <i>/dev/[r]dp10n</i> | <i>/dev/[r]dsk/c1d10sn</i> | s10                   |
| <i>/dev/[r]dp11n</i> | <i>/dev/[r]dsk/c1d11sn</i> | s11                   |
| <b>THIRD DP</b>      |                            |                       |
| <i>/dev/[r]dp12n</i> | <i>/dev/[r]dsk/c1d12sn</i> | s12                   |
| <i>/dev/[r]dp13n</i> | <i>/dev/[r]dsk/c1d13sn</i> | s13                   |
| <i>/dev/[r]dp14n</i> | <i>/dev/[r]dsk/c1d14sn</i> | s14                   |
| <i>/dev/[r]dp15n</i> | <i>/dev/[r]dsk/c1d15sn</i> | s15                   |
| <i>/dev/[r]dp16n</i> | <i>/dev/[r]dsk/c1d16sn</i> | s16                   |
| <i>/dev/[r]dp17n</i> | <i>/dev/[r]dsk/c1d17sn</i> | s17                   |

and so on.

With the CENTIX 6.0 release, the conventions for naming tape drives have also changed.

In CENTIX systems before the 6.0 release, the tape drives are named as follows:

```
/dev/[n][r]mntn
```

where:

- [n] indicates that the tape is not to rewind a tape file closes. The default is that the tape automatically rewinds.
- [r] indicates that the tape device will handle raw data streams rather than one kB blocks of data.

## intro

- *n* represents the tape drive in the system. *n* is 0 for the first half-inch tape drive on the system, 1 for a quarter-inch cartridge (QIC) tape drive, 2 for the second half inch tape drive on the system, 3 for the third, and so on.

With the 6.0 release, the tape drives on your system are named as follows:

```
/dev/[r]mt/cndn[n]
```

where:

- [r] indicates that the tape device will handle raw data streams rather than one kB blocks of data.
- *cn* represents the controller number. For a QIC tape drive, *cn* is always 0. For a half-inch tape drive, *cn* is always 1.
- *dn* represents the tape drive on the controller. You can have only one QIC drive on your system; it is d0. The first half inch tape drive is d0, the second is d1, and so on.
- [n] indicates that the tape is not to rewind when a tape file closes. The default is that the tape automatically rewinds.

Table 6-3 Naming Conventions for Tape Drives

|                             | Pre-6.0 Release | 6.0 Release and Later |
|-----------------------------|-----------------|-----------------------|
| First half-inch drive       | /dev/[n][r]mt0  | /dev/[r]mt/c1d0[n]    |
| QIC drive                   | /dev/[n][r]mt1  | /dev/[r]mt/c0d0[n]    |
| Second half-inch tape drive | /dev/[n][r]mt2  | /dev/[r]mt/c1d1[n]    |
| Third half-inch tape drive  | /dev/[n][r]mt3  | /dev/[r]mt/c1d2[n]    |
| and so on.                  |                 |                       |

# console

## Name

**console** - console terminal

## Description

The special file `console` designates a standard destination for system diagnostics. The kernel writes its diagnostics to this file, as does any user process with messages of system-wide importance. If `console` is associated with a physical terminal, then `console` messages also appear on that terminal; it is not necessary to have `console` associated with a physical terminal.

Note that `inittab` (see Section 4) does not normally post a `getty` process on `console`. This is because `console` might become associated with a terminal that is already a login terminal. Each Application Processor has its own `console`, which can be associated with any terminal or with no terminal at all. Whether or not the `console` is associated with a terminal, the most recent `console` output is saved in a circular buffer.

I/O operations on `console` by a process running on an AP affect the `console` for that AP. The exact meaning depends on whether or not the `console` is associated with a terminal.

- If the `console` is associated with a terminal, all I/O operations to `console`, including `ioctl` system calls, have the same affect as if applied directly to the terminal, except that the output is duplicated on the `console` buffer.
- If the `console` is not associated with a terminal, all attempts to read the `console` return an end of file condition, all writes to the `console` go only to the `console` buffer, and `ioctl` operations have no effect on any terminal.

If the kernel debugger is enabled, a `CODE-b` on the terminal associated with the `console` activates the kernel debugger. The command `go` to the kernel debugger resumes normal processing.

The `console` shell command and `syslocal` system calls control terminal association and print the buffers of AP consoles.

# console

## Files

/dev/console

## Caution

The kernel debugger is not a supported product and may disappear without warning. Normal system processing is suspended while the kernel debugger is active.

## See Also

**console** in Section 1: **syslocal** in Section 2.

# dsk

## Name

**dsk** - winchester, cartridge, and floppy disks

## Description

The files `/dev/[r]dsk/cndnnsn` refer to slices on winchester, cartridge, and floppy disks, where:

- `[r]` is an optional field that you include when you are loading the file system to a raw memory device. A device that is defined as raw handles raw data streams (one character at a time) rather than one kB blocks of data.
- `cn` represents the controller number. The controller number is always `c0` if the controller is a file processor (FP). The controller number is always `c1` if the controller is a disk processor (DP).
- `dnn` represents the disk number. CENTIX disk numbers are the same as the BTOS disk sevice numbers, except that you must add a 0 in front of a one-digit BTOS disk number for CENTIX. That is, if a built-in disk is named `d4` in BTOS, `nn` is `04` in CENTIX. Or, if an SMD disk is named `s1` in BTOS, `nn` is `01` in CENTIX. (Do not add a zero in front of a two-digit BTOS disk number. For BTOS disk `s10`, `nn` is `10`).
- `sn` represents the disk partition. Each disk has a maximum of 8 partitions (0 through 7).

In the XE 500 CENTIX System architecture, BTOS manages disk initialization and low-level input/output; CENTIX only accesses the disks to store and retrieve data. A disk special file is a reference to a BTOS disk file set aside specially for CENTIX's use. The BTOS file is called a file system partition and is created using the `crup` shell command (see Section 1). The relationship between file system partitions and CENTIX special files is controlled by the BTOS file system configuration file, `[Sys]<Sys>ConfigUFS.sys`. For more information on using disk devices, see the *XE 500 CENTIX Administration Guide*.

# dsk

## Files

/dev/dsk/  
/dev/rdisk/  
/dev/dump?  
/dev/boot?

## See Also

**crup**, **mknod**, **ofcopy** in Section 1; **ioctl** in Section 2; **intro**.

# fp

## Name

fp - winchester, cartridge, and floppy disks

## Description

This entry describes disk device naming conventions prior to the CENTIX 6.0 release. It is included for compatibility with earlier versions of CENTIX. If your CENTIX system is release 6.0 or later, refer to the entry for **dsk**, earlier in this section.

The files `/dev/fp000` through `/dev/fp64n` and `rfp000` through `rfp64n` refer to slices on winchester, cartridge, and floppy disks. An `r` in the name indicates the character (raw) interface. The three hexadecimal digits are the file processor number, disk number, and slice number. The cartridge drive is disk 0 on file processor 0.

XE 500 CENTIX System architecture greatly simplifies the CENTIX disk interface: BTOS manages disk initialization and low-level input/output; CENTIX only accesses the disks to store and retrieve data. A disk special file is a reference to a BTOS disk file set aside specially for use by CENTIX. The BTOS file is called a file system partition and is created by the **crup** shell command. The relationship between file system partitions and CENTIX special files is controlled by the BTOS file system configuration file, `[Sys]<Sys>ConfigUFS.sys`.

## See Also

**crup**, **mknod**, **ofcopy** in Section 1; **ioctl** in Section 2.

# lp

## Name

lp - parallel printer interface

## Description

Lp is an interface to the parallel printer channel. Bytes written are sent to the printer. Opening and closing produce page ejects. Unlike the serial interfaces (**termio**), the lp driver never prepends a carriage return to a new line (line feed). The lp driver does have options to filter output, for the benefit of printers with special requirement. The driver also controls page format. Page format and filter options are controlled with the **ioctl** system call:

```
#include <sys/lprio.h>
ioctl (filides, command, arg)
```

where *command* is one of the following constants:

**LPRSET** Set the current page format from the location pointed to by *arg*; this location is a structure of type **lprio**, declared in the header file:

```
struct lprio {
    short ind;
    short col;
    short line;
}
```

*Arg* should be declared as follows:

```
struct lprio *arg;
```

*Ind* is the page indent in columns, initially 4. *Col* is the number of columns in a line, initially 132. *Line* is the number lines on a page, initially 66. A new-line that extends over the end of a page is output as a formfeed. Lines longer than the line length minus the indent are truncated.

**LPRGET** Get the current page format and put it in the **lprio** structure pointed to by *arg*.

# lp

## LPRSOPTS

Set the filter options from *arg*, which must be of type int. *Arg* should be the logical or of one or more of the following constants, defined in the header file:

| Constant | Value | Meaning  |
|----------|-------|--|
| LPNOBS   | 4     | No backspace. Set this bit if the printer cannot properly interpret backspace characters. The driver uses carriage return to produce equivalent overstriking.  |
| LPRAW    | 8     | Raw output. Set this bit if the driver must not edit output in any way. The driver ignores all other option bits in the minor device number.   |
| LPCAP    | 16    | Capitals. This option supports printers with a "half-ASCII" character set. Lowercase is translated to uppercase.   |
| LPNOCR   | 32    | No Carriage Return. This option supports printers that do not respond to a carriage return (character OD hexadecimal). Carriage returns are changed to new-lines. If No Newline is also set, carriage returns are changed to form feeds. |
| LPNOFF   | 64    | No Form Feed. This option supports printers that do not respond to a form feed (character OC hexadecimal). Form feeds are changed to new-lines. If No Newline is also set, form feeds are changed to carriage returns.                   |

## lp

|       |    |  |
|-------|----|--|
| LPNON | 12 | No Newline. This option supports printers that do not respond to a new-line (character 0A hexadecimal). New-lines are changed to carriage returns. If No Carriage Return is also set, new-lines are changed to form feeds. |
|-------|----|--|

Setting all three of No Carriage Return, No Newline, and No Form Feed has the same effect as setting none of them.

### LPRGOPTS

Get the current state of the filter options and put them in *arg*, which must be an int.

## Files

/dev/lp

## See Also

lpr, lpset in Section 1.

# mem

## Name

mem, kmem - core memory

## Description

Mem is a special file that is an image of the core memory of the CENTIX-based processor board. It may be used, for example, to examine, and even to patch the system.

Byte addresses in mem are interpreted as memory addresses. References to non-existent locations cause errors to be returned.

Examining and patching device registers is likely to lead to unexpected results when read-only or write-only bits are present.

The file kmem is the same as mem except that kernel virtual memory rather than physical memory is accessed.

## Caution

When reading and writing memory in other processes, reads and writes are done in multiples of 1K. As a result, the data may actually change between 1K reads and writes.

## Files

/dev/memxx, /dev/kmemxx, where xx is the two-digit processor number.

# mt

## Name

mt - interface for magnetic tape

## Description

This interface provides access to all magnetic tape drives.

`mtx` is the block device with rewind on close for drive `x`. To get the no-rewind device, prepend `n`; to get the raw (character) device, prepend `r`; and to get the no-rewind on close, raw device, prepend `nr`.

There can be up to four drives, any of which can be built-in quarter-inch cartridge (QIC) drives or external drives controlled by a Storage Processor. The connection between drives and drive numbers is in the file system configuration file, under BTOS.

Tape files are separated by tape marks, also known as EOFs. Closing a file open for writing writes one tape mark on a QIC drive and two tape marks on other drives; if the device was no-rewind, the tape is left positioned just after the single QIC tape mark or between the two marks. If the file was a no-rewind file, reopening the drive for writing overwrites the second mark, if there is one, and creates another tape file. Thus on a QIC drive, a single tape mark separates the tape files and ends the tape; on other drives, a single tape mark separates the tape files and a double mark ends the tape.

Here are summaries of block and character device features:

- The block devices read and write only 1024-byte physical blocks; reads and writes of other sizes are resolved into 1K physical I/O. Seeks are ignored on QIC drives. On other drives seeks are allowed, but once the file is opened, reading is restricted to between the last write and the next tape mark. Reading the tape mark produces a zero-length read and leaves the tape positioned after the tape mark; if the file is a no-rewind file, the program can access the next tape file by closing the device and then reopening or opening another device for the same drive.

## mt

- On the raw devices, each read or write reads or writes the next physical block. A read must match the size of a normal tape block. The size of a write determines the size of the next block; Write sizes must be a multiple of 512 on QIC drives, a multiple of 2 on other drives. Read/write buffers must begin on an even address; this is the same alignment as **short**. Seeks are ignored. Reading a tape mark produces a zero-length read and leaves the tape positioned after the mark; the program can, without closing the device, read the next tape file.

## Files

```
/dev/mt/*  
/dev/nmt/*  
/dev/rmt/*  
/dev/nrmt/*
```

## Caution

A nondata error cannot be recovered from except by closing the device.

A QIC tape has no special mark for end of tape, as opposed to end of file.

# null

## Name

null - the null file

## Description

Data written on a null special file is discarded.

Reads from a null special file always return 0 bytes.

## Files

`/dev/null`

# prf

## Name

**prf** - operating system profiler

## Description

The **prf** file provides access to activity information in the operating system. Writing the file loads the measurement facility with text addresses to be monitored. Reading the file returns these addresses and a set of counters indicative of activity between adjacent text addresses.

The recording mechanism is driven by the system clock and samples the program counter at line frequency. Samples that catch the operating system are matched against the stored text addresses and increment corresponding counters for later processing.

The file **prf** is a pseudo-device with no associated hardware.

## Files

`/dev/prf`

## See Also

**profiler** in Section 1.

# termio

## Name

termio - general terminal interface

## Description

CENTIX systems use a single interface convention for all RS-232 and cluster (RS-422) terminals, although cluster terminals do not use all the features of the convention. The convention is almost completely taken from the UNIX System V interface for asynchronous terminals.

Two kinds of terminals use this convention:

- RS-232 terminals connected to channels on the XE 500 itself.
- PT 1500 cluster terminals. Generally a cluster channel supports more than one PT 1500; some terminals are indirectly connected through other terminals. Cluster terminals use the same interface as directly connected RS-232 terminals, except that hardware control operations are meaningless on cluster terminals. (Note that "cluster terminal" refers to the way the terminal is used, not to the terminal itself; a PT 1500 terminal can serve as an RS-232 terminal or as a cluster terminal.)

A single naming convention applies to regular RS-232 and cluster terminals. A direct RS-232 or cluster terminal has a name of the form `ttyxxx`, where `xxx` is the terminal's number expressed in three digits.

When a terminal file is opened, it normally causes the process to wait until a connection is established. In practice, users' programs seldom open these files; they are opened by `getty` and become a user's standard input, output, and error files. The very first terminal file opened by the process group leader of a terminal file not already associated with a process group becomes the control terminal for that process group. The control terminal plays a special role in handling quit and interrupt signals, as discussed below. The control terminal is inherited by a child process during a `fork` system call. A process can break this association by changing its process group using the `setpgrp` system call.

## termio

A terminal associated with one of these files ordinarily operates in full-duplex mode. Characters may be typed at any time, even while output is occurring, and are only lost when the system's character input buffers become completely full, which is rare, or when the user has accumulated the maximum allowed number of input characters that have not yet been read by some program. Currently, this limit is 256 characters. When the input limit is reached, all the saved characters are thrown away without notice.

Normally, terminal input is processed in units of lines. A line is delimited by a new-line (ASCII LF) character, an end-of-file (ASCII EOT) character, or an end-of-line character. This means that a program attempting to read will be suspended until an entire line has been typed. Also, no matter how many characters are requested in the read call, at most one line will be returned. It is not, however, necessary to read a whole line at once; any number of characters may be requested in a read, even one, without losing information.

During input, erase and kill processing is normally done. By default, the character generated by a PT 1500 BACKSPACE key (ASCII BS, Control-H on most terminals) erases the last character typed, except that it will not erase beyond the beginning of the line. By default, the character @ kills (deletes) the entire input line, and optionally outputs a new-line character. Both these characters operate on a keystroke basis, independently of any backspacing or tabbing that may have been done. Both the erase and kill characters may be entered literally by preceding them with the escape character (\). In this case the escape character is not read. The erase and kill characters may be changed.

## termio

Certain characters have special functions on input. These functions and their default character values are summarized as follows:

|       |   |
|-------|---|
| INTR  | (Rubout of ASCII DEL; generated by a PT 1500 DELETE key) generates an interrupt signal that is sent to all processes with the associated control terminal. Normally, each such process is forced to terminate, but arrangements may be made either to ignore the signal or to receive a trap to an agreed-upon location; see signal in Section 2.   |
| QUIT  | (Control- <code> </code> or ASCII FS; generated by a PT 1500 CODE-CANCEL key) generates a quit signal. Its treatment is identical to the interrupt signal except that, unless a receiving process has made other arrangements, it will not only be terminated but a core image file (called core) will be created in the current working directory.   |
| ERASE | (Control-H or ASCII BS; generated by a PT 1500 BACKSPACE key) erases the preceding character. It will not erase beyond the start of a line, as delimited by an NL, EOF, or EOL character.   |
| KILL  | ( <code>@</code> ) deletes the entire line, as delimited by an NL, EOF, or EOL character.   |
| EOF   | (Control-D or ASCII EOT; generated by a PT 1500 FINISH key) may be used to generate an end-of-file from a terminal. When received, all the characters waiting to be read are immediately passed to the program, without waiting for a new-line, and the EOF is discarded. Thus, if there are no characters waiting, which is to say the EOF occurred at the beginning of a line, zero characters will be passed back, which is the standard end-of-file indication. |
| NL    | (ASCII LF) is the normal line delimiter. It cannot be changed or escaped.   |
| EOL   | (ASCII NUL) is an additional line delimiter, like NL. It is not normally used.  |
| STOP  | (Control-S or ASCII DC3) can be used to temporarily suspend output. It is useful with CRT terminals to prevent output from disappearing before it can be read. While output is suspended, STOP characters are ignored and not read.   |
| START | (Control-Q or ASCII DC1) is used to resume output that has been suspended by a STOP character. While output is not suspended, START characters are ignored and not read. The start/stop characters cannot be changed or escaped.  |

## termio

The character values for INTR, QUIT, ERASE, KILL, EOF, and EOL may be changed to suit individual tastes. The ERASE, KILL, and EOF characters may be escaped by a preceding \ character, in which case no special function is done.

When the carrier signal from the data-set drops, a hangup signal is sent to all processes that have this terminal as the control terminal. Unless other arrangements have been made, this signal causes the processes to terminate. If the hangup signal is ignored, any subsequent read returns with an end-of-file indication. Thus programs that read a terminal and test for end-of-file can terminate appropriately when hung up on.

When one or more characters are written, they are transmitted to the terminal as soon as previously-written characters have finished typing. Input characters are echoed by putting them in the output queue as they arrive. If a process produces characters more rapidly than they can be typed, it will be suspended when its output queue exceeds some limit. When the queue has drained down to some threshold, the program is resumed.

Several `ioctl` system calls apply to terminal files. The primary calls use the following structure, defined in `<termio.h>`:

```
#define NCC 8
struct termio {
    unsigned short c_iflag; /*input modes*/
    unsigned short c_oflag; /*output modes*/
    unsigned short c_cflag; /*control modes*/
    unsigned short c_lflag; /*local modes*/
    char c_line; /*line discipline*/
    unsigned char c_cc[NCC]; /*control chars*/
};
```

## termio

The special control characters are defined by the array *c\_cc*. The relative positions for each function are as follows:

|   |          |
|---|----------|
| 0 | INTR     |
| 1 | QUIT     |
| 2 | ERASE    |
| 3 | KILL     |
| 4 | EOF      |
| 5 | EOL      |
| 6 | reserved |
| 7 | reserved |

The *c\_iflag* field describes the basic terminal input control:

|        |         |   |
|--------|---------|---|
| IGNBRK | 0000001 | Ignore break condition.                 |
| BRKINT | 0000002 | Signal interrupt on break.              |
| IGNPAR | 0000004 | Ignore characters with parity errors.   |
| PARMRK | 0000010 | Mark parity errors.                     |
| INPCK  | 0000020 | Enable input parity check.              |
| ISTRIP | 0000040 | Strip character.                        |
| INLCR  | 0000100 | Map NL to CR on input.                  |
| IGNCR  | 0000200 | Ignore CR.                              |
| ICRNL  | 0000400 | Map CR to NL on input.                  |
| IUCLC  | 0001000 | Map upper-case to lower-case on input.  |
| IXON   | 0002000 | Enable start/stop output control.       |
| IXANY  | 0004000 | Enable any character to restart output. |
| IXOFF  | 0010000 | Enable start/stop input control.        |

If IGNBRK is set, the break condition (a character framing error with data all zeros) is ignored, that is, not put on the input queue and therefore not read by any process. Otherwise, if BRKINT is set, the break condition will generate an interrupt signal and flush both the input and output queues. If IGNPAR is set, characters with other framing and parity errors are ignored.

If PARMRK is set, a character with a framing or parity error which is not ignored is read as the three character sequence: 0377, O, X, where X is the data of the character received in error. To avoid ambiguity in this case, if ISTRIP is not set, a valid character of 0377 is read as 0377, 0377. If PARMRK is not set, a framing or parity error which is not ignored is read as the character NUL (0).

## termio

If INPCK is set, input parity checking is enabled. If INPCK is not set, input parity checking is disabled. This allows output parity generation without input parity errors.

If ISTRIP is set, valid input characters are first stripped to 7-bits, otherwise all 8-bits are processed.

If INLCR is set, a received NL character is translated into a CR character. If IGNCR is set, a received CR character is ignored (not read). Otherwise if ICRNL is set, a received CR character is translated into an NL character.

If IUCLC is set, a received upper-case alphabetic character is translated into the corresponding lower-case character.

If IXON is set, start/stop output control is enabled. A received STOP character will suspend output and a received START character will restart output. All start/stop characters are ignored and not read. If IXANY is set, any input character will restart output that has been suspended.

If IXOFF is set, the system will transmit START/STOP characters when the input queue is nearly empty/full.

The initial input control value is all bits clear.

The *c\_oflag* field specifies the system treatment of output.

|        |         |                                    |
|--------|---------|------------------------------------|
| OPOST  | 0000001 | Postprocess output.                |
| OLCUC  | 0000002 | Map lower case to upper on output. |
| ONLCR  | 0000004 | Map NL to CR-NL on output.         |
| OCRNL  | 0000010 | Map CR to NL on output.            |
| ONOCR  | 0000020 | No CR output at column 0.          |
| ONLRET | 0000040 | NL performs CR function.           |
| OFILL  | 0000100 | Use fill characters for delay.     |
| OFDEL  | 0000200 | Fill is DEL, else NUL.             |
| NLDLY  | 0000400 | Select new-line delays:            |
| NL0    | 0       |                                    |
| NL1    | 0000400 |                                    |
| CRDLY  | 0003000 | Select carriage-return delays:     |
| CR0    | 0       |                                    |
| CR1    | 0001000 |                                    |
| CR2    | 0002000 |                                    |
| CR3    | 0003000 |                                    |

## termio

|        |         |                               |
|--------|---------|-------------------------------|
| TABDLY | 0014000 | Select horizontal-tab delays: |
| TAB0   | 0       |                               |
| TAB1   | 0004000 |                               |
| TAB2   | 0010000 |                               |
| TAB3   | 0014000 | Expand tabs to spaces.        |
| BSDLY  | 0020000 | Select backspace delays:      |
| BS0    | 0       |                               |
| BS1    | 0020000 |                               |
| VTDLY  | 0040000 | Select vertical-tab delays:   |
| VT0    | 0       |                               |
| VT1    | 0040000 |                               |
| FFDLY  | 0100000 | Select form-feed delays:      |
| FF0    | 0       |                               |
| FF1    | 0100000 |                               |

If OPOST is set, output characters are post-processed as indicated by the remaining flags, otherwise characters are transmitted without change.

If OLCUC is set, a lower-case alphabetic character is transmitted as the corresponding upper-case character. This function is often used in conjunction with IUCLC.

If ONLCR is set, the NL character is transmitted as the CR-NL character pair. If OCRNL is set, the CR character is transmitted as the NL character. If ONOCR is set, no CR character is transmitted when at column 0 (first position). If ONLRET is set, the NL character is assumed to do the carriage-return function; the column pointer will be set to 0 and the delays specified for CR will be used. Otherwise the NL character is assumed to do just the line-feed function; the column pointer will remain unchanged. The column pointer is also set to 0 if the CR character is actually transmitted.

The delay bits specify how long transmission stops to allow for mechanical or other movement when certain characters are sent to the terminal. In all cases a value of 0 indicates no delay. If OFILL is set, fill characters will be transmitted for delay instead of a timed delay. This is useful for high baud rate terminals that need only a minimal delay. If OFDEL is set, the fill character is DEL, otherwise NUL.

If a form-feed vertical-tab delay is specified, it lasts for about 2 seconds.

## termio

New-line delay lasts about 0.10 seconds. If `ONLRET` is set, the carriage-return delays are used instead of the new-line delays. If `OFILL` is set, two fill characters will be transmitted.

Carriage-return delay type 1 is dependent on the current column position, type 2 is about 0.10 seconds, and type 3 is about 0.18 seconds. If `OFILL` is set, delay type 1 transmits one or two fill characters, and type 2 and 3, two fill characters.

Horizontal-tab delay type 1 is dependent on the current column position. Type 2 is about 0.04 seconds. Type 3 specifies that tabs are to be expanded into spaces. If `OFILL` is set, delay type 1 transmits zero or two fill characters and delay type 2 transmits 1 fill character.

Backspace delay lasts about 0.05 seconds. If `OFILL` is set, one fill character will be transmitted.

The actual delays depend on line speed and system load.

The initial output control value is all bits clear.

The `c_cflag` field describes the hardware control of the terminal (not used on cluster terminals):

|       |         |            |
|-------|---------|------------|
| CBAUD | 0000017 | Baud rate: |
| B0    | 0       | Hang up    |
| B50   | 0000001 | 50 baud    |
| B75   | 0000002 | 75 baud    |
| B110  | 0000003 | 110 baud   |
| B134  | 0000004 | 134.5 baud |
| B150  | 0000005 | 150 baud   |
| B200  | 0000006 | 200 baud   |
| B300  | 0000007 | 300 baud   |
| B600  | 0000010 | 600 baud   |
| B1200 | 0000011 | 1200 baud  |
| B1800 | 0000012 | 1800 baud  |
| B2400 | 0000013 | 2400 baud  |

## termio

|        |         |                               |
|--------|---------|-------------------------------|
| B4800  | 0000014 | 4800 baud                     |
| B9600  | 0000015 | 9600 baud                     |
| EXTA   | 0000016 | 19200 baud                    |
| EXTB   | 0000017 | External clock.               |
| CSIZE  | 0000060 | Character size:               |
| CS5    | 0       | 5 bits                        |
| CS6    | 0000020 | 6 bits                        |
| CS7    | 0000040 | 7 bits                        |
| CS8    | 0000060 | 8 bits                        |
| CSTOPB | 0000100 | Send two stop bits, else one. |
| CREAD  | 0000200 | Enable receiver.              |
| PARENB | 0000400 | Parity enable.                |
| PARODD | 0001000 | Odd parity, else even.        |
| HUPCL  | 0002000 | Hang up on last close.        |
| CLOCAL | 0004000 | Local line, else dial-up.     |

The CBAUD bits specify the baud rate. The zero baud rate, B0, is used to hang up the connection. If B0 is specified, the data-terminal-ready signal will not be asserted. Normally, this will disconnect the line. For any particular hardware, impossible speed changes are ignored. EXTB specifies external clocking.

The CSIZE bits specify the character size in bits for both transmission and reception. This size does not include the parity bit, if any. If CSTOPB is set, two stop bits are used, otherwise one stop bit. For example, at 110 baud, two stop bits are required.

If PARENB is set, parity generation and detection is enabled and a parity bit is added to each character. If parity is enabled, the PARODD flag specifies odd parity if set, otherwise even parity is used.

## termio

If CREAD is set, the receiver is enabled. Otherwise no characters will be received.

If HUPCL is set, the line will be disconnected when the last process with the line open closes it or terminates. That is, the data-terminal-ready signal will not be asserted.

If CLOCAL is set, the line is assumed to be a local, direct connection with no modem control. Otherwise modem control is assumed.

The initial hardware control value after open is B9600, CS8, CREAD, HUPCL.

The *c\_flag* field of the argument structure is used by the line discipline to control terminal functions. The basic line discipline (O) provides the following:

|        |         |  |
|--------|---------|--|
| ISIG   | 0000001 | Enable signals.                              |
| ICANON | 0000002 | Canonical input (erase and kill processing). |
| XCASE  | 0000004 | Canonical upper/lower presentation.          |
| ECHO   | 0000010 | Enable echo.                                 |
| ECHOE  | 0000020 | Echo erase character as BS-SP-BS.            |
| ECHOK  | 0000040 | Echo NL after kill character.                |
| ECHONL | 0000100 | Echo NL.                                     |
| NOFLSH | 0000200 | Disable flush after interrupt or quit.       |

If ISIG is set, each input character is checked against the special control characters INTR and QUIT. If an input character matches one of these control characters, the function associated with that character is performed. If ISIG is not set, no checking is done. Thus these special input functions are possible only if ISIG is set. These functions may be disabled individually by changing the value of the control character to an unlikely or impossible value (for example, 0377).

## termio

If ICANON is set, canonical processing is enabled. This enables the erase and kill edit functions, and the assembly of input characters into lines delimited by NL, EOF, and EOL. If ICANON is not set, read requests are satisfied directly from the input queue. A read will not be satisfied until at least MIN characters have been received or the timeout value TIME has expired. This allows fast bursts of input to be read efficiently while still allowing single character input. The MIN and TIME values are stored in the position for the EOF and EOL characters respectively. The time value represents tenths of seconds.

If XCASE is set, and if ICANON is set, an upper-case letter is accepted on input by preceding it with a \ character, and is output preceded by a \ character. In this mode, the following escape sequences are generated on output and accepted on input:

| <i>for.</i> | <i>use.</i> |
|-------------|-------------|
| .           | \\.         |
|             | \\          |
| ~           | \\~         |
| {           | \\{         |
| }           | \\}         |
| \           | \\          |

For example, A is input as \a, \n as \\n, and \N as \\N.

If ECHO is set, characters are echoed as received.

When ICANON is set, the following echo functions are possible. If ECHO and ECHOE are set, the erase character is echoed as ASCII BS SP BS, which will clear the last character from a CRT screen. If ECHOE is set and ECHO is not set, the erase character is echoed as ASCII SP BS. If ECHOK is set, the NL character will be echoed after the kill character to emphasize that the line will be deleted. Note that an escape character preceding the erase or kill character removes any special function. If ECHONL is set, the NL character will be echoed even if ECHO is not set. This is useful for terminals set to local echo (so-called half duplex).

## termio

Unless escaped, the EOF character is not echoed. Because EOT is the default EOF character, this prevents terminals that respond to EOT from hanging up.

If NOFLSH is set, the normal flush of the input and output queues associated with the quit and interrupt characters will not be done.

The initial line-discipline control value is all bits clear.

The primary **ioctl** system calls have the form:

```
ioctl (fildes, command, arg)
struct termio *arg;
```

The commands using this form are:

|         |  |
|---------|--|
| TCGETA  | Get the parameters associated with the terminal and store in the termio structure referenced by <i>arg</i> .                               |
| TCSETA  | Set the parameters associated with the terminal from the structure referenced by <i>arg</i> . The change is immediate.                     |
| TCSETAW | Wait for the output to drain before setting the new parameters. This form should be used when changing parameters that will affect output. |
| TCSETAF | Wait for the output to drain, then flush the input queue and set the new parameters.   |

Additional **ioctl** calls have the form:

```
ioctl (fildes, command, arg)
int arg;
```

The commands using this form are:

|        |  |
|--------|--|
| TCSBRK | Wait for the output to drain. If <i>arg</i> is 0, then send a break (zero bits to 0.25 seconds).                                 |
| TCXONC | Start/stop control. If <i>arg</i> is 0, suspend output; if 1, restart suspended output; if 2, transmit XOFF; if 3, transmit XON. |
| TCFLSH | If <i>arg</i> is 0, flush the input queue; if 1, flush the output queue; if 2, flush both the input and output queues.           |

# termio

## Files

/dev/tty??? /dev/tp????

## Caution

The default value for ERASE is backspace rather than the historical #.

## Known problems

Local RS-232 terminals do not currently provide hangup (B0), draining, flushing, or delay.

## See Also

**stty**, **ioctl** in Section 2; **tp**, **tty**.

## tp

### Name

tp - controlling terminal's local RS-232 channels

### Description

The tp devices access the RS-232 channels on the controlling terminal. The terminal must be a cluster terminal configured to permit use of the local RS-232 channels (see **termio**). Just as `/dev/tty` permits a process to conveniently access its process group's controlling terminal (see **tty**), `/dev/tp1` and `/dev/tp2` access the controlling terminal's RS-232 channels without reference to the terminal number. This is convenient for accessing the user's local hardware, such as a telephone with an RS-232 interface.

### See Also

**tty**.

# tty

## Name

tty - controlling terminal interface

## Description

The file `/dev/tty` is, in each process, a synonym for the control terminal associated with the process group of that process, if any. It is useful for programs or shell sequences that wish to be sure of writing messages on the terminal no matter how output has been redirected. It can also be used for programs that demand the name of a file for output, when typed output is desired and it is tiresome to find out what terminal is currently in use.

If the terminal is under window management, a process group is controlled by a specific window, and I/O on `/dev/tty` is directed to that window. A terminal can control one process group in each window. See **window**.

## Files

`/dev/tty`

## See Also

**tp**, **window**.

# window

## Name

window - window management primitives

## Format

```
#include <sys/window.h>
```

## Description

Window management (see **wm** in Section 1) provides a superset of windowless terminal features. This entry describes terminal file features special to window management. Window management features are designed not to interfere with programs that do not know about window management. Such design includes simple extensions to the CENTIX System's standard concepts of file descriptor and control terminal.

- Each terminal file descriptor has an associated window number, a small positive integer that identifies a window. A window number is the most primitive way to refer to a window, and should not be confused with the window ID used by window management sub-routines. A new window gets the smallest window number not already in use. Closing a window frees its number for possible assignment to a later window. Output and control calls on the file descriptor apply only to the descriptor's window; input calls succeed only when the window is active.

A file descriptor created by a **dup** system call or inherited across a **fork** system call inherits the original descriptor's window number. All the file descriptors in such a chain of inheritance, provided they belong to processes in the same process group, are affected when **ioctl** changes the window number of any of them.

## window

- When a process group's control terminal is under window management, the process group is actually controlled by a particular window. Such can have more than one process group, each controlled by a different window. Keyboard-generated signals (interrupt and quit) go to the process group controlled by the active window.

When the user creates a new window by using the SPLIT key, the window manager forks a process for that window. The new process inherits file descriptors for standard input (0), standard output (1), and standard error (2) that are associated with the new window. The new process is leader of a process group controlled by the new window.

Programs that create and use windows use window management `ioctl` calls. Such calls take the form

```
ioctl (fildes, command, arg)
struct wiocctl *arg;
```

*Fildes* is a file descriptor for terminal and window affected, *command* is a window management command (see below), *arg* is a pointer to the following structure, declared in `<sys/window.h>`:

```
#define NWCC 2

struct wiocctl {
    wndw_t          wi_dflltwn dw;
    wndw_t          wi_wndw;
    slot_t wi_mycpu slot;
    slot_t wi_destcpu slot;
    port_t wi_bport;
    char wi_dummy;
    unsigned char wi_cc[NWCC];
};
```

Window management `ioctl` calls `get (WIOCGET)` and `set (WIOCSET and WIOCSETP)` terminal attributes described in the `wiocctl` structure:

|                            |  |
|----------------------------|--|
| <code>wi_dflltwn dw</code> | The window number for the process's default window. If the process does an <code>open</code> on <code>/dev/tty</code> , the new file descriptor is associated with the default window. |
|----------------------------|--|

# window

|                             |   |
|-----------------------------|---|
| <code>wi_wndw</code>        | The window number for the window that <i>fildev</i> ( <code>ioctl</code> 's first parameter) is associated with.  |
| <code>wi_mycpuslot</code>   | The slot number of the process's host processor. (Not settable.)  |
| <code>wi_destcpuslot</code> | The slot number of the processor that drives the terminal. (Not settable.)  |
| <code>wi_bport</code>       | The terminal's Cluster Processor or Terminal Processor channel number. (Not settable.)  |
| <code>wi_cc</code>          | Not used by the CENTIX kernel. A value supplied by a <code>WIOCSET</code> or <code>WIOCSETP</code> is stored in a place associated with window <code>wi_wndw</code> . A subsequent <code>WIOCGET</code> on the same window retrieves the information. |

Here are the window management `ioctl` commands:

|                       |   |
|-----------------------|---|
| <code>WIOCGET</code>  | Get information on calling process and file descriptor <i>fildev</i> . Fill in <i>arg</i> .   |
| <code>WIOCSET</code>  | Set values for calling process and file descriptor <i>fildev</i> from information in <i>arg</i> . Has no effect on process group-control terminal relationship.   |
| <code>WIOCSETP</code> | Set values for calling process and file descriptor <i>fildev</i> from information in <i>arg</i> . The window specified in <i>arg</i> -> <code>wi_wndw</code> becomes the process's group's controlling terminal provided the following: <ul style="list-style-type: none"> <li>The calling process is the process group leader.</li> <li>The process group is not currently controlled by another window on this or any other terminal.</li> <li>The specified window is not already a control window.</li> </ul> |
| <code>WIOCCLRP</code> | Only valid executed by process group leader. The process group ceases to have a control terminal or window and the control terminal/window ceases to control any process group. The process group is free to find another control terminal/window, and the old control terminal/window is free to become the control terminal/window for another process group.   |

## window

|              |   |
|--------------|---|
| WIOCCLUSTER  | <b>ioctl</b> returns 1 if and only if the terminal is a cluster terminal. |
| WIODIRECT    | Enable direct sending of terminal IPC requests.                           |
| WIOCUNDIRECT | Disable direct sending of terminal IPC requests.                          |

An **open** on a terminal special file other than `/dev/tty` (for example, `/dev/tty000`) produces a file descriptor for the lowest-numbered open window. **ioctl** can move this file descriptor to any window.

An **open** can also obtain a controlling terminal/window. The requirements are the same as for **WIOCSETP**.

## Files

`/dev/tty` - control terminal  
`/dev/tty???` - terminals

## Cautions

WIODIRECT and WIOCUNDIRECT are required by the operating system. Their use by user programs is inadvisable.

Use these features in as standard and conservative a way as possible. The best way to enforce standards is to use window management through the library calls described in Section 3.

## See Also

**stty**, **wm** in Section 1; **dup**, **fork**, **ioctl**, **open** in Section 2; **wmgetid**, **wmlayout**, **wmop**, **wmsetid** in Section 3; **termio**, **tty**.



## Permuted Index

This index includes entries for all pages of all four volumes of this guide. The entries themselves are based on the one-line descriptions or titles found in the **Name** portion of each manual entry; the significant words (keywords) of these descriptions are listed alphabetically down the center of the index.

The permuted index is a keyword-in-context index that has three columns. To use the index, read the center column to look up specific commands by name or by subject topics. Note that the entry may begin in the left column or wrap around and continue into the left column. A period (.) marks the end of the entry, and a slash (/) indicates where the entry is continued or truncated. The right column gives the manual entry under which the command or subject is described; following each manual entry name is the section number, in parentheses, in which that entry can be found.

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| comparison. diff3:      | 3-way differential file   | <b>diff3(1)</b>      |
| between long integer/   | a64l, l64a: convert       | <b>a64l(3)</b>       |
| /obtain and             | abandon exchanges.        | <b>exchanges(2)</b>  |
| fault.                  | abort: generate an IOT    | <b>abort(3)</b>      |
| absolute value.         | abs: return integer       | <b>abs(3)</b>        |
| adb:                    | absolute debugger         | <b>adb(1)</b>        |
| abs: return integer     | absolute value.           | <b>abs(3)</b>        |
| ceiling, remainder,     | absolute value/ /floor,   | <b>floor(3)</b>      |
| allow/prevent LP/       | accept, reject:           | <b>accept(1)</b>     |
| times of/ touch: update | access and modification   | <b>touch(1)</b>      |
| times. utime: set file  | access and modification   | <b>utime(2)</b>      |
| /ofCloseAllFiles:       | Access BTOS files         | <b>ofopenfile(3)</b> |
| accessibility of a/     | access: determine         | <b>access(2)</b>     |
| in a/ sputl, sgetl:     | access long integer data  | <b>sputl(3)</b>      |

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| file systems for optimal | access time. /copy       | dcopy(1)   |
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| access: determine        | accessibility of a file. | access(2)  |
| or disable process       | accounting. /enable      | acct(2)    |
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| admin: create and        | administer SCCS files.   | admin(1)   |
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|--------------------------|--------------------------|--------------------------|
| for sendmail.            | aliases: aliases file    | aliases(5)               |
| sendmail. aliases:       | aliases file for         | aliases(5)               |
| /ofDelete:               | allocate BTOS files.     | ofcreate(3)              |
| data segment space       | allocation. /change      | brk(2)                   |
| calloc: main memory      | allocator. /realloc,     | malloc(3)                |
| fast main memory         | allocator. /mallinfo:    | malloc(3) (fast version) |
| accept, reject:          | allow/prevent LP/        | accept(1)                |
| brc, bcheckrc, rc,       | allrc, conrc: system/    | brc(1)                   |
| running process/ renice: | alter priority of        | renice(1)                |
| sort: sort               | and/or merge files.      | sort(1)                  |
| and link editor output.  | a.out: common assembler  | a.out(4)                 |
| Processor number.        | apnum: print Application | apnum(1)                 |
| number. apnum: print     | Application Processor    | apnum(1)                 |
| console: control         | Application Processor/   | console(1)               |
| /a process on a specific | Application Processor.   | spawn(1)                 |
| /a process on a specific | Application Processor.   | spawn(3)                 |
| /to commands and         | application programs.    | intro(1)                 |
| code. exServeRq:         | appropriate a request    | exserverq(2)             |
| maintainer for portable/ | ar: archive and library  | ar(1)                    |
| format.                  | ar: common archive file  | ar(4)                    |
| arithmetic/ bc:          | arbitrary-precision      | bc(1)                    |
| maintainer for/ ar:      | archive and library      | ar(1)                    |
| cpio: format of cpio     | archive                  | cpio(4)                  |
| ar: common               | archive file format.     | ar(4)                    |

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|                          |                           |                    |
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| header of a member of an | archive file. /archive    | <b>ldahread(3)</b> |
| /convert object and      | archive files to common/  | <b>convert(1)</b>  |
| ldahread: read the       | archive header of a/      | <b>ldahread(3)</b> |
| tar: tape file           | archiver.                 | <b>tar(1)</b>      |
| maintainer for portable  | archives. /and library    | <b>ar(1)</b>       |
| cpio: copy file          | archives in and out.      | <b>cpio(1)</b>     |
| varargs: handle variable | argument list.            | <b>varargs(5)</b>  |
| /output of a varargs     | argument list.            | <b>vprintf(3)</b>  |
| xargs: construct         | argument list(s) and/     | <b>xargs(1)</b>    |
| /get option letter from  | argument vector.          | <b>getopt(3)</b>   |
| expr: evaluate           | arguments as an/          | <b>expr(1)</b>     |
| echo: echo               | arguments.                | <b>echo(1)</b>     |
| bc: arbitrary-precision  | arithmetic language.      | <b>bc(1)</b>       |
| expr: evaluate arguments | as an expression.         | <b>expr(1)</b>     |
|                          | as: assembler.            | <b>as(1)</b>       |
| ascii: map of            | ASCII character set.      | <b>ascii(5)</b>    |
| hd: hexadecimal and      | ascii file dump.          | <b>hd(1)</b>       |
| character set.           | ascii: map of ASCII       | <b>ascii(5)</b>    |
| long integer and base-64 | ASCII string. /between    | <b>a64l(3)</b>     |
| atof: convert            | ASCII string to/          | <b>atof(3)</b>     |
| date/ /localtime,        | asctime, tzset: convert   | <b>ctime(3)</b>    |
| gmtime,                  |                           |                    |
| sin, cos, tan,           | asin, acos, atan, atan2:/ | <b>trig(3)</b>     |
| help:                    | ask for help.             | <b>help(1)</b>     |

|                          |                          |             |
|--------------------------|--------------------------|-------------|
| editor/ a.out: common    | assembler and link       | a.out(4)    |
| as:                      | assembler.               | as(1)       |
| assertion.               | assert: verify program   | assert(3)   |
| assert: verify program   | assertion.               | assert(3)   |
| setbuf, setvbuf:         | assign buffering to a/   | setbuf(3)   |
| wmsetid, wmsetids:       | associate a file/        | wmsetid(3)  |
| commands at a later/     | at, batch: execute       | at(1)       |
| cos, tan, asin, acos,    | atan, atan2: sin,        | trig(3)     |
| tan, asin, acos, atan,   | atan2: trigonometric/    | trig(3)     |
| string to/               | atof: convert ASCII      | atof(3)     |
| strtod,                  | atof: convert string to/ | strtod(3)   |
| integer. strtol, atol,   | atoi: convert string to  | strtol(3)   |
| string to/ strtol,       | atol, atoi: convert      | strtol(3)   |
| process. wait:           | await completion of      | wait(1)     |
| and processing/          | awk: pattern scanning    | awk(1)      |
| request. qurmove: take   | back a BTOS queue        | qurmove(3)  |
| ungetc: push character   | back into input stream.  | ungetc(3)   |
| finc: fast incremental   | backup.                  | finc(1)     |
| recover files from a     | backup tape. frec:       | frec(1)     |
|                          | banner: make posters.    | banner(1)   |
| modem capability data    | base. modemcap: smart    | modemcap(5) |
| terminal capability data | base. termcap:           | termcap(4)  |
| terminal capability data | base. terminfo:          | terminfo(4) |

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|  |                                   |                    |
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| between long integer and<br>(visual) display editor                                  | base-64 ASCII string.<br>/convert | <b>a64l(3)</b>     |
| portions of path names.  | based on ex.<br>/screen-oriented  | <b>vi(1)</b>       |
| at a later time. at,<br>arithmetic language.<br>system initialization/ brc,<br>copy. | basename, dirname:<br>deliver     | <b>basename(1)</b> |
| cb: C program  | batch: execute commands           | <b>at(1)</b>       |
| j0, j1, jn, y0, y1, yn:  | bc: arbitrary-precision           | <b>bc(1)</b>       |
| /install object files in<br>fread, fwrite:   | bcheckrc, rc, allrc, conrc:       | <b>brc(1)</b>      |
| bsearch:   | bcopy: interactive block<br>copy. | <b>bcopy(1)</b>    |
| tfind, tdelete, twalk:<br>manage   | bdiff: big diff.                  | <b>bdiff(1)</b>    |
| bcopy: interactive   | beautifier.                       | <b>cb(1)</b>       |
| sum: print checksum and<br>sync: update the super                                    | Bessel functions.                 | <b>bessel(3)</b>   |
| df: report number of free<br>disk  | bfs: big file scanner.            | <b>bfs(1)</b>      |
| conrc: system<br>initialization/<br>spare allocation.                                | binary directories.               | <b>cpset(1)</b>    |
|  | binary input/output.              | <b>fread(3)</b>    |
|  | binary search a sorted<br>table.  | <b>bsearch(3)</b>  |
|  | binary search trees,<br>tsearch,  | <b>tsearch(3)</b>  |
|  | block copy.                       | <b>bcopy(1)</b>    |
|  | block count of a file             | <b>sum(1)</b>      |
|  | block.                            | <b>sync(1)</b>     |
|  | blocks.                           | <b>df(1)</b>       |
|  | brc, bcheckrc, rc, allrc,         | <b>brc(1)</b>      |
|  | brk, sbrk: change data<br>segment | <b>brk(2)</b>      |

|  |                                   |               |
|--|-----------------------------------|---------------|
| compiler/interp<br>reter/                              | bs: a                             | bs(1)         |
| sorted table   | bsearch: binary search a          | bsearch(3)    |
| /ofDIDir,<br>ofReadDirSector:                          | BTOS directory functions.         | ofdir(3)      |
| ofWrite: Input/output on a                             | BTOS file. ofRead,                | ofread(3)     |
| ofRename: rename a                                     | BTOS file.                        | ofrename(3)   |
| ofSetFileStatus:                                       | BTOS File Status.                 | ofstatus(3)   |
| ofcopy: copy to or from the<br>directories. ofls: list | BTOS file system.                 | ofcopy(1)     |
| /ofDelete: Allocate                                    | BTOS files and                    | ofls(1)       |
| ofed, ofvi: edit                                       | BTOS files.                       | ofcreate(3)   |
| ofCloseAllFiles: Access                                | BTOS files.                       | ofeditors(1)  |
| interpreter for interactive                            | BTOS files. /ofCloseFile.         | ofopenfile(3) |
| CENTIX kernel and copy<br>it to                        | BTOS JCL. ofcli:<br>command line  | ofcli(1)      |
| quAdd: add a new entry<br>to a                         | BTOS. mkboot: reformat            | mkboot(1)     |
| quReadKeyed: examine                                   | BTOS queue.                       | quadd(3)      |
| quRemove: take back a                                  | BTOS queue.<br>quReadNext.        | quread(3)     |
| stdio: standard  | BTOS queue request.               | quremove(3)   |
| setbuf, setvbuf: assign                                | buffered input/output<br>package. | stdio(3)      |
| mknod:   | buffering to a stream             | setbuf(3)     |
| swapshort, swaplong:<br>translate                      | build special file.               | mknod(1)      |
| swab: swap   | byte orders to<br>Motorola/Intel. | swapshort(3)  |
|  | bytes.                            | swab(3)       |

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|                                      |                                       |                                 |
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| <b>cc:</b>                           | <b>C compiler.</b>                    | <b>cc(1)</b>                    |
| <b>cflow: generate</b>               | <b>C flowgraph.</b>                   | <b>cflow(1)</b>                 |
| <b>cpp: the</b>                      | <b>C language preprocessor.</b>       | <b>cpp(1)</b>                   |
| <b>cb:</b>                           | <b>C program beautifier.</b>          | <b>cb(1)</b>                    |
| <b>lint: a</b>                       | <b>C program checker.</b>             | <b>lint(1)</b>                  |
| <b>cxref: generate</b>               | <b>C program cross reference.</b>     | <b>cxref(1)</b>                 |
| <b>ctrace:</b>                       | <b>C program debugger.</b>            | <b>ctrace(1)</b>                |
|                                      | <b>cal: print calendar.</b>           | <b>cal(1)</b>                   |
| <b>dc: desk</b>                      | <b>calculator.</b>                    | <b>dc(1)</b>                    |
| <b>cal:print</b>                     | <b>calendar.</b>                      | <b>cal(1)</b>                   |
| <b>service.</b>                      | <b>calendar: reminder</b>             | <b>calendar(1)</b>              |
| <b>cú:</b>                           | <b>call another computer system.</b>  | <b>cu(1)</b>                    |
| <b>data returned by stat system</b>  | <b>call. stat:</b>                    | <b>stat(5)</b>                  |
| <b>malloc, free, realloc,</b>        | <b>calloc: main memory allocator.</b> | <b>malloc(3)</b>                |
| <b>fast/ malloc, free, realloc,</b>  | <b>calloc, mallopt, mallinfo:</b>     | <b>malloc(3) (fast version)</b> |
| <b>intro: introduction to system</b> | <b>calls and error number.</b>        | <b>intro(2)</b>                 |
| <b>link and unlink system</b>        | <b>calls. link, unlink: exercise</b>  | <b>link(1)</b>                  |
| <b>to an LP line printer. lp.,</b>   | <b>cancel: send/cancel requests</b>   | <b>lp(1)</b>                    |
| <b>modemcap: smart modem</b>         | <b>capability data base.</b>          | <b>modemcap(5)</b>              |
| <b>termcap: terminal</b>             | <b>capability data base.</b>          | <b>termcap(4)</b>               |
| <b>terinfo: terminal</b>             | <b>capability data base.</b>          | <b>terminfo(4)</b>              |
| <b>disks. dsk: winchester,</b>       | <b>cartridge, and floppy</b>          | <b>dsk(6)</b>                   |
| <b>(variant of ex for</b>            | <b>casual users). /editor</b>         | <b>edit(1)</b>                  |

|                              |                               |           |
|------------------------------|-------------------------------|-----------|
| files.                       | cat: concatenate and print    | cat(1)    |
| beautifier.                  | cb: C program                 | cb(1)     |
|                              | cc: C compiler.               | cc(1)     |
| directory.                   | cd: change working            | cd(1)     |
| commentary of an SCCS delta. | cdc: change the delta         | cdc(1)    |
| ceiling, remainder,/ floor,  | ceil, fmod, fabs: floor,      | floor(3)  |
| /ceil, fmod, fabs: floor,    | ceiling, remainder, absolute/ | floor(3)  |
| BTOS. mkboot: reformat       | CENTIX kernel and copy it to  | mkboot(1) |
| uname: CENTIX system to      | CENTIX system copy.           | uucp(1)   |
| uucp, uulog, uname:          | CENTIX system to CENTIX/      | uucp(1)   |
| print name of current        | CENTIX system. uname:         | uname(1)  |
| get name of current          | CENTIX system. uname:         | uname(2)  |
| command execution. uux:      | CENTIX-to-CENTIX system       | uux(1)    |
| uuto, uupick: public         | CENTIX-to-CENTIX system file/ | uuto(1)   |
| flowgraph.                   | cflow: generate C             | cflow(1)  |
| delta: make a delta          | (change) to an SCCS file.     | delta(1)  |
| of running process by        | changing nice. /priority      | renice(1) |
| pipe: create an interprocess | channel.                      | pipe(2)   |
| terminal's local RS-232      | channels. tp: controlling     | tp(6)     |
| stream. ungetc: push         | character back into input     | ungetc(3) |

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|                                 |                                |                     |
|---------------------------------|--------------------------------|---------------------|
| user. cuserid: get              | character login name of the    | <b>cuserid(3)</b>   |
| getchar, fgetc, getw: get       | character or word from a/      | <b>getc(3)</b>      |
| /putchar, fputc, putw: put      | character or word on a stream. | <b>putc(3)</b>      |
| ascii: map of ASCII             | character set.                 | <b>ascii(5)</b>     |
| __tolower, toascii: translate   | characters. /__toupper,        | <b>conv(3)</b>      |
| isctrl, isascii: classify       | characters. /isprint, isgraph, | <b>ctype(3)</b>     |
| tr: translate                   | characters.                    | <b>tr(1)</b>        |
| directory.                      | chdir: change working          | <b>chdir(2)</b>     |
| /dfsck: file system consistency | check and interactive repair.  | <b>fsck(1)</b>      |
| lint: a C program               | checker.                       | <b>lint(1)</b>      |
| grpck: password/group file      | checkers. pwck,                | <b>pwck(1)</b>      |
| copy file systems with label    | checking. volcopy, labelit:    | <b>volcopy(1)</b>   |
| systems processed by fsck.      | checklist: list of file        | <b>checklist(4)</b> |
| file. sum: print                | checksum and block count of a  | <b>sum(1)</b>       |
| chown,                          | chgrp: change owner or group   | <b>chown(1)</b>     |
| times: get process and          | child process times.           | <b>times(2)</b>     |
| terminate. wait: wait for       | child process to stop or       | <b>wait(2)</b>      |
|                                 | chmod: change mode.            | <b>chmod(1)</b>     |
| file.                           | chmod: change mode of file.    | <b>chmod(2)</b>     |

|   |   |   |
|---|---|---|
| of a file.  | chown: change owner<br>and group                | <b>chown(2)</b>                         |
| group.  | chown, chgrp: change<br>owner or                | <b>chown(1)</b>                         |
| directory.  | chroot: change root                             | <b>chroot(2)</b>                        |
| for a command.  | chroot: change root<br>directory                | <b>chroot(1)</b>                        |
| isgraph, iscntrl, isascii:                                  | classify characters.<br>/isprint,               | <b>ctype(3)</b>                         |
| uuclean: uucp spool<br>directory                            | clean-up.                                       | <b>uuclean(1)</b>                       |
| screen.   | clear: clear terminal                           | <b>clear(1)</b>                         |
| clri:   | clear i-node.                                   | <b>clri(1)</b>                          |
| clear:  | clear terminal screen.                          | <b>clear(1)</b>                         |
| status./ ferror, feof,<br>exRespond: send a<br>message to a | clearerr, fileno: stream<br>client.             | <b>ferror(3)</b><br><b>exrespond(2)</b> |
| set a process alarm   | clock. alarm:                                   | <b>alarm(2)</b>                         |
| cron:   | clock daemon.                                   | <b>cron(1)</b>                          |
| used.   | clock: report CPU time<br>used.                 | <b>clock(3)</b>                         |
| ldclose, ldaclose:  | close a common object<br>file.                  | <b>ldclose(3)</b>                       |
| close:  | close a file descriptor.                        | <b>close(2)</b>                         |
| descriptor.   | close: close a file                             | <b>close(2)</b>                         |
| fclose, fflush:   | close or flush a stream.<br>clri: clear i-node. | <b>fclose(3)</b><br><b>clri(1)</b>      |
| appropriate a request                                       | cmp: compare two files.                         | <b>cmp(1)</b>                           |
| line-feeds.   | code. exServerRq:                               | <b>exserverq(2)</b>                     |
| deltas.   | col: filter reverse                             | <b>col(1)</b>                           |
| comb:   | comb: combine SCCS<br>combine SCCS deltas.      | <b>comb(1)</b><br><b>comb(1)</b>        |

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|                                    |                               |                   |
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| common to two sorted files.        | comm: select or reject lines  | <b>comm(1)</b>    |
| nice: run a                        | command at low priority.      | <b>nice(1)</b>    |
| change root directory for a        | command. chroot:              | <b>chroot(1)</b>  |
| env: set environment for           | command execution.            | <b>env(1)</b>     |
| uux: remote system                 | command execution.            | <b>uux(1)</b>     |
| quits. nohup: run a                | command immune to hangups and | <b>nohup(1)</b>   |
| interactive BTOS JCL.<br>ofcli:    | command line interpreter for  | <b>ofcli(1)</b>   |
| getyopt: parse                     | command options.              | <b>getopt(1)</b>  |
| locate executable file for         | command. path:                | <b>path(1)</b>    |
| shell, the standard/<br>restricted | command programming language. | <b>sh(1)</b>      |
| data and/ timex: time a            | command; report process       | <b>timex(1)</b>   |
| system: issue a shell              | command.                      | <b>system(3)</b>  |
| test: condition evaluation         | command.                      | <b>test(1)</b>    |
| time: time a                       | command.                      | <b>time(1)</b>    |
| argument list(s) and<br>execute    | command. xargs:<br>construct  | <b>xargs(1)</b>   |
| intro: introduction to             | commands and applicaton/      | <b>intro(1)</b>   |
| at, batch: execute                 | commands at a later/          | <b>at(1)</b>      |
| install: install                   | commands.                     | <b>install(1)</b> |
| cdc: change the delta              | commentary of an SCCS delta.  | <b>cdc(1)</b>     |
| ar:                                | common archive file format.   | <b>ar(4)</b>      |

|   |  |                          |
|---|--|--------------------------|
| editor output. a.out:                               | common assembler and link                            | a.out(4)                 |
| and archive files to routines. ldfcn:               | common formats. /object common object file access    | convert(1)<br>ldfcn(4)   |
| ldopen, ldaopen: open a /line number entries of a   | common object file for/ common object file function. | ldopen(3)<br>ldread(3)   |
| /ldaclose: close a read the file header of a        | common object file. ldhread:                         | ldclose(3)<br>ldhread(3) |
| entries of a section of a file header of a          | common object file. /number                          | ldseek(3)<br>ldohseek(3) |
| /entries of a section of a /section header of a     | common object file. common object file.              | ldrseek(3)<br>ldhread(3) |
| an indexed/name section of a                        | common object file. /seek to                         | ldsseek(3)               |
| of a symbol table entry of a                        | common object file. /the index                       | idtbindex(3)             |
| symbol table entry of a                             | common object file. /indexed                         | ldtbread(3)              |
| seek to the symbol table of a                       | common object file. ldtbseek:                        | ldtbseek(3)              |
| line number entries in a                            | common object file. linenum:                         | linenum(4)               |
| nm: print name list of relocation information for a | common object file. common object file. reloc:       | nm(1)<br>reloc(4)        |
| scnhdr: section header for a                        | common object file.                                  | scnhdr(4)                |

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|                                |                               |                     |
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| line number information from a | common object file. /and      | <b>strip(1)</b>     |
| retrieve symbol name for       | common object file symbol/    | <b>ldgetname(3)</b> |
| table format. syms:            | common object file symbol     | <b>syms(4)</b>      |
| filehdr: file header for       | common object files.          | <b>filehdr(4)</b>   |
| ld: link editor for            | common object files.          | <b>ld(1)</b>        |
| size: print section sizes of   | common object files.          | <b>size(1)</b>      |
| comm: select or reject lines   | common to two sorted files.   | <b>comm(1)</b>      |
| ipcs: report inter-process     | communication facilities/     | <b>ipcs(1)</b>      |
| stdipc: standard interprocess  | communication package (ftok). | <b>stdipc(3)</b>    |
| diff: differential file        | comparator.                   | <b>diff(1)</b>      |
| cmp:                           | compare two files.            | <b>cmp(1)</b>       |
| SCCS file. sccsdiff:           | compare two versions of an    | <b>sccsdiff(1)</b>  |
| diff3: 3-way differential file | comparison.                   | <b>diff3(1)</b>     |
| dircmp: directory              | comparison.                   | <b>dircmp(1)</b>    |
| expression. regcmp, regex:     | compile and execute regular   | <b>regcmp(3)</b>    |
| regexp: regular expression     | compile and match routines.   | <b>regexp(5)</b>    |
| regcmp: regular expression     | compile.                      | <b>regcmp(1)</b>    |
| term: format of                | compiled term file.           | <b>term(4)</b>      |
| cc: C                          | compiler.                     | <b>cc(1)</b>        |
| tic: terminfo                  | compiler.                     | <b>tic(1)</b>       |
| yacc: yet another              | compiler-compiler.            | <b>yacc(1)</b>      |

|                                       |  |  |
|---------------------------------------|--|--|
| modest-sized/<br>bs: a                | compiler/interpreter for                   | <b>bs(1)</b>                           |
| erf, erfc: error function and         | complementary error<br>function.           | <b>erf(3)</b>                          |
| wait: await                           | completion of process.                     | <b>wait(1)</b>                         |
| pack, pcat, unpack:                   | compress and expand<br>files.              | <b>pack(1)</b>                         |
| table entry of a/<br>ldtindex:        | compute the index of a<br>symbol           | <b>ldtindex(3)</b>                     |
| cu: call another                      | computer system.                           | <b>cu(1)</b>                           |
| cat:                                  | concatenate and print<br>files.            | <b>cat(1)</b>                          |
| test:                                 | condition evaluation<br>command.           | <b>test(1)</b>                         |
| system. lpadmin:                      | configure the LP spooling                  | <b>lpadmin(1)</b>                      |
| fwtmp, wtmpfix:<br>manipulate         | connect accounting<br>records.             | <b>fwtmp(1)</b>                        |
| an out-going terminal<br>line         | connection. dial:<br>establish             | <b>dial(3)</b>                         |
| brc, bcheckrc, rc, allrc,             | conrc: system<br>initialization/           | <b>brc(1)</b>                          |
| fsck, dfsck: file system<br>terminal. | consistency check and/<br>console: console | <b>fsck(1)</b><br><b>console(6)</b>    |
| Application Processor/<br>console:    | console: control<br>console terminal.      | <b>console(1)</b><br><b>console(6)</b> |
| math: math functions<br>and           | constants.                                 | <b>math(5)</b>                         |
| mkfs:                                 | construct a file system.                   | <b>mkfs(1)</b>                         |
| execute command. xargs:               | construct argument<br>list(s) and          | <b>xargs(1)</b>                        |
| ls: list                              | contents of directory.                     | <b>ls(1)</b>                           |
| csplit:                               | context split.                             | <b>csplit(1)</b>                       |
| Processor/ console:                   | control Application                        | <b>console(1)</b>                      |

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| <b>ioctl:</b>   | control device.                   | <b>ioctl(2)</b>   |
| <b>fcntl: file</b>  | control.                          | <b>fcntl(2)</b>   |
| <b>init, icode, telinit:<br/>process</b>                                  | control initialization.           | <b>init(1)</b>    |
| <b>msgctl: message</b>  | control operations.               | <b>msgctl(2)</b>  |
| <b>semctl: semaphore</b>  | control operations                | <b>semctl(2)</b>  |
| <b>shmctl: shared memory</b>  | control operations.               | <b>shmctl(2)</b>  |
| <b>fcntl: file</b>  | control options.                  | <b>fcntl(5)</b>   |
| <b>uucp status inquiry and job</b>  | control. uustat:                  | <b>uustat(1)</b>  |
| <b>vc: version</b>  | control.                          | <b>vc(1)</b>      |
| <b>interface. tty:</b>  | controlling terminal              | <b>tty(6)</b>     |
| <b>RS-232 channels. tp:</b>   | controlling terminal's<br>local   | <b>tp(6)</b>      |
| <b>terminals. term:</b>   | conventional names for            | <b>term(5)</b>    |
| <b>units:</b>   | conversion program.               | <b>units(1)</b>   |
| <b>dd:</b>  | convert and copy a file.          | <b>dd(1)</b>      |
| <b>floating-point number.<br/>atof:</b>                                   | convert ASCII string to           | <b>atof(3)</b>    |
| <b>integers and/ l3tol, ltol3:<br/>and base-64 ASCII/<br/>a64l, l64a:</b> | convert between 3-byte            | <b>l3tol(3)</b>   |
| <b>and archive files to/<br/>/gmtime, asctime, tzset:</b>                 | convert between long<br>integer   | <b>a64l(3)</b>    |
| <b>to string. ecvt, fcvt, gcvt</b>  | convert: convert object           | <b>convert(1)</b> |
| <b>scanf, fscanf, sscanf:</b>   | convert date and time to/         | <b>ctime(3)</b>   |
| <b>archive files/ convert:</b>  | convert floating-point<br>numbner | <b>ecvt(3)</b>    |
| <b>strtod, atof:</b>  | convert formatted input.          | <b>scanf(3)</b>   |
|   | convert object and                | <b>convert(1)</b> |
|   | convert string to/                | <b>strtod(3)</b>  |

|                                |                                |            |
|--------------------------------|--------------------------------|------------|
| strtol, atol, atoi:            | convert string to integer.     | strtol(3)  |
| dd: convert and                | copy a file                    | dd(1)      |
| bcopy: interactive block       | copy                           | bcopy(1)   |
| cpio:                          | copy file archives in and out. | cpio(1)    |
| access time. dcopy:            | copy file systems for optimal  | dcopy(1)   |
| checking,. volcopy, labelit:   | copy file systems with label   | volcopy(1) |
| reformat CENTIX kernel and     | copy it to BTOS. mkboot:       | mkboot(1)  |
| cp, ln, mv:                    | copy, link or move files.      | cp(1)      |
| system, ofcopy:                | copy to or from the BTOS file  | ofcopy(1)  |
| system to CENTIX system        | copy. /uuname: CENTIX          | uucp(1)    |
| system-to-computer system file | copy. /uupick: public computer | uuto(1)    |
| file.                          | core: format of core image     | core(4)    |
| core: format of                | core image file.               | core(4)    |
| mem, kmem:                     | core memory.                   | mem(6)     |
| atan2: trigonometric/ sin,     | cos, tan, asin, acos, atan,    | trig(3)    |
| functions. sinh,               | cosh, tanh: hyperbolic         | sinh(3)    |
| sum: print checksum and block  | count of a file.               | sum(1)     |
| wc: word                       | count.                         | wc(1)      |
| files.                         | cp, ln, mv: copy, link or move | cp(1)      |
| cpio: format of                | cpio archive.                  | cpio(4)    |
| and out.                       | cpio: copy file archives in    | cpio(1)    |
| archive.                       | cpio: format of cpio           | cpio(4)    |

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| preprocessor.                 | cpp: the C language            | <b>cpp(1)</b>     |
| binary directories.           | cpset: install object files in | <b>cpset(1)</b>   |
| clock: report                 | CPU time used.                 | <b>clock(3)</b>   |
| rewrite an existing one.      | creat: create a new file or    | <b>creat(2)</b>   |
| file. tmpnam, tempnam:        | create a name for a temporary  | <b>tmpnam(3)</b>  |
| an existing one. creat:       | create a new file or rewrite   | <b>creat(2)</b>   |
| fork:                         | create a new process.          | <b>fork(2)</b>    |
| tmpfile:                      | create a temporary file.       | <b>tmpfile(3)</b> |
| channel. pipe:                | create an interprocess         | <b>pipe(2)</b>    |
| files. admin:                 | create and administer SCCS     | <b>admin(1)</b>   |
| (slice). crup:                | create file system partition   | <b>crup(1)</b>    |
| umask: set and get file       | creation mask.                 | <b>umask(2)</b>   |
| file.                         | cron: clock daemon.            | <b>cron(1)</b>    |
| crontab__user                 | crontab__user crontab          | <b>crontab(1)</b> |
| cxref: generate C program     | crontab file.                  | <b>crontab(1)</b> |
| optimization package.         | cross reference.               | <b>cxref(1)</b>   |
| curses:                       | CRT screen handling and        | <b>curses(3)</b>  |
| partition (slice).            | crup: create file system       | <b>crup(1)</b>    |
| generate DES encryption.      | crypt, setkey, encrypt:        | <b>crypt(3)</b>   |
| terminal.                     | csplit: context split.         | <b>csplit(1)</b>  |
| for terminal.                 | ct: spawn getty to a remote    | <b>ct(1)</b>      |
| asctime, tzset: convert date/ | ctermid: generate file name    | <b>ctermid(3)</b> |
|                               | ctime, localtime, gmtime,      | <b>ctime(3)</b>   |

|                               |                                |                    |
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| debugger.                     | ctrace: C program              | <b>ctrace(1)</b>   |
| system.                       | cu: call another computer      | <b>cu(1)</b>       |
| uname: get name of            | current CENTIX system          | <b>uname(2)</b>    |
| uname: get name of            | current CENTIX system          | <b>uname(2)</b>    |
| activity. sact: print         | current SCCS file editing      | <b>sact(1)</b>     |
| slot in the utmp file of the  | current user. /find the        | <b>ttyslot(3)</b>  |
| getcwd: get path-name of      | current working directory.     | <b>getcwd(3)</b>   |
| and optimization package.     | curses: CRT screen handling    | <b>curses(3)</b>   |
| name of the user.             | cuserid: get character login   | <b>cuserid(3)</b>  |
| of each line of a file.       | cut: cut out selected fields   | <b>cut(1)</b>      |
| each line of a file. cut:     | cut out selected fields of     | <b>cut(1)</b>      |
| cross reference.              | cxref: generate C program      | <b>cxref(1)</b>    |
| command; report process       | data and system/ /time a       | <b>timex(1)</b>    |
| smart modem capability        | data base. modemcap:           | <b>modemcap(5)</b> |
| termcap: terminal capability  | data base.                     | <b>termcap(4)</b>  |
| terminfo: terminal capability | data base.                     | <b>terminfo(4)</b> |
| /sgetl: access long integer   | data in a machine-independent  | <b>sputl(3)</b>    |
| lock process, text, or        | data in memory. plock:         | <b>plock(2)</b>    |
| prof: display profile         | data.                          | <b>prof(1)</b>     |
| call, stat:                   | data are turned by stat system | <b>stat(5)</b>     |

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| types: primitive system       | data types.                    | types(5)    |
| join: relational              | database operator.             | join(1)     |
| tput: query terminfo          | database.                      | tput(1)     |
| /asctime, tzset: convert      | date and time to string.       | ctime(3)    |
| date: print and set the date. | date.                          | date(1)     |
|                               | date: print and set the        | date(1)     |
|                               | dc: desk calculator.           | dc(1)       |
| optimal access time.          | dcopy: copy file systems for   | dcopy(1)    |
| file.                         | dd: convert and copy a         | dd(1)       |
| adb: absolute                 | debugger.                      | adb(1)      |
| ctrace: C program             | debugger.                      | ctrace(1)   |
| fsdb: file system             | debugger.                      | fsdb(1)     |
| sdb: symbolic                 | debugger.                      | sdb(1)      |
| names. basename, dirname:     | deliver portions of path       | basename(1) |
| file. tail:                   | deliver the last part of a     | tail(1)     |
| delta commentary of an SCCS   | delta. cdc: change the         | cdc(1)      |
| file. delta: make a           | delta (change) to an SCCS      | delta(1)    |
| delta. cdc: change the        | delta commentary of an SCCS    | cdc(1)      |
| rmel: remove a                | delta from an SCCS file.       | rmel(1)     |
| to an SCCS file.              | delta: make a delta (change)   | delta(1)    |
| comb: combine SCCS            | deltas.                        | comb(1)     |
| cron: clock                   | demon.                         | cron(1)     |

|                                 |                                 |            |
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| mesg: permit or                 | deny messages.                  | mesg(1)    |
| close: close a file             | descriptor.                     | close(2)   |
| dup: duplicate an open file     | descriptor.                     | dup(2)     |
| /wmsetid: associate a file      | descriptor with a window.       | wmsetid(3) |
| dc:                             | desk calculator.                | dc(1)      |
| file. access:                   | determine accessibility of a    | access(2)  |
| file:                           | determine file type.            | file(1)    |
| for finite width output         | device. /fold long lines        | fold(1)    |
| master: master                  | device information table.       | master(4)  |
| ioctl: control                  | device.                         | ioctl(2)   |
| devnm:                          | device name.                    | devnm(1)   |
|                                 | devnm: device name.             | devnm(1)   |
| blocks.                         | df: report number of free disk  | df(1)      |
| check and interactive/<br>fsck, | dfscck: file system consistency | fsck(1)    |
| terminal line connection.       | dial: establish an out-going    | dial(3)    |
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| comparator.                     | diff: differential file         | diff(1)    |
| comparison.                     | diff3: 3-way differential file  | diff3(1)   |
| sdiff: side-by-side             | difference program.             | sdiff(1)   |
| diff:                           | differential file comparator.   | diff(1)    |
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| install object files in binary | directories. cpset:           | <b>cpset(1)</b>          |
| dir: format of                 | directories.                  | <b>dir(4)</b>            |
| ofls: list BTOS files and      | directories.                  | <b>ofls(1)</b>           |
| rm, rmdir: remove files or     | directories.                  | <b>rm(1)</b>             |
| cd: change working             | directory.                    | <b>cd(1)</b>             |
| chdir: change working          | directory.                    | <b>chdir(2)</b>          |
| chroot: change root            | directory.                    | <b>chroot(2)</b>         |
| uuclean: uucp spool            | directory clean-up.           | <b>uuclean(1)</b>        |
| dircmp:                        | directory comparison.         | <b>dircmp(1)</b>         |
| unlink: remove                 | directory entry.              | <b>unlink(2)</b>         |
| chroot: change root            | directory for a command.      | <b>chroot(1)</b>         |
| /make a lost + found           | directory for fsck.           | <b>mklost + found(1)</b> |
| ofDIDir, ofReadDirSector: BTOS | directory functions. ofCrDir, | <b>ofdir(3)</b>          |
| path-name of current working   | directory. getcwd: get        | <b>getcwd(3)</b>         |
| ls: list contents of           | directory.                    | <b>ls(1)</b>             |
| mkdir: make a                  | directory.                    | <b>mkdir(1)</b>          |
| mkdir: move a                  | directory.                    | <b>mmdir(1)</b>          |
| pwd: working                   | directory name.               | <b>pwd(1)</b>            |
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|                              |                              |                    |
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| printers. enable,            | disable: enable/disable LP   | <b>enable(1)</b>   |
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| type, modes, speed, and line | discipline. /set terminal    | <b>getty(1)</b>    |
| sadp:                        | disk access profiler.        | <b>sadp(1)</b>     |
| df: report number of free    | disk blocks.                 | <b>df(1)</b>       |
| update: provide              | disk synchronization.        | <b>update(1)</b>   |
| du: summarize                | disk usage.                  | <b>du(1)</b>       |
| cartridge, and floppy        | disks. dsk: winchester,      | <b>dsk(6)</b>      |
| mount, umount: mount and     | dismount file system.        | <b>mount(1)</b>    |
| vi: screen-oriented (visual) | display editor based on ex.  | <b>vi(1)</b>       |
| prof:                        | display profile data.        | <b>prof(1)</b>     |
| hypot: Euclidean             | distance function.           | <b>hypot(3)</b>    |
| /lcong48: generate uniformly | distributed pseudo-random/   | <b>drand48(3)</b>  |
| whodo: who is                | doing what.                  | <b>whodo(1)</b>    |
| /atof: convert string to     | double-precision number.     | <b>strtod(3)</b>   |
| tdl: RS-232 terminal         | download.                    | <b>tdl(1)</b>      |
| nrnd48, mrnd48, jrnd48./     | drand48, erand48, lrand48.   | <b>drand48(3)</b>  |
| cartridge, and floppy/       | dsk: winchester,             | <b>dsk(6)</b>      |
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| od: octal                      | dump.                       | od(1)     |
| object file. dump:             | dump selected parts of an   | dump(1)   |
| descriptor.                    | dup: duplicate an open file | dup(2)    |
| descriptor. dup:               | duplicate an open file      | dup(2)    |
| echo:                          | echo arguments.             | echo(1)   |
|                                | echo: echo arguments.       | echo(1)   |
| floating-point number to/      | ecvt, fcvt, gcvt: convert   | ecvt(3)   |
|                                | ed, red: text editor.       | ed(1)     |
| program. end, etext,           | edata: last locations in    | end(3)    |
| ofed, ofvi:                    | edit BTOS files.            | ofed(1)   |
| ofed, ofvi:                    | edit BTOS files.            | ofvi(1)   |
| (variant of ex for/            | edit: text editor           | edit(1)   |
| sact: print current SCCS file  | editing activity.           | sact(1)   |
| /visual display                | editor based on ex.         | vi(1)     |
| ed, red: text                  | editor.                     | ed(1)     |
| ex: text                       | editor.                     | ex(1)     |
| files. ld: link                | editor for common object    | ld(1)     |
| common assembler and link      | editor output. a.out:       | a.out(4)  |
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| for casual/ edit: text         | editor (variant of ex       | edit(1)   |
| /user, real group, and         | effective group IDs.        | getuid(2) |
| and/ /getgid: get read user,   | effective user, real group, | getuid(2) |
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| for a pattern. grep,          | egrep, fgrep: search a file     | <b>grep(1)</b>     |
| enable/disable LP printers.   | enable, disable:                | <b>enable(1)</b>   |
| accounting. acct:             | enable or disable process       | <b>acct(2)</b>     |
| enable, disable:              | enable/disable LP printers      | <b>enable(1)</b>   |
| encryption, crypt, setkey,    | encrypt: generate DES           | <b>crypt(3)</b>    |
| setkey, encrypt: generate DES | encryption. crypt,              | <b>crypt(3)</b>    |
| locations in program.         | end, etext, edata: last         | <b>end(3)</b>      |
| getgrgid, getgrnam, setgrent, | endgrent, fgetgrent: get group/ | <b>getgrent(3)</b> |
| getpwuid, getpwnam, setpwent, | endpwent, fgetpwent: get/       | <b>getpwent(3)</b> |
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| nlist: get                    | entries from name list.         | <b>nlist(3)</b>    |
| file. linenum: line number    | entries in a common object      | <b>linenum(4)</b>  |
| file/ /manipulate line number | entries of a common object      | <b>ldlread(3)</b>  |
| common/ /seek to line number  | entries of a section of a       | <b>ldlseek(3)</b>  |
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| fgetgrent: get group file     | entry. /setgrent, endgrent,     | <b>getgrent(3)</b> |
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| utmpname: access utmp file     | entry. /setutent, endutent,     | <b>getut(3)</b>     |
| object file symbol table       | entry. /symbol name for common  | <b>ldgetname(3)</b> |
| /the index of a symbol table   | entry of a common object file.  | <b>ldtbindex(3)</b> |
| /read an indexed symbol table  | entry of a common object file.  | <b>ldtbread(3)</b>  |
| putpwent: write password file  | entry.                          | <b>putpwent(3)</b>  |
| quAdd: add a new               | entry to a BTOS queue.          | <b>quadd(3)</b>     |
| unlink: remove directory       | entry.                          | <b>unlink(2)</b>    |
| command execution.             | env: set environment for        | <b>env(1)</b>       |
|                                | environ: user environment.      | <b>environ(5)</b>   |
| profile: setting up an         | environment at login time.      | <b>profile(4)</b>   |
| environ: user                  | environment.                    | <b>environ(5)</b>   |
| execution. env: set            | environment for command         | <b>env(1)</b>       |
| getenv: return value for       | environment name.               | <b>getenv(3)</b>    |
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| complementary error/ erf,      | erfc: error function and        | <b>erf(3)</b>       |
| system error/ perror,          | errno, sys__errlist, sys__nerr: | <b>perror(3)</b>    |

|                                  |                                  |                     |
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| complementary/ erf, erfc:        | error function and               | <b>erf(3)</b>       |
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| to system calls and              | error numbers.<br>/introduction  | <b>intro(2)</b>     |
| matherr:                         | error-handling function.         | <b>matherr(3)</b>   |
| hashcheck: find spelling         | errors. /hashmake, spellin,      | <b>spell(1)</b>     |
| terminal line/ dial:             | establish an out-going           | <b>dial(3)</b>      |
| setmnt:                          | establish mount table.           | <b>setmnt(1)</b>    |
| in program. end:                 | etext, edata: last locations     | <b>end(3)</b>       |
| hypot:                           | Euclidean distance<br>function.  | <b>hypot(3)</b>     |
| expression. expr:                | evaluate arguments as an         | <b>expr(1)</b>      |
| test: condition                  | evaluation command.              | <b>test(1)</b>      |
| /text editor (variant of         | ex for casual users).            | <b>edit(1)</b>      |
| display editor based on          | ex: text editor.                 | <b>ex(1)</b>        |
| obtain/ exQueryDfltResp<br>Exch, | ex. /screen-oriented<br>(visual) | <b>vi(1)</b>        |
| exWait, exCheck:                 | exAllocExch,<br>exDeallocExch:   | <b>exchanges(2)</b> |
| quReadNext,<br>quReadKeyed:      | examine an ICC message<br>queue. | <b>exwait(2)</b>    |
| wait for the response.           | examine BTOS queue.              | <b>quread(3)</b>    |
| obtain and abandon               | exCall: Send a request<br>and    | <b>excall(2)</b>    |
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|                                  | exCheck: examine an ICC          | <b>exwait(2)</b>    |

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| abandon/ /exAllocExch, execlp, execvp: execute a/    | exDeallocExch: obtain and execl, execv, execl, execve, | <b>exchanges(2)</b><br><b>exec(2)</b> |
| execvp: execute/ execl, execv,                       | execl, execve, execlp,                                 | <b>exec(2)</b>                        |
| execl, execv, execl, execve,                         | execlp, execvp: execute a/                             | <b>exec(2)</b>                        |
| path: locate   | executable file for command.                           | <b>path(1)</b>                        |
| execve, execlp, execvp: specific Application/ spawn: | execute a file. /execl, execute a process on a         | <b>exec(2)</b><br><b>spawn(1)</b>     |
| specific/ spawnlp, spawnvp:                          | execute a process on a                                 | <b>spawn(3)</b>                       |
| construct argument list(s) and                       | execute command. xargs:                                | <b>xargs(1)</b>                       |
| regex: compile and set environment for command       | execute regular/ regcmp, execution. env:               | <b>regcmp(3)</b><br><b>env(1)</b>     |
| sleep: suspend                                       | execution for an interval.                             | <b>sleep(1)</b>                       |
| sleep: suspend                                       | execution for interval.                                | <b>sleep(3)</b>                       |
| monitor: prepare                                     | execution profile.                                     | <b>monitor(3)</b>                     |
| spawnsrv: service spawn                              | execution requests.                                    | <b>spawnsrv(1)</b>                    |
| profil:  | execution time profile.                                | <b>profil(2)</b>                      |
| uux: remote system command                           | execution.   | <b>uux(1)</b>                         |
| execvp: execute a/ execl,                            | execv, execl, execve, execlp,                          | <b>exec(2)</b>                        |
| execute/ execl, execv, execl,                        | execve, execlp, execvp:                                | <b>exec(2)</b>                        |
| /execv, execl, execve, execlp,                       | execvp: execute a file.                                | <b>exec(2)</b>                        |

|                                      |                                    |                     |
|--------------------------------------|------------------------------------|---------------------|
| system calls. link, unlink:          | exercise link and unlink           | <b>link(1)</b>      |
| a new file or rewrite an<br>process. | existing one. creat: create        | <b>creat(2)</b>     |
| exit,                                | exit, __exit: terminate            | <b>exit(2)</b>      |
| exponential, logarithm,/             | __exit: terminate process.         | <b>exit(2)</b>      |
| pcat, unpack: compress<br>and        | exp, log, log10, pow,<br>sqrt:     | <b>exp(3)</b>       |
| exp, log, log10, pow, sqrt:          | expand files. pack,                | <b>pack(1)</b>      |
| expression.                          | exponential, logarithm,<br>power,/ | <b>exp(3)</b>       |
| routines. regexp: regular            | expr: evaluate arguments<br>as an  | <b>expr(1)</b>      |
| regcmp: regular                      | expression compile and<br>match    | <b>regexp(5)</b>    |
| expr: evaluate arguments<br>as an    | expression compile.                | <b>regcmp(1)</b>    |
| compile and execute<br>regular       | expression.                        | <b>expr(1)</b>      |
| exAllocExch,<br>exDeallocExch:/      | expression. regcmp, regex:         | <b>regcmp(3)</b>    |
| server.                              | exQueryDfltRespExch,               | <b>exchanges(2)</b> |
| client.                              | exRequest: Send a<br>message to a  | <b>exrequest(2)</b> |
| exCnxSendOnDealloc:<br>make/         | exRespond: send a<br>message to a  | <b>exrespond(2)</b> |
| request code.                        | exSendOnDealloc,                   | <b>exfinal(2)</b>   |
| ICC message queue.                   | exServeRq: appropriate a           | <b>exserverq(2)</b> |
| remainder,/ floor, ceil,<br>fmod,    | exWait, exCheck: examine<br>an     | <b>exwait(2)</b>    |
| factor:                              | fabs: floor, ceiling,              | <b>floor(3)</b>     |
| true,                                | factor a number                    | <b>factor(1)</b>    |
|                                      | factor: factor a number.           | <b>factor(1)</b>    |
|                                      | false: provide truth values.       | <b>true(1)</b>      |

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|                                |                                |                                 |
|--------------------------------|--------------------------------|---------------------------------|
| data in a machine-independent  | fashion.. /access long integer | <b>sputl(3)</b>                 |
| finc:                          | fast incremental backup.       | <b>finc(1)</b>                  |
| /calloc, malloc, mallinfo:     | fast main memory allocator.    | <b>malloc(3)</b> (fast version) |
| abort: generate an IOT         | fault.                         | <b>abort(3)</b>                 |
| a stream.                      | fclose, fflush: close or flush | <b>fclose(3)</b>                |
|                                | fcntl: file control.           | <b>fcntl(2)</b>                 |
|                                | fcntl: file control options.   | <b>fcntl(5)</b>                 |
| floating-point number/ecvt,    | fcvt, gcvt: convert            | <b>ecvt(3)</b>                  |
| fopen, freopen,                | fdopen: open a stream.         | <b>fopen(3)</b>                 |
| status inquiries. ferror,      | feof, clearerr, fileno: stream | <b>ferror(3)</b>                |
| fileno: stream status/         | ferror, feof, clearerr,        | <b>ferror(3)</b>                |
| statistics for a file system.  | ff: list file names and        | <b>ff(1)</b>                    |
| stream. fclose,                | fflush: close or flush a       | <b>fclose(3)</b>                |
| word from a/ getc, getchar,    | fgetc, getw: get character or  | <b>getc(3)</b>                  |
| getgrnam, setgrent, endgrent,  | fgetgrent: get group file/     | <b>getgrent(3)</b>              |
| /getpwnam, setpwent, endpwent, | fgetpwent: get password file/  | <b>getpwent(3)</b>              |
| stream. gets,                  | fgets: get a string from a     | <b>gets(3)</b>                  |
| pattern. grep, egrep,          | fgrep: search a file for a     | <b>grep(1)</b>                  |
| times. utime: set              | file access and modification   | <b>utime(2)</b>                 |
| ldfcn: common object           | file access routines.          | <b>ldfcn(4)</b>                 |
| determine accessibility of a   | file. access:                  | <b>access(2)</b>                |

|                                   |                                   |            |
|-----------------------------------|-----------------------------------|------------|
| tar: tape                         | file archiver.                    | tar(1)     |
| cpio: copy                        | file archives in and out.         | cpio(1)    |
| pwck, grpck:<br>password/group    | file checkers.                    | pwck(1)    |
| chmod: change mode of             | file.                             | chmod(2)   |
| change owner and group<br>of a    | file. chown:                      | chown(2)   |
| diff: differential                | file comparator.                  | diff(1)    |
| diff3: 3-way differential         | file comparison.                  | diff3(1)   |
| fcntl:                            | file control.                     | fcntl(2)   |
| fcntl:                            | file control options.             | fcntl(5)   |
| system-to-computer<br>system      | file copy. /public<br>computer    | uuto(1)    |
| core: format of core<br>image     | file.                             | core(4)    |
| umask: set and get                | file creation mask.               | umask(2)   |
| crontab--user crontab             | file.                             | crontab(1) |
| fields of each line of a          | file. cut: cut out selected       | cut(1)     |
| dd: convert and copy a            | file.                             | dd(1)      |
| a delta (change) to an<br>SCCS    | file. delta: make                 | delta(1)   |
| close: close a                    | file descriptor.                  | close(2)   |
| dup: duplicate an open            | file descriptor.                  | dup(2)     |
| wmsetid, wmsetids:<br>associate a | file descriptor with a<br>window. | wmsetid(3) |
| hd: hexadecimal and ascii         | file: determine file type.        | file(1)    |
| selected parts of an<br>object    | file dump.                        | hd(1)      |
|                                   | file. dump: dump                  | dump(1)    |

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|   |                                 |                    |
|---|---------------------------------|--------------------|
| sact: print current SCCS                          | file editing activity.          | <b>sact(1)</b>     |
| endgrent, fgetgrent: get group                    | file entry. /setgrent,          | <b>getgrent(3)</b> |
| fgetpwent: get password                           | file entry. /endpwent,          | <b>getpwent(3)</b> |
| utmpname: access utmp                             | file entry. /endutent,          | <b>getut(3)</b>    |
| putpwent; write password                          | file entry.                     | <b>putpwent(3)</b> |
| execlp, execvp: execute a                         | file. /execv, execl, execve,    | <b>exec(2)</b>     |
| grep, egrep, fgrep: search a                      | file for a pattern.             | <b>grep(1)</b>     |
| path: locate executable                           | file for command.               | <b>path(1)</b>     |
| ldopen: open a common object                      | file for reading. ldopen,       | <b>ldopen(3)</b>   |
| aliases: aliases                                  | file for sendmail.              | <b>aliases(5)</b>  |
| ar: common archive                                | file format.                    | <b>ar(4)</b>       |
| intro: introduction to entries of a common object | file formats.                   | <b>intro(4)</b>    |
| get: get a version of an SCCS                     | file function. /line number     | <b>ldlread(3)</b>  |
| group: group                                      | file.                           | <b>get(1)</b>      |
| files. filehdr:                                   | file.                           | <b>group(4)</b>    |
| file. ldfhread: read the                          | file header for common object   | <b>filehdr(4)</b>  |
| ldohseek: seek to the optional                    | file header of a common object  | <b>ldfhread(3)</b> |
| split: split a                                    | file header of a common object/ | <b>ldohseek(3)</b> |
| issue: issue identification                       | file into pieces.               | <b>split(1)</b>    |
|   | file.                           | <b>issue(4)</b>    |

|                                |                                |                    |
|--------------------------------|--------------------------------|--------------------|
| of a member of an archive      | file. /read the archive header | <b>ldahread(3)</b> |
| close a common object          | file. ldclose, ldaclose:       | <b>ldclose(3)</b>  |
| file header of a common object | file. ldhread: read the        | <b>ldhread(3)</b>  |
| a section of a common object   | file. /line number entries of  | <b>ldseek(3)</b>   |
| file header of a common object | file. /seek to the optional    | <b>ldohseek(3)</b> |
| a section of a common object   | file. /relocation entries of   | <b>ldrseek(3)</b>  |
| header of a common object      | file. /indexed/named section   | <b>ldhread(3)</b>  |
| section of a common object     | file. /to an indexed/named     | <b>ldsseek(3)</b>  |
| table entry of a common object | file. /the index of a symbol   | <b>ldtindex(3)</b> |
| table entry of a common object | file. /read an indexed symbol  | <b>ldtbread(3)</b> |
| table of a common object       | file. /seek to the symbol      | <b>ldtbseek(3)</b> |
| entries in a common object     | file. linenum: line number     | <b>linenum(4)</b>  |
| link: link to a                | file.                          | <b>link(2)</b>     |
| access to regions of a         | file. locking: exclusive       | <b>locking(2)</b>  |
| mknod: build special           | file.                          | <b>mknod(1)</b>    |
| or a special or ordinary       | file. /make a directory,       | <b>mknod(2)</b>    |
| ctermid: generate              | file name for terminal.        | <b>ctermid(3)</b>  |
| mktemp: make a unique          | file name.                     | <b>mktemp(3)</b>   |
| a file system. ff: list        | file names and statistics for  | <b>ff(1)</b>       |
| change the format of a text    | file. newform:                 | <b>newform(1)</b>  |

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|                              |                                  |                    |
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| name list of common object   | file. nm: print                  | <b>nm(1)</b>       |
| null: the null               | file.                            | <b>null(6)</b>     |
| /find the slot in the utmp   | file of the current user.        | <b>ttyslot(3)</b>  |
| Input/output on a BTOS       | file. ofRead, ofWrite:           | <b>ofread(3)</b>   |
| ofRename: rename a BTOS      | file.                            | <b>ofrename(3)</b> |
| one. creat: create a new     | file or rewrite an existing      | <b>creat(2)</b>    |
| passwd: password             | file.                            | <b>passwd(4)</b>   |
| or subsequent lines of one   | file. /lines of several files    | <b>paste(1)</b>    |
| soft-copy terminals. pg:     | file perusal filter for          | <b>pg(1)</b>       |
| /rewind, ftell: reposition a | file pointer in a stream.        | <b>fseek(3)</b>    |
| lseek: move read/write       | file pointer.                    | <b>lseek(2)</b>    |
| activity/ fpsar:             | File Processor system            | <b>fpsar(1)</b>    |
| prs: print an SCCS           | file.                            | <b>prs(1)</b>      |
| read: read from              | file.                            | <b>read(2)</b>     |
| for a common object          | file. /relocation information    | <b>reloc(4)</b>    |
| remove a delta from an SCCS  | file. rmdel:                     | <b>rmdel(1)</b>    |
| bfs: big                     | file scanner.                    | <b>bfs(1)</b>      |
| two versions of an SCCS      | file. sccsdiff: compare          | <b>sccsdiff(1)</b> |
| sccsfile: format of SCCS     | file.                            | <b>sccsfile(4)</b> |
| header for a common object   | file. scnhdr: section            | <b>scnhdr(4)</b>   |
| ofSetFileStatus: BTOS        | File Status.<br>ofGetFileStatus, | <b>ofstatus(3)</b> |

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|                                |                                |              |
|--------------------------------|--------------------------------|--------------|
| stat, fstat: get               | file status.                   | stat(2)      |
| from a common object           | file. /line number information | strip(1)     |
| checksum and block count of a  | file. sum: print               | sum(1)       |
| swrite: synchronous write on a | file.                          | swrite(2)    |
| /symbol name for common object | file symbol table entry.       | ldgetname(3) |
| syms: common object            | file symbol table format.      | syms(4)      |
| and interactive/ fsck, dfck:   | file system consistency check  | fsck(1)      |
| fsdb:                          | file system debugger.          | fsdb(1)      |
| names and statistics for a     | file system. ff: list file     | ff(1)        |
| fs: format of                  | file system.                   | fs(4)        |
| mkfs: construct a              | file system.                   | mkfs(1)      |
| umount: mount and dismount     | file system. mount,            | mount(1)     |
| mount: mount a                 | file system.                   | mount(2)     |
| copy to or from the BTOS       | file system. ofcopy:           | ofcopy(1)    |
| crup: create                   | file system partition (slice). | crup(1)      |
| ustat: get                     | file system statistics.        | ustat(2)     |
| mnttab: mounted                | file system table.             | mnttab(4)    |
| umount: unmount a              | file system.                   | umount(2)    |
| access time. dcopy: copy       | file systems for optimal       | dcopy(1)     |
| fsck. checklist: list of       | file systems processed by      | checklist(4) |
| volcopy, labelit: copy         | file systems with label/       | volcopy(1)   |
| deliver the last part of a     | file. tail:                    | tail(1)      |

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|                                |                               |                   |
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| term: format of compiled term  | file.                         | <b>term(4)</b>    |
| tmpfile: create a temporary    | file.                         | <b>tmpfile(3)</b> |
| create a name for a temporary  | file. tmpnam, tempnam:        | <b>tmpnam(3)</b>  |
| and modification times of a    | file. touch: update access    | <b>touch(1)</b>   |
| ftw: walk a                    | file tree.                    | <b>ftw(3)</b>     |
| file: determine                | file type.                    | <b>file(1)</b>    |
| undo a previous get of an SCCS | file. unget:                  | <b>unget(1)</b>   |
| report repeated lines in a     | file. uniq:                   | <b>uniq(1)</b>    |
| val: validate SCCS             | file.                         | <b>val(1)</b>     |
| write: write on a              | file.                         | <b>write(2)</b>   |
| umask: set                     | file-creation mode mask.      | <b>umask(1)</b>   |
| common object files.           | filehdr: file header for      | <b>filehdr(4)</b> |
| ferror, feof, clearerr,        | fileno: stream status/        | <b>ferror(3)</b>  |
| create and administer SCCS     | files. admin:                 | <b>admin(1)</b>   |
| /improvement in large          | files and direct I/O.         | <b>piif(5)</b>    |
| ofls: list BTOS                | files and directories.        | <b>ofls(1)</b>    |
| cat: concatenate and print     | files.                        | <b>cat(1)</b>     |
| cmp: compare two               | files.                        | <b>cmp(1)</b>     |
| lines common to two sorted     | files. comm: select or reject | <b>comm(1)</b>    |
| cp, ln, mv: copy, link or move | files.                        | <b>cp(1)</b>      |
| file header for common object  | files. filehdr:               | <b>filehdr(4)</b> |

|                                |                               |                      |
|--------------------------------|-------------------------------|----------------------|
| find: find                     | files                         | <b>find(1)</b>       |
| frec: recover                  | files from a backup tape.     | <b>frec(1)</b>       |
| format specification in text   | files. fspec:                 | <b>fspec(4)</b>      |
| cpset: install object          | files in binary directories.  | <b>cpset(1)</b>      |
| intro: introduction to special | files.                        | <b>intro(6)</b>      |
| link editor for common object  | files. ld:                    | <b>ld(1)</b>         |
| lockf: record locking on       | files.                        | <b>lockf(3)</b>      |
| ofDelete: Allocate BTOS        | files. /ofChangeFileLength.   | <b>ofcreate(3)</b>   |
| ofed, ofvi: edit BTOS          | files.                        | <b>ofeditors(1)</b>  |
| ofCloseAllFiles: Access BTOS   | files. /ofCloseFile,          | <b>ofopenfile(3)</b> |
| rm, rmdir: remove              | files or directories.         | <b>rm(1)</b>         |
| /merge same lines of several   | files or subsequent lines of/ | <b>paste(1)</b>      |
| unpack: compress and expand    | files. pack, pcat,            | <b>pack(1)</b>       |
| pr: print                      | files.                        | <b>pr(1)</b>         |
| section sizes of common object | files. size: print            | <b>size(1)</b>       |
| sort: sort and/or merge        | files.                        | <b>sort(1)</b>       |
| /object and archive            | files to common formats.      | <b>convert(1)</b>    |
| what: identify SCCS            | files.                        | <b>what(1)</b>       |
| terminals. pg: file perusal    | filter for soft-copy          | <b>pg(1)</b>         |
| nl: line numbering             | filter.                       | <b>nl(1)</b>         |
| col:                           | filter reverse line-feeds.    | <b>col(1)</b>        |
| /exCnxSendOnDealloc: make      | final requests.               | <b>exfinal(2)</b>    |

|   |  |                            |
|---|--|----------------------------|
|   | <b>finc: fast incremental backup.</b>            | <b>finc(1)</b>             |
| <b>find:</b>  | <b>find files.</b>                               | <b>find(1)</b>             |
|   | <b>find: find files.</b>                         | <b>find(1)</b>             |
| <b>hyphen:</b>  | <b>find hyphenated words.</b>                    | <b>hyphen(1)</b>           |
| <b>ttyname, isatty:</b>                                     | <b>find name of a terminal.</b>                  | <b>ttyname(3)</b>          |
| <b>object library. lorder:</b>                              | <b>find ordering relation of an</b>              | <b>lorder(1)</b>           |
| <b>hashmake, spellin, hashcheck:</b>                        | <b>find spelling errors. spell,</b>              | <b>spell(1)</b>            |
| <b>of the current user. ttyslot:</b>                        | <b>find the slot in the utmp file</b>            | <b>ttyslot(3)</b>          |
| <b>fold: fold long lines for tee: pipe</b>                  | <b>finite width output device. fitting.</b>      | <b>fold(1)<br/>tee(1)</b>  |
| <b>atof: convert ASCII string to</b>                        | <b>floating-point number.</b>                    | <b>atof(3)</b>             |
| <b>ecvt, fcvt, gcvt: convert</b>                            | <b>floating-point number to/</b>                 | <b>ecvt(3)</b>             |
| <b>/modf: manipulate parts of</b>                           | <b>floating-point numbers.</b>                   | <b>frexp(3)</b>            |
| <b>floor, ceiling, remainder,/ floor, ceil, fmod, fabs:</b> | <b>floor, ceil, fmod, fabs:</b>                  | <b>floor(3)</b>            |
| <b>/cartridge, and</b>                                      | <b>floor, ceiling, remainder,/ floppy disks.</b> | <b>floor(3)<br/>dsk(6)</b> |
| <b>cflow: generate C</b>                                    | <b>flow graph.</b>                               | <b>cflow(1)</b>            |
| <b>fclose, fflush: close or remainder,/ floor, ceil,</b>    | <b>flush a stream.</b>                           | <b>fclose(3)</b>           |
| <b>finite width output device.</b>                          | <b>fmod, fabs: floor, ceiling,</b>               | <b>floor(3)</b>            |
| <b>width output device. fold:</b>                           | <b>fold: fold long lines for</b>                 | <b>fold(1)</b>             |
|   | <b>fold long lines for finite</b>                | <b>fold(1)</b>             |

|                                   |                                   |                    |
|-----------------------------------|-----------------------------------|--------------------|
| stream.                           | fopen, freopen, fdopen:<br>open a | <b>fopen(3)</b>    |
|                                   | fork: create a new<br>process.    | <b>fork(2)</b>     |
| ar: common archive file           | format.                           | <b>ar(4)</b>       |
| newform: change the               | format of a text file.            | <b>newform(1)</b>  |
| i-node:                           | format of an i-node.              | <b>inode(4)</b>    |
| term:                             | format of compiled term<br>file.  | <b>term(4)</b>     |
| core:                             | format of core image file.        | <b>core(4)</b>     |
| cpio:                             | format of cpio archive.           | <b>cpio(4)</b>     |
| dir:                              | format of directories.            | <b>dir(4)</b>      |
| fs:                               | format of file system.            | <b>fs(4)</b>       |
| sccsfile:                         | format of SCCS file.              | <b>sccsfile(4)</b> |
| files. fspec:                     | format specification in<br>text   | <b>fspec(4)</b>    |
| object file symbol table          | format. syms: common              | <b>syms(4)</b>     |
| archive files to common           | formats. /object and              | <b>convert(1)</b>  |
| intro: introduction to file       | formats.                          | <b>intro(4)</b>    |
| wtmp: utmp and wtmp<br>entry      | formats. utmp,                    | <b>utmp(4)</b>     |
| scanf, fscanf, sscanf:<br>convert | formatted input.                  | <b>scanf(3)</b>    |
| /vfprintf, vsprintf: print        | formatted output of a<br>varargs/ | <b>vprintf(3)</b>  |
| reporter. fpsar:                  | fp system activity                | <b>fpsar(1)</b>    |
| fprintf, sprintf: print           | formatted output. printf,         | <b>printf(3)</b>   |
| system activity/                  | fpsar: File Processor             | <b>fpsar(1)</b>    |
| word on a/ putc,<br>putchar,      | fputc, putw: put character<br>or  | <b>putc(3)</b>     |

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|                              |                             |                          |
|------------------------------|-----------------------------|--------------------------|
| stream. puts,                | fputs: put a string on a    | <b>puts(3)</b>           |
| input/output.                | fread, fwrite: binary       | <b>fread(3)</b>          |
| backup tape.                 | frec: recover files from a  | <b>frec(1)</b>           |
| df: report number of         | free disk blocks.           | <b>df(1)</b>             |
| memory allocator. malloc,    | free, realloc, calloc: main | <b>malloc(3)</b>         |
| malloc, mallinfo:/           | free, realloc, calloc,      | <b>malloc(3)</b>         |
| stream. fopen,               | freopen, fdopen: open a     | <b>fopen(3)</b>          |
| parts of floating-point/     | frexp, ldexp, modf:         | <b>frexp(3)</b>          |
|                              | manipulate                  |                          |
| frec: recover files          | from a backup tape.         | <b>frec(1)</b>           |
| /and line number             | from a common object        | <b>strip(1)</b>          |
| information                  | file.                       |                          |
| getw: get character or       | from a stream. /fgetc,      | <b>getc(3)</b>           |
| word                         |                             |                          |
| gets, fgets: get a string    | from a stream.              | <b>gets(3)</b>           |
| rm del: remove a delta       | from an SCCS file.          | <b>rm del(1)</b>         |
| getopt: get option letter    | from argument vector.       | <b>getopt(3)</b>         |
| read: read                   | from file.                  | <b>read(2)</b>           |
| ncheck: generate names       | from i-numbers.             | <b>ncheck(1)</b>         |
| nlist: get entries           | from name list.             | <b>nlist(3)</b>          |
| ofcopy: copy to or           | from the BTOS file          | <b>ofcopy(1)</b>         |
|                              | system.                     |                          |
| getpw: get name              | from UID.                   | <b>getpw(3)</b>          |
|                              | fs: format of file system.  | <b>fs(4)</b>             |
| formatted input. scanf,      | fscanf, sscanf: convert     | <b>scanf(3)</b>          |
| a lost + found directory for | fsck. mklost + found:       | <b>mklost + found(1)</b> |
|                              | make                        |                          |
| of file systems processed    | fsck. checklist: list       | <b>checklist(4)</b>      |
| by                           |                             |                          |

|                                   |                                |                   |
|-----------------------------------|--------------------------------|-------------------|
| consistency check and/            | fsck, dfsck: file system       | <b>fsck(1)</b>    |
|                                   | fsdb: file system debugger.    | <b>fsdb(1)</b>    |
| reposition a file pointer in/     | fseek, rewind, ftell:          | <b>fseek(3)</b>   |
| size.                             | fsize: calculate file          | <b>fsize(1)</b>   |
| text files.                       | fspec: format specification in | <b>fspec(4)</b>   |
| or efl files.                     | fsplit: split fortran, ratfor, | <b>fsplit(1)</b>  |
| stat,                             | fstat: get file status.        | <b>stat(2)</b>    |
| pointer in a/ fseek, rewind,      | ftell: reposition a file       | <b>fseek(3)</b>   |
| communication package             | (ftok). /standard interprocess | <b>stdipc(3)</b>  |
|                                   | ftw: walk a file tree.         | <b>ftw(3)</b>     |
| error/ erf, erfc: error           | function and complementary     | <b>erf(3)</b>     |
| and complementary error           | function. /error function      | <b>erf(3)</b>     |
| gamma: log gamma                  | function. .                    | <b>gamma(3)</b>   |
| hypot: Euclidean distance         | function.                      | <b>hypot(3)</b>   |
| of a common object file           | function. /line number entries | <b>ldlread(3)</b> |
| matherr: error-handling           | function.                      | <b>matherr(3)</b> |
| prof: profile within a            | function.                      | <b>prof(5)</b>    |
| math: math                        | functions and constants.       | <b>math(5)</b>    |
| j0, j1, yn, y0, y1, yn:<br>Bessel | functions.                     | <b>bessel(3)</b>  |
| logarithm, power, square root     | functions. /sqrt: exponential, | <b>exp(3)</b>     |
| remainder, absolute value         | functions. /floor, ceiling,    | <b>floor(3)</b>   |
| ocurse: optimized screen          | functions.                     | <b>ocurses(3)</b> |

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|                                  |  |  |
|----------------------------------|--|--|
| BTOS directory                   | functions.<br>/ofReadDirSector:                      | <b>ofdir(3)</b>                        |
| sinh, cosh, tanh:<br>hyperbolic  | functions.   | <b>sinh(3)</b>                         |
| atan, atan2:<br>trigonometric    | functions. /tan, asin,<br>acos,                      | <b>trig(3)</b>                         |
| fread,                           | fwrite: binary<br>input/output.                      | <b>fread(3)</b>                        |
| connect accounting<br>records.   | fwtmp, wtmpfix:<br>manipulate                        | <b>fwtmp(1)</b>                        |
| gamma: log                       | gamma function.<br><br>gamma: log gamma<br>function. | <b>gamma(3)</b><br><br><b>gamma(3)</b> |
| number to string. ecvt,<br>fcvt, | gcvt: convert floating-point                         | <b>ecvt(3)</b>                         |
| abort:                           | generate an IOT fault                                | <b>abort(3)</b>                        |
| cflow:                           | generate C flow graph.                               | <b>cflow(1)</b>                        |
| reference. cxref:                | generate C program cross                             | <b>cxref(1)</b>                        |
| terminal. ctermid:               | generate file name for                               | <b>ctermid(3)</b>                      |
| crypt, setkey, encrypt:          | generate DES encryption.                             | <b>crypt(3)</b>                        |
| ncheck:                          | generate names from<br>i-numbers.                    | <b>ncheck(1)</b>                       |
| lexical tasks. lex:              | generate programs for<br>simple                      | <b>lex(1)</b>                          |
| /srand48, seed48,<br>lcong48:    | generate uniformly<br>distributed/                   | <b>drand48(3)</b>                      |
| srand: simple<br>random-number   | generator. rand,                                     | <b>rand(3)</b>                         |
| gets, fgets:                     | get a string from a<br>stream.                       | <b>gets(3)</b>                         |
| get:                             | get a version of an SCCS<br>file.                    | <b>get(1)</b>                          |
| ulimit:                          | get and set user limits.                             | <b>ulimit(2)</b>                       |
| the user. cuserid:               | get character login name of                          | <b>cuserid(3)</b>                      |

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|  |                                    |             |
|--|------------------------------------|-------------|
| getc, getchar, fgetc,<br>getw:                     | get character or word<br>from a/   | getc(3)     |
| nlist:   | get entries from name list.        | nlist(3)    |
| umask: set and                                     | get file creation mask.            | umask(2)    |
| stat, fstat:                                       | get file status.                   | stat(2)     |
| ustat:   | get file system statistics.        | ustat(2)    |
| file.  | get: get a version of an<br>SCCS   | get(1)      |
| setgrent, endgrent,<br>fgetgrent:                  | get group file entry.              | getgrent(3) |
| getlogin:  | get login name.                    | getlogin(3) |
| logname:   | get login name.                    | logname(1)  |
| msgget:  | get message queue.                 | msgget(2)   |
| getpw:   | get name from UID.                 | getpw(3)    |
| system. uname:                                     | get name of current<br>CENTIX      | uname(2)    |
| unset: undo a previous<br>argument vector. getopt: | get of an SCCS file.               | unset(1)    |
| setpwent, endpwent,<br>fgetpwent:                  | get option letter from             | getopt(3)   |
| working directory.<br>getcwd:                      | get password file entry.           | getpwent(3) |
| times. times:                                      | get path-name of current           | getcwd(3)   |
| and/ getpid, getpgrp,<br>getppid:                  | get process and child<br>process   | times(2)    |
| /geteuid, getgid, getegid:                         | get process, process<br>group,     | getpid(2)   |
| semget:  | get real user, effective<br>user,/ | getuid(2)   |
| shmget:  | get set of semaphores.             | semget(2)   |
| wmlayout:  | get shared memory<br>segment.      | shmget(2)   |
|  | get terminal's window<br>layout.   | wmlayout(3) |

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|  |  |                        |
|--|--|------------------------|
| tty:   | get the terminal's name.                                       | tty(1)                 |
| time:  | get time.  | time(2)                |
| wmgetid:   | get window ID.   | wmgetid(3)             |
| get character or word from a/<br>character or work from/<br>getc,          | getc, getchar, fgetc, getw:                                    | getc(3)                |
| current working directory.   | getchar, fgetc, getw: get                                      | getc(3)                |
| getuid, geteuid, getgid,<br>environment name.                              | getcwd: get path-name of                                       | getcwd(3)              |
| real user, effective/<br>getuid,   | getegid: get real user,/<br>getenv: return value for           | getuid(2)<br>getenv(3) |
| user./ getuid, geteuid,<br>setgrent, endgrent,/<br>endgrent,/<br>getgrent, | geteuid, getgid, getegid:<br>get                               | getuid(2)              |
| getgrent, getgrgid,  | getgid, getegid: get real                                      | getuid(2)              |
| argument vector.   | getgrent, getgrgid,<br>getgrnam,                               | getgrent(3)            |
|  | getgrgid, getgrnam,<br>setgrent,                               | getgrent(3)            |
|  | getgrnam, setgrent,<br>endgrent,/<br>getlogin: get login name. | getgrent(3)            |
|  | getlogin: get login name.                                      | getlogin(3)            |
|  | getopt: get option letter<br>from                              | getopt(3)              |
|  | getopt: parse command<br>options.                              | getopt(1)              |
|  | getpass: read a password.                                      | getpass(3)             |
| process group, and/<br>getpid,   | getpgrp, getppid: get<br>process,                              | getpid(2)              |
| process, process group,<br>and/<br>group, and/<br>getpid,<br>getpgrp,      | getpid, getpgrp, getppid:<br>get                               | getpid(2)              |
|  | getppid: get process,<br>process                               | getpid(2)              |
|  | getpw: get name from<br>UID.                                   | getpw(3)               |

|   |   |  |
|---|---|--|
| setpwent, endpwent,/<br>getpwent, getpwuid,<br>endpwent,/<br>a stream.<br>and terminal settings<br>used by<br>modes, speed, and line/<br>ct: spawn<br>settings used by getty.<br>getegid: get real user,/<br>pututline, setutent,/<br>setutent, endutent,/<br>getutent,<br>setutent,/<br>getutent, getutid,<br>from a/ getc, getchar,<br>fgetc,<br>convert/ ctime, localtime,<br>setjmp, longjmp:<br>non-local<br>sag: system activity<br>plot:<br>subroutines. plot:<br>/for typesetting view<br>file for a pattern. | getpwent, getpwuid,<br>getpwnam,<br>getpwnam, setpwent,<br>endpwent,/<br>getpwuid, getpwnam,<br>setpwent,<br>gets, fgets: get a string<br>from<br>getty. gettydefs: speed<br>getty: set terminal type,<br>getty to a remote<br>terminal.<br>gettydefs: speed and<br>terminal<br>getuid, geteuid, getgid,<br>getutent, getutid,<br>getutline,<br>getutid, getutline,<br>pututline,<br>getutline, pututline,<br>getw: get character or<br>word<br>gmtime, asctime, tzset:<br>goto.<br>graph.<br>graphics interface.<br>graphics interface<br>graphs and slides.<br>grep, egrep, fgrep: search a | getpwent(3)<br>getpwent(3)<br>getpwent(3)<br>gets(3)<br>gettydefs(4)<br>getty(1)<br>ct(1)<br>gettydefs(4)<br>getuid(2)<br>getut(3)<br>getut(3)<br>getut(3)<br>getc(3)<br>ctime(3)<br>setjmp(3)<br>sag(1)<br>plot(4)<br>plot(3)<br>mv(5)<br>grep(1) |
|---|---|--|

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|   |   |  |
|---|---|--|
| /user, effective user, real                                       | group, and effective group/                                     | <b>getuid(2)</b>   |
| /getppid: get process, process                                    | group, and parent process IDs.                                  | <b>getpid(2)</b>   |
| chown, chgrp: change owner or                                     | group.  | <b>chown(1)</b>  |
| endgrent, fgetgrent: get group:                                   | group file entry. /setgrent, group file.<br>group.: group file. | <b>getgrent(3)</b><br><b>group(4)</b><br><b>group(4)</b> |
| setpgrp: set process id: print user and real group, and effective | group ID.<br>group IDs and names.                               | <b>setpgrp(2)</b><br><b>id(1)</b>                        |
| setuid, setgid: set user and                                      | group IDs. /effective user,                                     | <b>getuid(2)</b>   |
| newgrp: log in to a new   | group IDs.  | <b>setuid(2)</b>   |
| chown: change owner and   | group.  | <b>newgrp(1)</b>   |
| a signal to a process or a update, and regenerate                 | group of a file.  | <b>chown(2)</b>  |
| checkers. pwck,   | group of processes. /send groups of programs. /maintain,        | <b>kill(2)</b><br><b>make(1)</b>                         |
| ssignal,  | grpck: password/group file                                      | <b>pwck(1)</b>   |
| terminal download. tdl, processing. shutdown,                     | gsignal: software signals.                                      | <b>ssignal(3)</b>  |
| varargs:  | gtdl, ptdl: RS-232  | <b>tdl(1)</b>  |
| package. curses: CRT screen                                       | halt: terminate all   | <b>shutdown(1)</b>                                       |
|   | handle variable argument list.                                  | <b>varargs(5)</b>  |
|   | handling and optimization                                       | <b>curses(3)</b>   |

|  |   |                                      |
|--|---|--------------------------------------|
| nohup: run a command<br>immune to                  | hangups and quits.                                      | <b>nohup(1)</b>                      |
| hcreate, hdestroy:<br>manage                       | hash search tables<br>hsearch,                          | <b>hsearch(3)</b>                    |
| spell, hashmake, spellin,<br>/encrypt: generate    | hashcheck: find spelling/<br>hashing encryption.        | <b>spell(1)</b><br><b>crypt(3)</b>   |
| hashcheck: find/ spell,<br>search tables. hsearch, | hashmake, spellin,<br>hcreate, hdestroy: manage<br>hash | <b>spell(1)</b><br><b>hsearch(3)</b> |
| dump.  | hd: hexadecimal and ascii<br>file                       | <b>hd(1)</b>                         |
| tables, hsearch, hcreate,                          | hdestroy: manage hash<br>search                         | <b>hsearch(3C)</b>                   |
| file. scnhdr: section                              | header for a common<br>object                           | <b>scnhdr(4)</b>                     |
| files. filehdr: file                               | header for common object                                | <b>filehdr(4)</b>                    |
| file. ldfhread: read the file                      | header of a common<br>object                            | <b>ldfhread(3)</b>                   |
| /seek to the optional file                         | header of a common<br>object/                           | <b>ldohseek(3)</b>                   |
| /read an indexed/named<br>section                  | header of a common<br>object/                           | <b>ldhread(3)</b>                    |
| ldahread: read the<br>archive                      | header of a member of an/                               | <b>ldahread(3)</b>                   |
|  | help: ask for help.                                     | <b>help(1)</b>                       |
| help: ask for                                      | help.   | <b>help(1)</b>                       |
| dump. hd:  | hexadecimal and ascii file                              | <b>hd(1)</b>                         |
| manage hash search<br>tables.                      | hsearch, hcreate, hdestroy:                             | <b>hsearch(3)</b>                    |
| sinh, cosh, tanh:                                  | hyperbolic functions.                                   | <b>sinh(3)</b>                       |
|  | hyphen: find hyphenated<br>words.                       | <b>hyphen(1)</b>                     |
| hyphen: find                                       | hyphenated words.                                       | <b>hyphen(1)</b>                     |

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|                                   |                                   |                   |
|-----------------------------------|-----------------------------------|-------------------|
| function.                         | hypot: Euclidean distance         | <b>hypot(3)</b>   |
| exWait, exCheck:<br>examine an    | ICC message queue.                | <b>exwait(2)</b>  |
| processor. pstat:                 | ICC statistics for                | <b>pstat(1)</b>   |
| control initialization. init,     | icode, telinit: process           | <b>init(1)</b>    |
| semaphore set or shared<br>memory | id. /remove a message<br>queue,   | <b>ipcrm(1)</b>   |
| and names.                        | id: print user and group IDs      | <b>id(1)</b>      |
| setpgrp: set process<br>group     | ID.                               | <b>setpgrp(2)</b> |
| wmgetid: get window               | ID.                               | <b>wmgetid(3)</b> |
| issue: issue                      | identification file.              | <b>issue(4)</b>   |
| what:                             | identify SCCS files.              | <b>what(1)</b>    |
| id: print user and group          | IDs and names.                    | <b>id(1)</b>      |
| group, and parent<br>process      | IDs. /get process, process        | <b>getpid(2)</b>  |
| group, and effective<br>group     | IDs. /effective user, real        | <b>getuid(2)</b>  |
| setgid: set user and<br>group     | IDs. setuid,                      | <b>setuid(2)</b>  |
| core: format of core              | image file.                       | <b>core(4)</b>    |
| crash: examine system             | images.                           | <b>crash(1)</b>   |
| nohup: run a command              | immune to hangups and<br>quits.   | <b>nohup(1)</b>   |
| direct/ pilf, dio:<br>performance | improvement in large files<br>and | <b>pilf(5)</b>    |
| finc: fast                        | incremental backup.               | <b>finc(1)</b>    |
| tgoto, tputs: terminal            | independent operations.           | <b>termcap(3)</b> |
| for formatting a<br>permuted      | index. /the macro package         | <b>mptx(5)</b>    |

|                               |                                |                     |
|-------------------------------|--------------------------------|---------------------|
| of a/ ldtbindex: compute the  | index of a symbol table entry  | <b>ldtbindex(3)</b> |
| a common/ ldtbread: read an   | indexed symbol table entry of  | <b>ldtbread(3)</b>  |
| ldshread, ldnsbread: read an  | indexed/named section header/  | <b>ldshread(3)</b>  |
| ldsseek, ldnsseek: seek to an | indexed/named section of a/    | <b>ldsseek(3)</b>   |
| control initialization.       | init, icode, telinit: process  | <b>init(1)</b>      |
| inittab: script for the       | init process.                  | <b>inittab(4)</b>   |
| tellinit: process control     | initialization. init, icode,   | <b>init(1)</b>      |
| rc, allrc, conrc: system      | initialization shell scripts.  | <b>brc(1)</b>       |
| process. popen, pclose:       | initiate pipe to/from a        | <b>popen(3)</b>     |
| process.                      | inittab: script for the init   | <b>inittab(4)</b>   |
| clri: clear                   | i-node.                        | <b>clri(1)</b>      |
|                               | inode: format of an i-node     | <b>inode(4)</b>     |
| inode: format of an           | i-node.                        | <b>inode(4)</b>     |
| convert formatted             | input. /fscanf, sscanf:        | <b>scanf(3)</b>     |
| push character back into      | input stream. ungetc:          | <b>ungetc(3)</b>    |
| fread, fwrite: binary         | input/output.                  | <b>fread(3)</b>     |
| ofRead, ofWrite:              | Input/output on a BTOS file.   | <b>ofread(3)</b>    |
| stdio: standard buffered      | input/output package.          | <b>stdio(3)</b>     |
| fileno: stream status         | inquiries. /feof, clearerr,    | <b>ferror(3)</b>    |
| uustat: uucp status           | inquiry and job control.       | <b>uustat(1)</b>    |
| install:                      | install commands.              | <b>install(1)</b>   |
|                               | install: install commands.     | <b>install(1)</b>   |
| directories. cpset:           | install object files in binary | <b>cpset(1)</b>     |

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|                                  |                                 |           |
|----------------------------------|---------------------------------|-----------|
| tset: set terminal,<br>terminal  | interface, and terminal/        | tset(1)   |
| abs: return                      | integer absolute value.         | abs(3)    |
| /164a: convert between<br>long   | integer and base-64<br>ASCII/   | a64l(3)   |
| sputl, sgetl: access long        | integer data in a/              | sputl(3)  |
| atol, atoi: convert string to    | integer, strtol,                | strtol(3) |
| /tol3: convert between<br>3-byte | integers and long integers.     | l3tol(3)  |
| 3-byte integers and long         | integers. /convert<br>between   | l3tol(3)  |
| bcopy:                           | interactive block copy.         | bcopy(1)  |
| command line interpreter<br>for  | interactive BTOS JCL.<br>ofcli: | ofcli(1)  |
| system consistency check<br>and  | interactive repair. /file       | fsck(1)   |
| mt:                              | interface for magnetic<br>tape. | mt(6)     |
| lp: parallel printer             | interface.                      | lp(6)     |
| plot: graphics                   | interface.                      | plot(4)   |
| plot: graphics                   | interface subroutines.          | plot(3)   |
| termio: general terminal         | interface.                      | termio(6) |
| tty: controlling terminal        | interface.                      | tty(6)    |
| BTOS JCL. ofcli:<br>command line | interpreter for interactive     | ofcli(1)  |
| pipe: create an                  | interprocess channel.           | pipe(2)   |
| facilities/ ipc: report          | inter-process<br>communication  | ipc(1)    |
| package/ stdipc:<br>standard     | interprocess<br>communication   | stdipc(3) |
| suspend execution for an         | interval., sleep:               | sleep(1)  |

|                                |                                   |                  |
|--------------------------------|-----------------------------------|------------------|
| sleep: suspend executin<br>for | interval.                         | <b>sleep(3)</b>  |
| commands and<br>application/   | intro: introduction to            | <b>intro(1)</b>  |
| formats.                       | intro: introduction to file       | <b>intro(4)</b>  |
| miscellany.                    | intro: introduction to            | <b>intro(5)</b>  |
| files.                         | intro: introduction to<br>special | <b>intro(6)</b>  |
| subroutines and libraries.     | intro: introduction to            | <b>intro(3)</b>  |
| calls and error numbers.       | intro: introduction to<br>system  | <b>intro(2)</b>  |
| applicaton programs.<br>intro: | introduction to commands<br>and   | <b>intro(1)</b>  |
| intro:                         | introduction to file<br>formats.  | <b>intro(4)</b>  |
| intro:                         | introduction to miscellany.       | <b>intro(5)</b>  |
| intro:                         | introduction to special<br>files. | <b>intro(6)</b>  |
| and libraries. intro:          | introduction to subroutines       | <b>intro(3)</b>  |
| and error numbers. intro:      | introduction to system<br>calls   | <b>intro(2)</b>  |
| ncheck: generate names<br>from | i-numbers.                        | <b>ncheck(1)</b> |
| in large files and direct      | I/O. /performance<br>improvement  | <b>pilf(5)</b>   |
|                                | ioctl: control device.            | <b>ioctl(2)</b>  |
| abort: generate an             | IOT fault.                        | <b>abort(3)</b>  |
| semaphore set or<br>shared/    | ipcrm: remove a message<br>queue, | <b>ipcrm(1)</b>  |
| communication facilities/      | ipcs: report inter-process        | <b>ipcs(1)</b>   |
| /islower, isdigit, isxdigit,   | isalnum, isspace, ispunct./       | <b>ctype(3)</b>  |
| isdigit, isxdigit, isalnum,/   | isalpha, isupper, islower,        | <b>ctype(3)</b>  |

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|                              |                                |                   |
|------------------------------|--------------------------------|-------------------|
| /isprint, isgraph, iscntrl,  | isascii: classify characters.  | <b>ctype(3)</b>   |
| terminal. ttyname,           | isatty: find name of a         | <b>ttyname(3)</b> |
| /ispunct, isprint, isgraph,  | iscntrl, isascii: classify/    | <b>ctype(3)</b>   |
| isalpha, isupper, islower,   | isdigit, isxdigit, isalnum,/   | <b>ctype(3)</b>   |
| isspace, ispunct, isprint,   | isgraph, iscntrl, isascii:/    | <b>ctype(3)</b>   |
| isalnum,/ isalpha,           | islower, isdigit, isxdigit,    | <b>ctype(3)</b>   |
| isupper,                     |                                |                   |
| /isalnum, isspace,           | isprint, isgraph, iscntrl,/    | <b>ctype(3)</b>   |
| ispunct,                     |                                |                   |
| isxdigit, isalnum, isspace,  | ispunct, isprint, isgraph./    | <b>ctype(3)</b>   |
| /isdigit, isxdigit, isalnum, | isspace, ispunct, isprint,/    | <b>ctype(3)</b>   |
| system:                      | issue a shell command.         | <b>system(3)</b>  |
| issue:                       | issue identification file.     | <b>issue(4)</b>   |
| file.                        | issue: issue identification    | <b>issue(4)</b>   |
| isxdigit, isalnum,/          | isupper, islower, isdigit,     | <b>ctype(3)</b>   |
| isalpha,                     |                                |                   |
| /isupper, islower, isdigit,  | isxdigit, isalnum, isspace,/   | <b>ctype(3)</b>   |
| news: print news             | items.                         | <b>news(1)</b>    |
| functions.                   | j0, j1, jn, y0, y1, yn: Bessel | <b>bessel(3)</b>  |
| functions. j0                | j1, jn, y0, y1, yn: Bessel     | <b>bessel(3)</b>  |
| for interactive BTOS         | JCL. /command line             | <b>ofcli(1)</b>   |
|                              | interpreter                    |                   |
| functions. j0, j1,           | jn, y0, y1, yn: Bessel         | <b>bessel(3)</b>  |
| operator.                    | join: relational database      | <b>join(1)</b>    |
| lrnd48, nrnd48,              | jrnd48, srnd48,                | <b>drand48(3)</b> |
| mrnd48,                      | seed48,/                       |                   |
| mkboot: reformat CENTIX      | kernel and copy it to          | <b>mkboot(1)</b>  |
|                              | BTOS.                          |                   |

|  |  |   |
|--|--|---|
| killall:   | kill all active processes.   | <b>killall(1)</b>   |
| process or a group of/<br><br>processes.   | kill: send a signal to a<br><br>kill: terminate a process.   | <b>kill(2)</b><br><b>kill(1)</b>  |
| mem,   | killall: kill all active   | <b>killall(1)</b>   |
| 3-byte integers and<br>long/<br>integer and base-64/<br>a64l,  | kmem: core memory.<br><br>l3tol, ltol3: convert<br>between<br><br>164a: convert between<br>long                | <b>mem(6)</b><br><b>l3tol(3)</b><br><b>a64l(3)</b>                      |
| copy file systems with<br>with label checking.<br>volcopy,<br><br>scanning and processing<br>arbitrary-precision<br>arithmetic | label checking. /labelit:<br><br>labelit: copy file systems<br><br>language. awk: pattern<br><br>language. bc: | <b>volcopy(1)</b><br><b>volcopy(1)</b><br><b>awk(1)</b><br><b>bc(1)</b> |
| cpp: the C<br>command programming  | language preprocessor.<br><br>language.<br>/standard/restricted  | <b>cpp(1)</b><br><b>sh(1)</b>   |
| get terminal's window<br><br>/jrand48, srand48,<br>seed48,   | layout. wmlayout:<br><br>lcong48: generate<br>uniformly/   | <b>wmlayout(3)</b><br><b>drand48(3)</b>                                 |
| object files.  | ld: link editor for common   | <b>ld(1)</b>  |
| object file. ldclose,  | ldaclose: close a common   | <b>ldclose(3)</b>   |
| header of a member of an/<br>file for reading. ldopen,   | ldahread: read the archive<br><br>ldaopen: open a common<br>object   | <b>ldahread(3)</b><br><b>ldopen(3)</b>                                  |
| common object file.  | ldclose, ldaclose: close a   | <b>ldclose(3)</b>   |
| of floating-point/frexp,<br><br>access routines.   | ldexp, modf: manipulate<br>parts<br><br>ldfcn: common object file  | <b>frexp(3)</b><br><b>ldfcn(4)</b>                                      |

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| of a common object file.                                | ldfhread: read the file header  | <b>ldfhread(3)</b>  |
| name for common object file/                            | ldgetname: retrieve symbol      | <b>ldgetname(3)</b> |
| line number entries/<br>ldread,                         | ldlinit, ldlitem: manipulate    | <b>ldlread(3)</b>   |
| number/<br>ldread, ldlinit,                             | ldlitem: manipulate line        | <b>ldlread(3)</b>   |
| manipulate line number/<br>to line number entries/      | ldlread, ldlinit, ldlitem:      | <b>ldlread(3)</b>   |
| number entries of a section/                            | ldlseek, ldnlseek: seek         | <b>ldlseek(3)</b>   |
| entries of a section/<br>ldrseek,                       | ldlseek, ldnlseek: seek to line | <b>ldlseek(3)</b>   |
| indexed/named/<br>ldshread,                             | ldnrseek: seek to relocation    | <b>ldrseek(3)</b>   |
| indexed/named/<br>ldsseek,                              | ldnshread: read an              | <b>ldshread(3)</b>  |
| file header of a common/<br>object file for reading.    | ldnsseek: seek to an            | <b>ldsseek(3)</b>   |
| relocation entries of a/<br>indexed/named section of a/ | ldohseek: seek to the optional  | <b>ldohseek(3)</b>  |
| indexed/named section of a/                             | ldopen, ldaopen: open a common  | <b>ldopen(3)</b>    |
| of a symbol table entry of a/                           | ldrseek, ldnrseek: seek to      | <b>ldrseek(3)</b>   |
| symbol table entry of a/                                | ldshread, ldnshread: read an    | <b>ldshread(3)</b>  |
| table of a common object/                               | ldsseek, ldnsseek: seek to an   | <b>ldsseek(3)</b>   |
| getopt: get option                                      | ldtindex: compute the index     | <b>ldtindex(3)</b>  |
|   | ldtbread: read an indexed       | <b>ldtbread(3)</b>  |
|   | ldtbseek: seek to the symbol    | <b>ldtbseek(3)</b>  |
|   | letter from argument vector.    | <b>getopt(3)</b>    |

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| generate programs for simple  | lexical tasks. lex:             | lex(1)     |
| update. lsearch,              | lfind: linear search and        | lsearch(3) |
| to subroutines and            | libraries. /introduction        | intro(3)   |
| relation for an object        | library. /find ordering         | lorder(1)  |
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| ulimit: get and set user      | limits.                         | ulimit(2)  |
| an out-going terminal         | line connection. /establish     | dial(3)    |
| type, modes, speed, and       | line discipline. /set terminal  | getty(1)   |
| interactive/ ofcli: command   | line interpreter for            | ofcli(1)   |
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| common object file. linenum:  | line number entries in a        | linenum(4) |
| /ldlinit, ldlitem: manipulate | line number entries of a/       | ldlread(3) |
| ldlseek, ldnlseek: seek to    | line number entries of a/       | ldlseek(3) |
| strip: strip symbol and       | line number information from a/ | strip(1)   |
| nl:                           | line numbering filter.          | nl(1)      |
| out selected fields of each   | line of a file. cut: cut        | cut(1)     |
| send/cancel requests to an LP | line printer, lp, cancel:       | lp(1)      |
| lpset: set parallel           | line printer options.           | lpset(1)   |
| lpr:                          | line printer spooler.           | lpr(1)     |
|                               | line: read one line.            | line(1)    |
| lsearch, lfind:               | linear search and update.       | lsearch(3) |

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| col: filter reverse            | line-feeds.                    | <b>col(1)</b>       |
| in a common object file        | linenum: line number entries   | <b>linenum(4)</b>   |
| files. comm: select or reject  | lines common to two sorted     | <b>comm(1)</b>      |
| device. fold: fold long        | lines for finite width output  | <b>fold(1)</b>      |
| head: give first few           | lines.                         | <b>head(1)</b>      |
| uniq: report repeated          | lines in a file.               | <b>uniq(1)</b>      |
| of several files or subsequent | lines of one file. /same lines | <b>paste(1)</b>     |
| subsequent/ paste: merge same  | lines of several files or      | <b>paste(1)</b>     |
| link, unlink: exercise         | link and unlink system calls.  | <b>link(1)</b>      |
| files. ld:                     | link editor for common object  | <b>ld(1)</b>        |
| a.out: common assembler and    | link editor output.            | <b>a.out(4)</b>     |
|                                | link: link to a file.          | <b>link(2)</b>      |
| cp, ln, mv: copy,              | link or move files.            | <b>cp(1)</b>        |
| link:                          | link to a file.                | <b>link(2)</b>      |
| and unlink system calls.       | link, unlink: exercise link    | <b>link(1)</b>      |
|                                | lint: a C program checker.     | <b>lint(1)</b>      |
| ls:                            | list contents of directory.    | <b>ls(1)</b>        |
| directories. ofls:             | list BTOS files and            | <b>ofls(1)</b>      |
| for a file system. ff:         | list file names and statistics | <b>ff(1)</b>        |
| nlist: get entries from name   | list.                          | <b>nlist(3)</b>     |
| nm: print name                 | list of common object file. .  | <b>nm(1)</b>        |
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| xargs: construct argument       | list(s) and execute command.   | <b>xargs(1)</b>    |
| files. cp,                      | ln, mv: copy, link or move     | <b>cp(1)</b>       |
| tzset: convert data/ctime,      | localtime, gmtime, asctime,    | <b>ctime(3)</b>    |
| command. path:                  | locate executable file for     | <b>path(1)</b>     |
| end, etext, edata: last         | locations in program.          | <b>end(3)</b>      |
| data in memory. plock:          | lock process, text, or         | <b>plock(2)</b>    |
| files.                          | lockf: record locking on       | <b>lockf(3)</b>    |
| regions of a file.              | locking: exclusive access to   | <b>locking(2)</b>  |
| lockf: record                   | locking on files.              | <b>lockf(3)</b>    |
| gamma:                          | log gamma function.            | <b>gamma(3)</b>    |
| newgrp:                         | log in to a new group.         | <b>newgrp(1)</b>   |
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| logarithm, power,/ exp, log,    | log10, pow, sqrt: exponential, | <b>exp(3)</b>      |
| /log10, pow, sqrt: exponential, | logarithm, power, square root/ | <b>exp(3)</b>      |
| getlogin: get                   | login name.                    | <b>getlogin(3)</b> |
| logname: get                    | login name.                    | <b>logname(1)</b>  |
| cuserid: get character          | login name of the user.        | <b>cuserid(3)</b>  |
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| passwd: change                  | login password.                | <b>passwd(1)</b>   |
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|                                 | logname: get login name.       | <b>logname(1)</b>  |

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| a64l, l64a: convert between   | long integer and base-64 ASCII/                                    | <b>a64l(3)</b>                                 |
| sputl, sgetl: access between 3-byte integers and                          | long integer data in a/ long integers. /lto13: convert             | <b>sputl(3)</b><br><b>l3tol(3)</b>             |
| output device. fold: fold setjmp,   | long lines for finite width longjmp: non-local goto.               | <b>fold(1)</b><br><b>setjmp(3)</b>             |
| for an object library.  | lorder: find ordering relation                                     | <b>lorder(1)</b>                               |
| mklost + found: make a  | lost + found directory for fsck.                                   | <b>mklost + found(1)</b>                       |
| nice: run a command at requests to an LP line/ send/cancel requests to an | low priority. lp, cancel: send/cancel LP line printer. lp, cancel: | <b>nice(1)</b><br><b>lp(1)</b><br><b>lp(1)</b> |
| interface.  | lp: parallel printer   | <b>lp(6)</b>                                   |
| disable: enable/disable   | LP printers. enable,   | <b>enable(1)</b>                               |
| lpshut, lpmove: start/stop the  | LP request scheduler and move/                                     | <b>lpsched(1)</b>                              |
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| lpadmin: configure the  | LP spooling system.  | <b>lpadmin(1)</b>                              |
| lpstat: print   | LP status information.   | <b>lpstat(1)</b>                               |
| spooling system.  | lpadmin: configure the LP  | <b>lpadmin(1)</b>                              |
| request/ lpsched, lpshut,   | lpmove: start/stop the LP  | <b>lpsched(1)</b>                              |
|   | lpr: line printer spooler.   | <b>lpr(1)</b>                                  |
| start/stop the LP request/  | lpsched, lpshut, lpmove:   | <b>lpsched(1)</b>                              |

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| printer options.                                  | lpset: set parallel line                         | <b>lpset(1)</b>                     |
| LP request scheduler/<br>lpsched,<br>information. | lpshut, lpmove: start/stop<br>the                | <b>lpsched(1)</b>                   |
| jrاند48,/ drاند48,<br>erاند48,                    | lpstat: print LP status                          | <b>lpstat(1)</b>                    |
| directory.  | lrاند48, nrاند48,<br>mrاند48,                    | <b>drاند48(3)</b>                   |
| and update.                                       | ls: list contents of                             | <b>ls(1)</b>                        |
| pointer.  | lsearch, lfind: linear<br>search                 | <b>lsearch(3)</b>                   |
| integers and long/ l3tol,                         | lseek: move read/write<br>file                   | <b>lseek(2)</b>                     |
| values:   | l3tol3: convert between<br>3-byte                | <b>l3tol(3)</b>                     |
| /access long integer data<br>in a                 | m4: macro processor.                             | <b>m4(1)</b>                        |
| permuted index. mptx:<br>the                      | machine-dependent values.                        | <b>values(5)</b>                    |
| documents. mm: the MM                             | machine-independent<br>fashion.                  | <b>sputl(3)</b>                     |
| typesetting/ mv: a troff                          | macro package for<br>formatting                  | <b>mptx(5)</b>                      |
| m4:   | macro package for<br>formatting                  | <b>mm(5)</b>                        |
| in this manual. man:                              | macro processor.                                 | <b>mv(5)</b>                        |
| send mail to users or read<br>users or read mail. | macros for formatting<br>entries                 | <b>man(5)</b>                       |
| mail, rmail: send                                 | mail. mail, rmail:                               | <b>mail(1)</b>                      |
| malloc, free, realloc,<br>calloc:                 | mail, rmail: send mail to<br>users or read mail. | <b>mail(1)</b>                      |
| /mallopt, mallinfo: fast                          | main memory allocator.                           | <b>malloc(3)</b>                    |
| regenerate groups of/<br>make:                    | main memory allocator.                           | <b>malloc(3) (fast<br/>version)</b> |
|   | maintain, update, and                            | <b>make(1)</b>                      |

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| ar: archive and library        | maintainer for portable/       | <b>ar(1)</b>                    |
| SCCS file. delta:              | make a delta (change) to an    | <b>delta(1)</b>                 |
| mkdir:                         | make a directory.              | <b>mkdir(1)</b>                 |
| or ordinary file. mknod:       | make a directory, or a special | <b>mknod(2)</b>                 |
| mktemp:                        | make a unique file name.       | <b>mktemp(3)</b>                |
| exCnxSendOnDeal<br>loc:        | make final requests.           | <b>exfinal(2)</b>               |
| regenerate groups of/          | make: maintain, update, and    | <b>make(1)</b>                  |
| banner:                        | make posters.                  | <b>banner(1)</b>                |
| session. script:               | make typescript of terminal    | <b>script(1)</b>                |
| realloc, calloc, malloc,       | malloc: fast main memory/      | <b>malloc(3) (fast version)</b> |
| main memory allocator.         | malloc, free, realloc, calloc: | <b>malloc(3)</b>                |
| malloc, mallinfo: fast main/   | malloc, free, realloc, calloc, | <b>malloc(3)</b>                |
| malloc, free, realloc, calloc, | malloc, mallinfo: fast main/   | <b>malloc(3) (fast version)</b> |
| /tfind, tdelete, twalk:        | manage binary search trees.    | <b>tsearch(3)</b>               |
| hsearch, hcreate, hdestroy:    | manage hash search tables.     | <b>hsearch(3)</b>               |
| wmop: window                   | management operations.         | <b>wmop(3)</b>                  |
| window: window                 | management primitives.         | <b>window(6)</b>                |
| wm: window                     | management. .                  | <b>wm(1)</b>                    |
| records. fwtmp, wtmpfix:       | manipulate connect accounting  | <b>fwtmp(1)</b>                 |
| of/ ldlread, ldlini, ldliitem: | manipulate line number entries | <b>ldlread(3)</b>               |
| frexp, ldexp, modf:            | manipulate parts of/           | <b>frexp(3)</b>                 |
| ascii:                         | map of ASCII character set.    | <b>ascii(5)</b>                 |
| umask: set file-creation mode  | mask.                          | <b>umask(1)</b>                 |

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| set and get file creation         | mask. umask:                      | <b>umask(2)</b>                     |
| table. master:                    | master device information         | <b>master(4)</b>                    |
| information table.                | master: master device             | <b>master(4)</b>                    |
| regular expression<br>compile and | match routines. regexp:           | <b>regexp(5)</b>                    |
| math:                             | math functions and<br>constants.  | <b>math(5)</b>                      |
| constants.                        | math: math functions and          | <b>math(5)</b>                      |
| function.                         | matherr: error-handling           | <b>matherr(3)</b>                   |
| processor type.                   | mc68k, pdp11, u3b, vax:           | <b>machid(1)</b>                    |
|                                   | mem, kmem: core<br>memory.        | <b>mem(6)</b>                       |
| memcpy, memset:<br>memory/        | memcpy, memchr,<br>memcmp,        | <b>memory(3)</b>                    |
| memset: memory/<br>memcpy,        | memchr, memcmp,<br>memcpy,        | <b>memory(3)</b>                    |
| operations. memcpy,<br>memchr,    | memcmp, memcpy,<br>memset: memory | <b>memory(3)</b>                    |
| memcpy, memchr,<br>memcmp,        | memcpy, memset:<br>memory/        | <b>memory(3)</b>                    |
| free, realloc, calloc: main       | memory allocator. malloc,         | <b>malloc(3)</b>                    |
| malloc, mallinfo: fast<br>main    | memory allocator. /calloc,        | <b>malloc(3) (fast<br/>version)</b> |
| shmctl: shared                    | memory control<br>operations.     | <b>shmctl(2)</b>                    |
| queue, semaphore set or<br>shared | memory id. /remove a<br>message   | <b>ipcrm(1)</b>                     |
| mem, kmem: core                   | memory.                           | <b>mem(6)</b>                       |
| memcmp, memcpy,<br>memset:        | memory operations.<br>/memchr,    | <b>memory(3)</b>                    |
| shmop: shared                     | memory operations.                | <b>shmop(2)</b>                     |
| text, or data in                  | memory. /lock process,            | <b>plock(2)</b>                     |
| shmget: get shared                | memory segment.                   | <b>shmget(2)</b>                    |

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| sort: sort and/or<br>files or subsequent/<br>paste: | merge files.<br><br>merge same lines of<br>several | <b>sort(1)</b><br><br><b>paste(1)</b> |
| msgctl:   | msg: permit or deny<br>messages.                   | <b>msg(1)</b>                         |
| msgop:  | message control<br>operations.                     | <b>msgctl(2)</b>                      |
| exCheck: examine an ICC                             | message operations.                                | <b>msgop(2)</b>                       |
| msgget: get   | message queue. exWait,                             | <b>exwait(2)</b>                      |
| or shared/ ipcrm: remove a                          | message queue.                                     | <b>msgget(2)</b>                      |
| exRespond: send a                                   | message queue,<br>semaphore set                    | <b>ipcrm(1)</b>                       |
| exRequest: Send a                                   | message to a client.                               | <b>exrespond(2)</b>                   |
| msg: permit or deny                                 | message to a server.                               | <b>exrequest(2)</b>                   |
| sys__nerr: system error                             | messages.  | <b>msg(1)</b>                         |
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| lost + found directory<br>for/                      | mkboot: reformat CENTIX<br>kernel                  | <b>mkboot(1)</b>                      |
| special or ordinary file.                           | mkdir: make a directory.                           | <b>mkdir(1)</b>                       |
| name:   | mkfs: construct a file<br>system.                  | <b>mkfs(1)</b>                        |
| table.  | mklost + found: make a                             | <b>mklost + found(1)</b>              |
| chmod: change                                       | mknod: build special file.                         | <b>mknod(1)</b>                       |
|   | mknod: make a directory,<br>or a                   | <b>mknod(2)</b>                       |
|   | mktemp: make a unique file                         | <b>mktemp(3)</b>                      |
|   | mnttab: mounted file<br>system                     | <b>mnttab(4)</b>                      |
|   | mode.  | <b>chmod(1)</b>                       |

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| umask: set file-creation  | mode mask.                    | <b>umask(1)</b>     |
| chmod: change             | mode of file.                 | <b>chmod(2)</b>     |
| modemcap: smart           | modem capability data base.   | <b>modemcap(5)</b>  |
| capability data base.     | modemcap: smart modem         | <b>modemcap(5)</b>  |
| getty: set terminal type, | modes, speed, and line/       | <b>getty(1)</b>     |
| /compiler/interpreter for | modem-sized programs.         | <b>bs(1)</b>        |
| floating-point/ frexp,    | modf: manipulate parts of     | <b>frexp(3)</b>     |
| ldexp,                    | modification times of a file. | <b>touch(1)</b>     |
| touch: update access and  | modification times.           | <b>utime(2)</b>     |
| utime: set file access    | monitor: prepare execution    | <b>monitor(3)</b>   |
| and                       | monitor uucp network.         | <b>uusub(1)</b>     |
| profile.                  | more, page: text perusal.     | <b>more(1)</b>      |
| uusub:                    | Motorola/Intel.               | <b>swapshort(3)</b> |
| translate byte orders to  | /swaplong:                    |                     |
| mount:                    | mount a file system.          | <b>mount(2)</b>     |
| system. mount, umount:    | mount and dismount file       | <b>mount(1)</b>     |
|                           | mount: mount a file           | <b>mount(2)</b>     |
|                           | system.                       |                     |
| setmnt: establish         | mount table.                  | <b>setmnt(1)</b>    |
| dismount file system.     | mount, umount: mount          | <b>mount(1)</b>     |
|                           | and                           |                     |
| mnttab:                   | mounted file system table..   | <b>mnttab(4)</b>    |
| mmdir:                    | move a directory.             | <b>mmdir(1)</b>     |
| cp, ln, mv: copy, link or | move files.                   | <b>cp(1)</b>        |
| lseek:                    | move read/write file          | <b>lseek(2)</b>     |
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| formatting a permuted index. | mptx: the macro package for    | <b>mptx(5)</b>    |
| /erand48, lrand48, nrand48,  | mrnd48, jrand48, srnd48,/      | <b>drand48(3)</b> |
| operations.                  | msgctl: message control        | <b>msgctl(2)</b>  |
|                              | msgget: get message queue.     | <b>msgget(2)</b>  |
|                              | msgop: message operations.     | <b>msgop(2)</b>   |
| tape.                        | mt: interface for magnetic     | <b>mt(6)</b>      |
| package for typesetting/     | mv: a troff macro              | <b>mv(5)</b>      |
| cp, ln,                      | mv: copy, link or move files.  | <b>cp(1)</b>      |
|                              | mvdir: move a directory.       | <b>mvdir(1)</b>   |
| i-numbers.                   | ncheck: generate names from    | <b>ncheck(1)</b>  |
| uusub: monitor uucp          | network.                       | <b>uusub(1)</b>   |
| a text file.                 | newform: change the format of  | <b>newform(1)</b> |
|                              | newgrp: log in to a new group. | <b>newgrp(1)</b>  |
| news: print                  | news items.                    | <b>news(1)</b>    |
|                              | news: print news items.        | <b>news(1)</b>    |
| process.                     | nice; change priority of a     | <b>nice(2)</b>    |
| process by changing          | nice. /of running              | <b>renice(1)</b>  |
| priority.                    | nice: run a command at low     | <b>nice(1)</b>    |
|                              | nl: line numbering filter.     | <b>nl(1)</b>      |
| list.                        | nlist: get entries from name   | <b>nlist(3)</b>   |
| object file.                 | nm: print name list of common  | <b>nm(1)</b>      |
| hangups and quits.           | nohup: run a command immune to | <b>nohup(1)</b>   |

|                                   |                                  |                     |
|-----------------------------------|----------------------------------|---------------------|
| setjmp, longjmp:                  | non-local goto.                  | <b>setjmp(3)</b>    |
| drand48, erand48,<br>lrand48,     | nrand48, mrand48,<br>jrand48, /  | <b>drand48(3)</b>   |
| null: the                         | null file.                       | <b>null(6)</b>      |
|                                   | null: the null file.             | <b>null(6)</b>      |
| nl: line                          | numbering filter.                | <b>nl(1)</b>        |
| to/ convert: convert              | object and archive files         | <b>convert(1)</b>   |
| ldfcn: common                     | object file access routines.     | <b>ldfcn(4)</b>     |
| dump selected parts of an         | object file. dump:               | <b>dump(1)</b>      |
| ldopen, ldaopen: open a<br>common | object file for reading.         | <b>ldopen(3)</b>    |
| number entries of a<br>common     | object file function. /line      | <b>ldlread(3)</b>   |
| ldaclose: close a common          | object file. ldclose,            | <b>ldclose(3)</b>   |
| the file header of a<br>common    | object file. ldff:read: read     | <b>ldffread(3)</b>  |
| of a section of a<br>common       | object file. /number<br>entries  | <b>ldlseek(3)</b>   |
| file header of a common           | object file. /to the<br>optional | <b>ldohseek(3)</b>  |
| of a section of a<br>common       | object file. /entries            | <b>ldrseek(3)</b>   |
| header of a common                | object file. /section            | <b>ldshread(3)</b>  |
| section header of a<br>common     | object file.<br>/indexed/named   | <b>ldsseek(3)</b>   |
| symbol table entry of a<br>common | object file. /the index of a     | <b>ldtbindex(3)</b> |
| symbol table entry of a<br>common | object file. /read an<br>indexed | <b>ldtbread(3)</b>  |
| the symbol table of a<br>common   | object file. /seek to            | <b>ldtbseek(3)</b>  |
| number entries in a<br>common     | object file. linenum: line       | <b>linenum(4)</b>   |

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|                                |                               |                      |
|--------------------------------|-------------------------------|----------------------|
| nm: print name list of common  | object file.                  | <b>nm(1)</b>         |
| information for a common       | object file. /relocation      | <b>reloc(4)</b>      |
| section header for a common    | object file. scnhdr:          | <b>scnhdr(4)</b>     |
| information from a common      | object file. /and line number | <b>strip(1)</b>      |
| entry. /symbol name for common | object file symbol table      | <b>ldgetname(3)</b>  |
| format. syms: common           | object file symbol table      | <b>syms(4)</b>       |
| file header for common         | object files. filehdr:        | <b>filehdr(4)</b>    |
| directories. cpset: install    | object files in binary        | <b>cpset(1)</b>      |
| ld: link editor for common     | object files.                 | <b>ld(1)</b>         |
| print section sizes of common  | object files. size:           | <b>size(1)</b>       |
| find ordering relation for an  | object library. lorder:       | <b>lorder(1)</b>     |
| /exAllocExch, exDeallocExch:   | obtain and abandon exchanges. | <b>exchanges(2)</b>  |
| od:                            | octal dump.                   | <b>od(1)</b>         |
| functions.                     | ocurse: optimized screen      | <b>ocurses(3)</b>    |
|                                | od: octal dump.               | <b>od(1)</b>         |
| Allocate BTOS/ ofCreate,       | ofChangeFileLength, ofDelete: | <b>ofcreate(3)</b>   |
| interpreter for interactive/   | ofcli: command line           | <b>ofcli(1)</b>      |
| ofOpenFile, ofCloseFile,       | ofCloseAllFiles: Access BTOS/ | <b>ofopenfile(3)</b> |
| Access BTOS/ ofOpenFile,       | ofCloseFile, ofCloseAllFiles: | <b>ofopenfile(3)</b> |
| BTOS file system.              | ofcopy: copy to or from the   | <b>ofcopy(1)</b>     |

|   |   |                      |
|---|---|----------------------|
| ofReadDirSector: BTOS/                          | ofCrDir, ofDIDir,                             | <b>ofdir(3)</b>      |
| ofDelete: Allocate BTOS/                        | ofCreate,<br>ofChangeFileLength,              | <b>ofcreate(3)</b>   |
| ofCreate,<br>ofChangeFileLength,                | ofDelete: Allocate BTOS<br>files.             | <b>ofcreate(3)</b>   |
| directory functions.<br>ofCrDir,                | ofDIDir, ofReadDirSector:<br>BTOS             | <b>ofdir(3)</b>      |
|   | ofed, ofvi: edit BTOS files.                  | <b>ofeditors(1)</b>  |
| ofSetFileStatus: BTOS<br>File/                  | ofGetFileStatus,                              | <b>ofstatus(3)</b>   |
| directories.                                    | ofls: list BTOS files and                     | <b>ofls(1)</b>       |
| ofCloseAllFiles: Access<br>BTOS/                | ofOpenFile, ofCloseFile,                      | <b>ofopenfile(3)</b> |
| on a BTOS file.                                 | ofRead, ofWrite:<br>Input/output              | <b>ofread(3)</b>     |
| directory/ ofCrDir,<br>ofDIDir,                 | ofReadDirSector: BTOS                         | <b>ofdir(3)</b>      |
|   | ofRename: rename a BTOS<br>file.              | <b>ofrename(3)</b>   |
| Status. ofGetFileStatus,<br>ofed,               | ofSetFileStatus: BTOS File                    | <b>ofstatus(3)</b>   |
| BTOS file. ofRead,<br>reading. ldopen, ldaopen: | ofvi: edit BTOS files.                        | <b>ofeditors(1)</b>  |
|   | ofWrite: Input/output on a                    | <b>ofread(3)</b>     |
| fopen, freopen, fdopen:                         | open a common object file<br>for              | <b>ldopen(3)</b>     |
| dup: duplicate an                               | open a stream.                                | <b>fopen(3)</b>      |
| open:   | open file descriptor.                         | <b>dup(2)</b>        |
| writing.  | open for reading or<br>writing.               | <b>open(2)</b>       |
| profiler. prf:                                  | open: open for reading or<br>operating system | <b>open(2)</b>       |
| prfdc, prfsnap, prfpr:                          | operating system/                             | <b>prf(6)</b>        |
| memcmp, memcpy,<br>memset: memory               | operations. memccpy,<br>memchr,               | <b>profiler(1)</b>   |
|   |   | <b>memory(3)</b>     |

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|                                      |                               |                    |
|--------------------------------------|-------------------------------|--------------------|
| <b>msgctl:</b> message control       | operations.                   | <b>msgctl(2)</b>   |
| <b>msgop:</b> message                | operations.                   | <b>msgop(2)</b>    |
| <b>semctl:</b> semaphore control     | operations.                   | <b>semctl(2)</b>   |
| <b>semop:</b> semaphore              | operations.                   | <b>semop(2)</b>    |
| <b>shmctl:</b> shared memory control | operations.                   | <b>shmctl(2)</b>   |
| <b>shmop:</b> shared memory          | operations.                   | <b>shmop(2)</b>    |
| <b>strcspn, strtok:</b> string       | operations. /strpbrk, strspn, | <b>string(3)</b>   |
| <b>tputs:</b> terminal independent   | operations. /tgetstr, tgoto,  | <b>termcap(3)</b>  |
| <b>wmop:</b> window management       | operations.                   | <b>wmop(3)</b>     |
| <b>join:</b> relational database     | operator.                     | <b>join(1)</b>     |
| <b>dcopy:</b> copy file systems for  | optimal access time.          | <b>dcopy(1)</b>    |
| <b>CRT screen handling and</b>       | optimization package.         | <b>curses(3)</b>   |
|                                      | <b>curses:</b>                |                    |
| <b>ocurse:</b>                       | optimized screen functions.   | <b>ocurses(3)</b>  |
| <b>vector., getopt:</b> get          | option letter from argument   | <b>getopt(3)</b>   |
| <b>common/ ldohseek:</b> seek to the | optional file header of a     | <b>ldohseek(3)</b> |
| <b>fcntl:</b> file control           | options.                      | <b>fcntl(5)</b>    |
| <b>stty:</b> set the                 | options for a terminal.       | <b>stty(1)</b>     |
| <b>getopt:</b> parse command         | options.                      | <b>getopt(1)</b>   |
| <b>set parallel line printer</b>     | options. lpset:               | <b>lpset(1)</b>    |
| <b>object library. lorder:</b> find  | ordering relation for an      | <b>lorder(1)</b>   |

|   |   |                    |
|---|---|--------------------|
| a directory, or a special or            | ordinary file. <b>mknod</b> : make          | <b>mknod(2)</b>    |
| <b>dial</b> : establish an              | out-going terminal line/                    | <b>dial(3)</b>     |
| assembler and link editor               | output. <b>a.out</b> : common               | <b>a.out(4)</b>    |
| long lines for finite width             | output device. <b>fold</b> : fold           | <b>fold(1)</b>     |
| <b>/vsprintf</b> : print formatted      | output of a varargs                         | <b>vsprintf(3)</b> |
|   | argument/                                   |                    |
| <b>sprintf</b> : print formatted        | output. <b>printf</b> , <b>fprintf</b> ,    | <b>printf(3)</b>   |
| <b>chown</b> : change                   | owner and group of a file                   | <b>chown(2)</b>    |
| <b>chown</b> , <b>chgrp</b> : change    | owner or group.                             | <b>chown(1)</b>    |
| and expand files.                       | <b>pack</b> , <b>pcat</b> , <b>unpack</b> : | <b>pack(1)</b>     |
|   | compress                                    |                    |
| handling and optimization               | package. <b>curses</b> : CRT                | <b>curses(3)</b>   |
|   | screen                                      |                    |
| <b>view</b> / <b>mv</b> : a troff macro | package for typesetting                     | <b>mv(5)</b>       |
| <b>sadc</b> : system activity           | package. <b>sa1</b> , <b>sa2</b> ,          | <b>sa(1)</b>       |
| report                                  |   |                    |
| standard buffered                       | package. <b>stdio</b> :                     | <b>stdio(3)</b>    |
| input/output                            |   |                    |
| interprocess                            | package ( <b>ftok</b> ). <b>/standard</b>   | <b>stdipc(3)</b>   |
| communication                           |   |                    |
| <b>more</b> ,                           | <b>page</b> : text perusal.                 | <b>more(1)</b>     |
| <b>lpset</b> : set                      | parallel line printer                       | <b>lpset(1)</b>    |
|   | options.                                    |                    |
| <b>lp</b> :                             | parallel printer interface.                 | <b>lp(6)</b>       |
| <b>process</b> , <b>process group</b> , | parent process IDs. <b>/get</b>             | <b>getpid(2)</b>   |
| and                                     |   |                    |
| <b>getopt</b> :                         | parse command options.                      | <b>getopt(1)</b>   |
| <b>crup</b> : create file system        | partition ( <b>slice</b> ).                 | <b>crup(1)</b>     |

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|   |                                |                    |
|---|--------------------------------|--------------------|
|   | passwd: change login password. | <b>passwd(1)</b>   |
|   | passwd: password file.         | <b>passwd(4)</b>   |
| /endpwent, fgetpwent:<br>get                    | password file entry.           | <b>getpwent(3)</b> |
| putpwent: write                                 | password file entry,.          | <b>putpwent(3)</b> |
| passwd:   | password file.                 | <b>passwd(4)</b>   |
| getpass: read a                                 | password.                      | <b>getpass(3)</b>  |
| passwd: change login                            | password.                      | <b>passwd(1)</b>   |
| pwck, grpck:                                    | password/group file checkers.  | <b>pwck(1)</b>     |
| several files or subsequent/<br>for command.    | paste: merge same lines of     | <b>paste(1)</b>    |
| dirname: deliver portions of                    | path: locate executable file   | <b>path(1)</b>     |
| directory. getcwd: get                          | path names. basename,          | <b>basename(1)</b> |
| fgrep: search a file for a processing language. | path-name of current working   | <b>getcwd(3)</b>   |
| awk:  | pattern. grep, egrep,          | <b>grep(1)</b>     |
| signal.   | pattern scanning and           | <b>awk(1)</b>      |
| expand files. pack,                             | pause: suspend process until   | <b>pause(2)</b>    |
| a process. popen,                               | pcat, unpack: compress and     | <b>pack(1)</b>     |
| type. mc68k,                                    | pclose: initiate pipe to/from  | <b>popen(3)</b>    |
| large files and/ pilf, dio:                     | pdp11, u3b, vax: processor     | <b>machid(1)</b>   |
| msg:  | performance improvement in     | <b>pilf(5)</b>     |
| format. acct:                                   | permit or deny messages.       | <b>msg(1)</b>      |
| sys__nerr: system error/                        | per-process accounting file    | <b>acct(4)</b>     |
|   | perror, errno, sys__errlist,   | <b>perror(3)</b>   |

|                             |                               |                    |
|-----------------------------|-------------------------------|--------------------|
| terminals. pg: file         | perusal filter for soft-copy  | <b>pg(1)</b>       |
| more, page: text            | perusal.                      | <b>more(1)</b>     |
| soft-copy terminals.        | pg: file perusal filter for   | <b>pg(1)</b>       |
| split: split a file into    | pieces.                       | <b>split(1)</b>    |
| improvement in large files/ | pilf, dio: performance        | <b>pilf(5)</b>     |
| channel.                    | pipe: create an interprocess  | <b>pipe(2)</b>     |
| tee:                        | pipe fitting.                 | <b>tee(1)</b>      |
| popen, pclose: initiate     | pipe to/from a process.       | <b>popen(3)</b>    |
| text, or data in/           | plock: lock process:          | <b>plock(2)</b>    |
| interface.                  | kplot: graphics               | <b>plot(4)</b>     |
| subroutines.                | plot: graphics interface      | <b>plot(3)</b>     |
| ftell: reposition a file    | pointer in a stream. /rewind, | <b>fseek(3)</b>    |
| lseek: move read/write file | pointer.                      | <b>lseek(2)</b>    |
| to/from a process.          | popen, pclose: initiate pipe  | <b>popen(3)</b>    |
| and library maintainer for  | portable archives. /archive   | <b>ar(1)</b>       |
| basename, dirname: deliver  | portions of path names.       | <b>basename(1)</b> |
| banner: make                | posters.                      | <b>banner(1)</b>   |
| logarithm, exp, log, log10, | pow, sqrt: exponential,       | <b>exp(3)</b>      |
| exp, log, log10,            | pow, sqrt: exponential,/      | <b>exp(3)</b>      |
| /exponential, logarithm,    | power, square root/           | <b>exp(3)</b>      |
| monitor:                    | pr: print files.              | <b>pr(1)</b>       |
| cpp: the C language         | prepare execution profile.    | <b>monitor(3)</b>  |
| unset: undo a               | preprocessor.                 | <b>cpp(1)</b>      |
|                             | previous get of an SCCS file. | <b>unset(1)</b>    |

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|                              |                                   |                    |
|------------------------------|-----------------------------------|--------------------|
| profiler.                    | prf: operating system             | <b>prf(6)</b>      |
| prfld, prfstat,              | prfdc, prfsnap, prfpr:/           | <b>profiler(1)</b> |
| prfsnap, prfpr:/             | prfld, prfstat, prfdc,            | <b>profiler(1)</b> |
| /prfstat, prfdc, prfsnap,    | prfpr: operating system/          | <b>profiler(1)</b> |
| prfld, prfstat, prfdc,       | prfsnap, prfpr:/                  | <b>profiler(1)</b> |
| prfpr: operating/ prfld,     | prfstat, prfdc, prfsnap,          | <b>profiler(1)</b> |
| types:                       | primitive system data<br>types.   | <b>types(5)</b>    |
| window: window<br>management | primitives.                       | <b>window(6)</b>   |
| prs:                         | print an SCCS file.               | <b>prs(1)</b>      |
| date:                        | print and set the date.           | <b>date(1)</b>     |
| number. apnum:               | print Application Processor       | <b>apnum(1)</b>    |
| cal:                         | print calendar.                   | <b>cal(1)</b>      |
| of a file. sum:              | print checksum and block<br>count | <b>sum(1)</b>      |
| editing activity. sact:      | print current SCCS file           | <b>sact(1)</b>     |
| cat: concatenate and         | print files.                      | <b>cat(1)</b>      |
| pr:                          | print files.                      | <b>pr(1)</b>       |
| vprintf, vfprintf, vsprintf: | print formatted output of a/      | <b>vprintf(3)</b>  |
| printf, fprintf, sprintf:    | print formatted output.           | <b>printf(3)</b>   |
| lpstat:                      | print LP status<br>information.   | <b>lpstat(1)</b>   |
| object file. nm:             | print name list of common         | <b>nm(1)</b>       |
| uname:                       | print name of system.             | <b>uname(1)</b>    |
| news:                        | print news items.                 | <b>news(1)</b>     |
| object files. size:          | print section sizes of<br>common  | <b>size(1)</b>     |

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|                                    |                                  |                   |
|------------------------------------|----------------------------------|-------------------|
| names. id:                         | print user and group IDs and     | <b>id(1)</b>      |
| lp: parallel                       | printer interface.               | <b>lp(6)</b>      |
| requests to an LP line             | printer. /cancel:<br>send/cancel | <b>lp(1)</b>      |
| lpset: set parallel line           | printer options.                 | <b>lpset(1)</b>   |
| lpr: line                          | printer spooler.                 | <b>lpr(1)</b>     |
| disable: enable/disable<br>LP      | printers. enable,                | <b>enable(1)</b>  |
| print formatted output.            | printf, fprintf, sprintf:        | <b>printf(3)</b>  |
| nice: run a command at<br>low      | priority.                        | <b>nice(1)</b>    |
| nice: change                       | priority of a process.           | <b>nice(2)</b>    |
| process/ renice: alter             | priority of running              | <b>renice(1)</b>  |
| acct: enable or disable            | process accounting.              | <b>acct(2)</b>    |
| alarm: set a                       | process alarm clock.             | <b>alarm(2)</b>   |
| times. times: get                  | process and child process        | <b>times(2)-</b>  |
| /priority of running               | process by changing/             | <b>renice(1)</b>  |
| init, icode, telinit:              | process control/                 | <b>init(1)</b>    |
| timex: time a command;<br>report   | process data and system/         | <b>timex(1)</b>   |
| exit, __exit: terminate            | process.                         | <b>exit(2)</b>    |
| fork: create a new                 | process.                         | <b>fork(2)</b>    |
| /getpgrp, getppid: get<br>process, | process group, and<br>parent/    | <b>getpid(2)</b>  |
| setpgrp: set                       | process group ID.                | <b>setpgrp(2)</b> |
| process group, and<br>parent       | process IDs. /get process,       | <b>getpid(2)</b>  |
| inittab: script for the init       | process.                         | <b>inittab(4)</b> |
| kill: terminate a                  | process.                         | <b>kill(1)</b>    |

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|   |                               |              |
|---|-------------------------------|--------------|
| nice: change priority of a process.             | process.                      | nice(2)      |
| Application/ spawn: execute a                   | process on a specific         | spawn(1)     |
| spawnlp, spawnvp: execute a                     | process on a specific/        | spawn(3)     |
| kill: send a signal to a process or a group of/ | process. popen, pclose:       | kill(2)      |
| initiate pipe to/from a                         | process, process group, and/  | popen(3)     |
| getpid, getpgrp, getppid: get                   | process status.               | getpid(2)    |
| ps: report                                      | process, text, or data        | ps(1)        |
| in memory. plock: lock                          | process times.                | plock(2)     |
| times: get process and child                    | process to stop or terminate. | times(2)     |
| wait: wait for child                            | process until signal.         | wait(2)      |
| pause: suspend                                  | process.                      | pause(2)     |
| wait: await completion of                       | processed by fsck. checklist: | wait(1)      |
| list of file systems                            | processes. /send a signal     | checklist(4) |
| to a process or a group of                      | processes.                    | kill(2)      |
| killall: kill all active                        | processing language.          | killall(1)   |
| awk: pattern scanning and                       | processing.                   | awk(1)       |
| shutdown, halt: terminate all                   | processor.                    | shutdown(1)  |
| m4: macro                                       | Processor number.             | m4(1)        |
| apnum: print Application                        | Processor pseudoconsole. .    | apnum(1)     |
| console: control Application                    |                               | console(1)   |

|                               |                               |                    |
|-------------------------------|-------------------------------|--------------------|
| ICC statistics for            | processor. pstat:             | <b>pstat(1)</b>    |
| on a specific Applicaton      | Processor. /execute a process | <b>spawn(1)</b>    |
| on a specific Application     | Processor. /execute a process | <b>spawn(3)</b>    |
| activity/ fpsar: File         | Processor system              | <b>fpsar(1)</b>    |
| mc68k, pdp11, u3b, vax:       | processor type.               | <b>machid(1)</b>   |
|                               | prof: display profile data.   | <b>prof(1)</b>     |
| function.                     | prof: profile within a        | <b>prof(5)</b>     |
| profile.                      | profil: execution time        | <b>profil(2)</b>   |
| prof: display                 | profile data.                 | <b>prof(1)</b>     |
| monitor: prepare execution    | profil,e.                     | <b>monitor(3)</b>  |
| profil: execution time        | profile.                      | <b>profil(2)</b>   |
| environment at login time.    | profile: setting up an        | <b>profile(4)</b>  |
| prof:                         | profile within a function.    | <b>prof(5)</b>     |
| prf: operating system         | profiler.                     | <b>prf(6)</b>      |
| prfpr: operating system       | profiler. /prfsnap,           | <b>profiler(1)</b> |
| sadp: disk access             | profiler.                     | <b>sadp(1)</b>     |
| standard/restricted command   | programming language. /the    | <b>sh(1)</b>       |
| update:                       | provide disk synchronization. | <b>update(1)</b>   |
| /pdp11, u3b, u3b5, vax        | provide truth value/          | <b>machid(1)</b>   |
| true, false:                  | provide truth values.         | <b>true(1)</b>     |
|                               | prs: print an SCCS file.      | <b>prs(1)</b>      |
|                               | ps: report process staus.     | <b>ps(1)</b>       |
| control Application Processor | pseudoconsole. console:       | <b>console(1)</b>  |

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|                                 |                                 |                    |
|---------------------------------|---------------------------------|--------------------|
| /generate uniformly distributed | pseudo-random numbers.          | <b>drand48(3)</b>  |
| for processor.                  | pstat: ICC statistics           | <b>pstat(1)</b>    |
| download. tdl, gtdl,            | ptdl: RS-232 terminal           | <b>tdl(1)</b>      |
|                                 | ptrace; process trace.          | <b>ptrace(2)</b>   |
|                                 | ptx: permuted index.            | <b>ptx(1)</b>      |
| stream. ungetc:                 | push character back into input  | <b>ungetc(3)</b>   |
| put character or word on a/     | putc, putchar, fputc, putw:     | <b>putc(3)</b>     |
| character or word on a/ putc,   | putchar, fputc, putw: put       | <b>putc(3)</b>     |
| environment.                    | putenv: change or add value to  | <b>putenv(3)</b>   |
| entry.                          | putpwent: write password file   | <b>putpwent(3)</b> |
| stream.                         | puts, fputs: put a string on a  | <b>puts(3)</b>     |
| getutent, getutid, getutline,   | pututline, setutent, endutent,/ | <b>getut(3)</b>    |
| a/ putc, putchar, fputc,        | putw: put character or word on  | <b>putc(3)</b>     |
| file checkers.                  | pwck, grpck: password/group     | <b>pwck(1)</b>     |
|                                 | pwd: working directory name.    | <b>pwd(1)</b>      |
|                                 | qsort: quicker sort.            | <b>qsort(3)</b>    |
| BTOS queue.                     | quAdd: add a new entry to a     | <b>quadd(3)</b>    |
| tput:                           | query temrinfo database.        | <b>tput(1)</b>     |
| examine an ICC message          | queue. exWait, exCheck:         | <b>exwait(2)</b>   |
| msgget: get message             | queue.                          | <b>msgget(2)</b>   |
| add a new entry to a BTOS       | queue. quAdd:                   | <b>quadd(3)</b>    |

|                                  |                                    |             |
|----------------------------------|------------------------------------|-------------|
| quReadKeyed: examine<br>BTOS     | queue. quReadNext,                 | quread(3)   |
| quRemove: take back a<br>BTOS    | queue request.                     | quremove(3) |
| ipcrm: remove a message          | queue, semaphore set or<br>shared/ | ipcrm(1)    |
| qsort:                           | quicker sort.                      | qsort(3)    |
| command immune to<br>hangups and | quits. nohup: run a                | nohup(1)    |
| queue. quReadNext,               | quReadKeyed: examine<br>BTOS       | quread(3)   |
| examine BTOS queue.              | quReadNext, quReadKeyed:           | quread(3)   |
| queue request.                   | quRemove: take back a<br>BTOS      | quremove(3) |
| random-number<br>generator.      | rand, srand: simple                | rand(3)     |
| rand, srand: simple              | random-number generator.           | rand(3)     |
| fsplit: split fortran,           | ratfor, or efl files.              | fsplit(1)   |
| initialization/brc,<br>bcheckrc, | rc, allrc, conrc: system           | brc(1)      |
| getpass:                         | read a password.                   | getpass(3)  |
| entry of a common/<br>ldtbread:  | read an indexed symbol<br>table    | ldtbread(3) |
| header/ ldshread,<br>ldnshread:  | read an indexed/named<br>section   | ldshread(3) |
| read:                            | read from file.                    | read(2)     |
| rmail: send mail to users or     | read mail. mail,                   | mail(1)     |
| line:                            | read one line.                     | line(1)     |
|                                  | read: read from file.              | read(2)     |
| member of an/ ldahread:          | read the archive header of a       | ldahread(3) |
| common object file.<br>ldfhread: | read the file header of a          | ldfhread(3) |

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|                               |                                 |                                 |
|-------------------------------|---------------------------------|---------------------------------|
| open a common object file for | reading. ldopen, ldaopen:       | <b>ldopen(3)</b>                |
| open: open for                | reading or writing.             | <b>open(2)</b>                  |
| lseek: move                   | read/write file pointer.        | <b>lseek(2)</b>                 |
| allocator. malloc, free,      | realloc, calloc: main memory    | <b>malloc(3)</b>                |
| mallinfo: fast/ malloc, free, | realloc, calloc, mallopt,       | <b>malloc(3) (fast version)</b> |
| specify what to do upon       | receipt of a signal. signal:    | <b>signal(2)</b>                |
| lockf:                        | record locking on files.        | <b>lockf(3)</b>                 |
| manipulate connect accounting | records. fwtmp, wtmpfix:        | <b>fwtmp(1)</b>                 |
| tape. frec:                   | recover files from a backup     | <b>frec(1)</b>                  |
| ed,                           | red: text editor.               | <b>ed(1)</b>                    |
| it to BTOS. mkboot:           | reformat CENTIX kernel and copy | <b>mkboot(1)</b>                |
| execute regular expression.   | regcmp, regex: compile and      | <b>regcmp(3)</b>                |
| expression compile.           | regcmp: regular                 | <b>regcmp(1)</b>                |
| make: maintain, update, and   | regenerate groups of programs.  | <b>make(1)</b>                  |
| regular expression. regcmp,   | regex: compile and execute      | <b>regcmp(3)</b>                |
| compile and match routines.   | regexp: regular expression      | <b>regexp(5)</b>                |
| locking: exclusive access to  | regions of a file.              | <b>locking(2)</b>               |
| match routines. regexp:       | regular expression compile and  | <b>regexp(5)</b>                |
| regcmp:                       | regular expression compile.     | <b>regcmp(1)</b>                |
| regex: compile and execute    | regular expression. regcmp,     | <b>regcmp(3)</b>                |
| requests. accept,             | reject: allow/prevent LP        | <b>accept(1)</b>                |

|   |  |                                      |
|---|--|--------------------------------------|
| sorted files. comm:<br>select or                            | reject lines common two                                  | <b>comm(1)</b>                       |
| lorder: find ordering                                       | relation for an object/                                  | <b>lorder(1)</b>                     |
| join:   | relational database<br>operator.                         | <b>join(1)</b>                       |
| for a common object file.                                   | reloc: relocation<br>information                         | <b>reloc(4)</b>                      |
| ldrseek, ldnrseek: seek to<br>common object file.<br>reloc: | relocation entries of a/<br>relocation information for a | <b>ldrseek(3)</b><br><b>reloc(4)</b> |
| /fmod, fabs: floor,<br>ceiling,                             | remainder, absolute value/                               | <b>floor(3)</b>                      |
| calendar.   | reminder service.  | <b>calendar(1)</b>                   |
| ct: spawn getty to a<br>file. rmdel:                        | remote terminal.<br>remove a delta from an<br>SCCS       | <b>ct(1)</b><br><b>rmdel(1)</b>      |
| semaphore set or/ ipcrm:                                    | remove a message queue,                                  | <b>ipcrm(1)</b>                      |
| unlink:   | remove directory entry.                                  | <b>unlink(2)</b>                     |
| rm, rmdir:  | remove files or directories.                             | <b>rm(1)</b>                         |
| ofRename:   | rename a BTOS file.                                      | <b>ofrename(3)</b>                   |
| of running process by/<br>check and interactive             | renice: alter priority<br>repair. /system<br>consistency | <b>renice(1)</b><br><b>fsck(1)</b>   |
| uniq: report  | repeated lines in a file.                                | <b>uniq(1)</b>                       |
| clock:  | report CPU time used.                                    | <b>clock(3)</b>                      |
| communication/ ipcs:  | report inter-process                                     | <b>ipcs(1)</b>                       |
| blocks. df:   | report number of free disk                               | <b>df(1)</b>                         |
| sa2, sadc: system<br>activity                               | report package. sa1,                                     | <b>sar(1)</b>                        |
| timex: time a command;                                      | report process data and<br>system/                       | <b>timex(1)</b>                      |

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|                                   |                                   |              |
|-----------------------------------|-----------------------------------|--------------|
| ps:                               | report process status.            | ps(1)        |
| file. uniq:                       | report repeated lines in a        | uniq(1)      |
| system activity                   | reporter. /Processor              | fpsar(1)     |
| sar: system activity              | reporter.                         | sar(1)       |
| stream, fseek, rewind,<br>ftell:  | reposition a file pointer in a    | fseek(3)     |
| reponse. exCall: Send a           | request and wait for the          | excall(2)    |
| exServeRq: appropriate a          | request code.                     | exserverq(2) |
| take back a BTOS queue            | request. quRemove:                | quremove(3)  |
| /lpmove: start/stop the<br>LP     | request scheduler and<br>move/    | lpsched(1)   |
| reject: allow/prevent LP          | requests. accept,                 | accept(1)    |
| exCnxSendOnDeal                   | request. exSendOnDealloc,         | exfinal(2)   |
| loc: make final                   |                                   |              |
| LP request scheduler and<br>move  | requests. /start/stop the         | lpsched(1)   |
| service spawn execution           | requests. spawnsvr:               | spawnsvr(1)  |
| syslocal: special system          | requests.                         | syslocal(2)  |
| lp, cancel: send/cancel           | requests to an LP line/.          | lp(1)        |
| a request and wait for the        | response. exCall: Send            | excall(2)    |
| common object file/<br>ldgetname: | retrieve symbol name for          | ldgetname(3) |
| abs:                              | return integer absolute<br>value. | abs(3)       |
| logname:                          | return login name of user.        | logname(3)   |
| name. getenv:                     | return value for<br>environment   | getenv(3)    |

|   |   |   |
|---|---|---|
| stat: data  | returned by stat system call.   | <b>stat(5)</b>  |
| col: filter   | reverse line-feeds.   | <b>col(1)</b>   |
| file pointer in a/ fseek,<br>creat: create a new file or<br>directories.  | rewind, ftell: reposition a<br>rewrite an existing one.   | <b>fseek(3)</b><br><b>creat(2)</b>  |
| read mail. mail,<br>SCCS file.  | rm, rmdir: remove files or<br>rmail: send mail to users or<br>rmdel: remove a delta<br>from an  | <b>rm(1)</b><br><b>mail(1)</b><br><b>rmdel(1)</b>                                     |
| directories. rm,<br>chroot: change<br>chroot: change  | rmdir: remove files or<br>root directory.<br>root directory for a<br>command.   | <b>rm(1)</b><br><b>chroot(2)</b><br><b>chroot(1)</b>                                  |
| logarithm, power, square  | root functions.<br>/exponential,  | <b>exp(3)</b>   |
| common object file<br>access  | routines. ldfcn:  | <b>ldfcn(4)</b>   |
| expression compile and<br>match   | routines. regexp: regular   | <b>regexp(5)</b>  |
| controlling terminal's<br>local   | RS-232 channels. tp:  | <b>tp(6)</b>  |
| tdl:  | rs232 terminal download.  | <b>tdl(1)</b>   |
| standard/restricted/ sh,<br>nice:   | rsh: shell, the<br>run a command at low<br>priority.  | <b>sh(1)</b><br><b>nice(1)</b>  |
| hangups and quits.<br>nohup:  | run a command immune to   | <b>nohup(1)</b>   |
| /alter priority of<br>activity report package.<br>report package. sal,<br>editing activity.<br>package. sa1, sa2, | running process by/<br>sa1, sa2, sadc: system<br>sa2, sadc: system activity<br>sact: print current SCCS file<br>sadc: system activity<br>report | <b>renice(1)</b><br><b>sar(1)</b><br><b>sar(1)</b><br><b>sact(1)</b><br><b>sar(1)</b> |

|                               |                                |                    |
|-------------------------------|--------------------------------|--------------------|
|                               | sar: system activity reporter. | <b>sar(1)</b>      |
| profiler.                     | sadp: disk access              | <b>sadp(1)</b>     |
| graph.                        | sag: system activity           | <b>sag(1)</b>      |
| reporter.                     | sar: system activity           | <b>sar(1)</b>      |
| space allocation. brk,        | sbrk: change data segment      | <b>brk(2)</b>      |
| formatted input.              | scanf, fscanf, sscanf: convert | <b>scanf(3)</b>    |
| bfs: big file                 | scanner.                       | <b>bfs(1)</b>      |
| language. awk: pattern        | scanning and processing        | <b>awk(1)</b>      |
| the delta commentary of an    | SCCS delta. cdc: change        | <b>cdc(1)</b>      |
| comb: combine                 | SCCS deltas.                   | <b>comb(1)</b>     |
| make a delta (change) to an   | SCCS file. delta:              | <b>delta(1)</b>    |
| sact: print current           | SCCS file editing activity.    | <b>sact(1)</b>     |
| get: get a version of an      | SCCS file.                     | <b>get(1)</b>      |
| prs: print an                 | SCCS file.                     | <b>prs(1)</b>      |
| rmdel: remove a delta from an | SCCS file.                     | <b>rmdel(1)</b>    |
| compare two versions of an    | SCCS file. sccsdiff:           | <b>sccsdiff(1)</b> |
| sccsfile: format of           | SCCS file.                     | <b>sccsfile(4)</b> |
| undo a previous get of an     | SCCS file. unget:              | <b>unget(1)</b>    |
| val: validate                 | SCCS file.                     | <b>val(1)</b>      |
| admin: create and administer  | SCCS files.                    | <b>admin(1)</b>    |
| what: identify                | SCCS files.                    | <b>what(1)</b>     |
| of an SCCS file.              | sccsdiff: compare two versions | <b>sccsdiff(1)</b> |

|                                |                                |                    |
|--------------------------------|--------------------------------|--------------------|
|                                | scsfile: format of SCCS file.  | <b>scsfile(4)</b>  |
| /start/stop the LP request     | scheduler and move requests.   | <b>lpsched(1)</b>  |
| common object file.            | scnhdr: section header for a   | <b>scnhdr(4)</b>   |
| clear: clear terminal          | screen.                        | <b>clear(1)</b>    |
| ocurse: optimized              | screen functions.              | <b>ocurse(3)</b>   |
| optimization/ curses: CRT      | screen handling and            | <b>curses(3)</b>   |
| display editor based on/ vi:   | screen-oriented (visual)       | <b>vi(1)</b>       |
| inittab:                       | script for the init process.   | <b>inittab(4)</b>  |
| terminal session.              | script: make typescript of     | <b>script(1)</b>   |
| system initialization shell    | scripts. /rc, allrc, conrc:    | <b>brc(1)</b>      |
|                                | sdb: symbolic debugger.        | <b>sdb(1)</b>      |
| program.                       | sdiff: side-by-side difference | <b>sdiff(1)</b>    |
| grep, egrep, fgrep:            | search a file for a pattern    | <b>grep(1)</b>     |
| bsearch: binary                | search a sorted table.         | <b>bsearch(3)</b>  |
| lsearch, lfind: linear         | search and update.             | <b>lsearch(3)</b>  |
| hcreate, hdestroy: manage hash | search tables. hsearch,        | <b>hsearch(3)</b>  |
| tdelete, twalk: manage binary  | search trees. tsearch, tfind,  | <b>tsearch(3)</b>  |
| object file. scnhdr:           | section header for a common    | <b>scnhdr(4)</b>   |
| object/ /read an indexed/named | section header of a common     | <b>ldshread(3)</b> |
| /to line number entries of a   | section of a common object/    | <b>ldlseek(3)</b>  |
| /to relocation entries of a    | section of a common object/    | <b>ldrseek(3)</b>  |
| /seek to an indexed/named      | section of a common object/    | <b>ldsseek(3)</b>  |

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|                                |                                 |                     |
|--------------------------------|---------------------------------|---------------------|
| files. size: print             | section sizes of common object  | <b>size(1)</b>      |
|                                | sed: stream editor.             | <b>sed(1)</b>       |
| /mrand48, jrand48, srand48,    | seed48, lcong48: generate/      | <b>drand48(3)</b>   |
| section of/ ldsseek, ldnseek:  | seek to an indexed/named        | <b>ldsseek(3)</b>   |
| a section/ ldlseek, ldnlseek:  | seek to line number entries of  | <b>ldlseek(3)</b>   |
| a section/ ldrseek, ldnrseek:  | seek to relocation entries of   | <b>ldrseek(3)</b>   |
| header of a common/ ldohseek:  | seek to the optional file       | <b>ldohseek(3)</b>  |
| common object file. ldtbseek:  | seek to the symbol table of a   | <b>ldtbseek(3)</b>  |
| shmget: get shared memory      | segment.                        | <b>shmget(2)</b>    |
| brk, sbrk: change data         | segment space allocation.       | <b>brk(2)</b>       |
| to two sorted files. comm:     | select or reject lines common   | <b>comm(1)</b>      |
| of a file. cut: cut out        | selected fields of each line    | <b>cut(1)</b>       |
| file. dump: dump               | selected parts of an object     | <b>dump(1)</b>      |
| semctl:                        | semaphore control operations.   | <b>semctl(2)</b>    |
| semop:                         | semaphore operations.           | <b>semop(2)</b>     |
| ipcrm: remove a message queue, | semaphore set or shared memory/ | <b>ipcrm(1)</b>     |
| semget: get set of operations. | semaphores.                     | <b>semget(2)</b>    |
|                                | semctl: semaphore control       | <b>semctl(2)</b>    |
|                                | semget: get set of semaphores.  | <b>semget(2)</b>    |
|                                | semop: semaphore operations.    | <b>semop(2)</b>     |
| exRspnd:                       | send a message to a client. .   | <b>exrespond(2)</b> |

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|                                |                                 |                     |
|--------------------------------|---------------------------------|---------------------|
| exRequest:                     | Send a message to a server.     | <b>exrequest(2)</b> |
| the response. exCall:          | Send a request and wait for     | <b>excall(2)</b>    |
| a group of processes. kill:    | send a signal to a process or   | <b>kill(2)</b>      |
| mail. mail, rmail:             | send mail to users or read      | <b>mail(1)</b>      |
| line printer. lp, cancel:      | send/cancel requests to an LP   | <b>lp(1)</b>        |
| aliases file for               | sendmail. aliases:              | <b>aliases(5)</b>   |
| exRequest: Send a message to a | server.                         | <b>exrequest(2)</b> |
| make typescript of terminal    | session. script:                | <b>script(1)</b>    |
| buffering to a stream          | setbuf, setvbuf: assign         | <b>setbuf(3)</b>    |
| IDs. setuid,                   | setgid: set user and group      | <b>setuid(2)</b>    |
| getgrent, getgrgid, getgrnam,  | setgrent, endgrent, fgetgrent:/ | <b>getgrent(3)</b>  |
| goto.                          | setjmp, longjmp: non-local      | <b>setjmp(3)</b>    |
| encryption. crypt,             | setkey, encrypt: generate DES   | <b>crypt(3)</b>     |
|                                | setmnt: establish mount table.  | <b>setmnt(1)</b>    |
|                                | setpgrp: set process group ID.  | <b>setpgrp(2)</b>   |
| getpwent, getpwuid, getpwnam,  | getpwent, endpwent, fgetpwent:/ | <b>getpwent(3)</b>  |
| environment/ cprofile:         | setting up a C shell            | <b>cprofile(4)</b>  |
| login time. profile:           | setting up an environment at    | <b>profile(4)</b>   |
| gettydefs: speed and terminal  | setting used by getty.          | <b>gettydefs(4)</b> |
| group IDs.                     | setuid, setgid: set user and    | <b>setuid(2)</b>    |

|                                 |                                |                    |
|---------------------------------|--------------------------------|--------------------|
|                                 | setuname: set name of system.  | <b>setuname(1)</b> |
| /getutid, getutline, pututline, | setutent, endutent, utmpname:/ | <b>getut(3)</b>    |
| stream. setbuf,                 | setvbuf: assign buffering to a | <b>setbuf(3)</b>   |
| data in a/ sputl,               | sgetl: access long integer     | <b>sputl(3)</b>    |
| standard/restricted command/    | sh, rsh: shell, the            | <b>sh(1)</b>       |
| operations. shmctl:             | shared memory control          | <b>shmctl(2)</b>   |
| queue, semaphore set or         | shared memory id. /a message   | <b>ipcrm(1)</b>    |
| shmop:                          | shared memory operations.      | <b>shmop(2)</b>    |
| shmget: get                     | shared memory segment.         | <b>shmget(2)</b>   |
| system: issue a                 | shell command.                 | <b>system(3)</b>   |
| cprofile: setting up a C        | shell environment at/          | <b>cprofile(4)</b> |
| conrc: system initialization    | shell scripts. /rc, allrc,     | <b>brc(1)</b>      |
| command programming/ sh, rsh:   | shell, the standard/restricted | <b>sh(1)</b>       |
| operations.                     | shmctl: shared memory control  | <b>shmctl(2)</b>   |
| segment.                        | shmget: get shared memory      | <b>shmget(2)</b>   |
| operations.                     | shmop: shared memory           | <b>shmop(2)</b>    |
| processing.                     | shutdown, halt: terminate all  | <b>shutdown(1)</b> |
| program. sdiff:                 | side-by-side difference        | <b>sdiff(1)</b>    |
| login:                          | sign on.                       | <b>login(1)</b>    |
| pause: suspend process until    | signal.                        | <b>pause(2)</b>    |
| what to do upon receipt of a    | signal. signal: specify        | <b>signal(2)</b>   |
| upon receipt of a signal.       | signal: specify what to do     | <b>signal(2)</b>   |

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|--|---|--------------------------------------|
| of processes. kill: send a                   | signal to a process or a group                                | <b>kill(2)</b>                       |
| ssignal, gsignal: software                   | signals.  | <b>ssignal(3)</b>                    |
| lex: generate programs for                   | simple lexical tasks.   | <b>lex(1)</b>                        |
| generator. rand, srand:                      | simple random-number  | <b>rand(3)</b>                       |
| atan, atan2:<br>trigonometric/<br>functions. | sin, cos, tan, asin, acos,<br>sinh, cosh, tanh:<br>hyperbolic | <b>trig(3)</b><br><br><b>sinh(3)</b> |
| fsize: calculate file                        | size.   | <b>fsize(1)</b>                      |
| common object files                          | size: print section sizes of                                  | <b>size(1)</b>                       |
| size: print section                          | sizes of common object files.                                 | <b>size(1)</b>                       |
| an interval.                                 | sleep: suspend execution for                                  | <b>sleep(1)</b>                      |
| interval.                                    | sleep: suspend execution for                                  | <b>sleep(3)</b>                      |
| create file system partition                 | (slice). crup:  | <b>crup(1)</b>                       |
| the/ ttyslot: find the                       | slot in the utmp file of                                      | <b>mv(5)</b>                         |
| current/ ttyslot: find the                   | slot in the utmp file of the                                  | <b>ttyslot(3)</b>                    |
| base. modemcap:                              | smart modem capability data                                   | <b>modemcap(5)</b>                   |
| pg: file perusal filter for                  | soft-copy terminals.  | <b>pg(1)</b>                         |
| ssignal, gsignal:                            | software signals.   | <b>ssignal(3)</b>                    |
| sort:  | sort and/or merge files.                                      | <b>sort(1)</b>                       |
| qsort: quicker                               | sort.   | <b>qsort(3)</b>                      |
|  | sort: sort and/or merge files.                                | <b>sort(1)</b>                       |
| tsort: topological                           | sort.   | <b>tsort(1)</b>                      |

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|                                 |                                 |                     |
|---------------------------------|---------------------------------|---------------------|
| or reject lines common to two   | sorted files. comm: select      | <b>comm(1)</b>      |
| bsearch: binary search a        | sorted table.                   | <b>bsearch(3)</b>   |
| brk, sbrk: change data segment  | space allocation.               | <b>brk(2)</b>       |
| specific Application/           | spawn: execute a process on a   | <b>spawn(1)</b>     |
| spawnsvr: service terminal. ct: | spawn execution requests.       | <b>spawnsvr(1)</b>  |
| process on a specific/          | spawn getty to a remote         | <b>ct(1)</b>        |
| execution requests.             | spawnlp, spawnvp: execute a     | <b>spawn(3)</b>     |
| a specific/ spawnlp,            | spawnsvr: service spawn         | <b>spawnsvr(1)</b>  |
| spawn: execute a process on a   | spawnvp: execute a process on   | <b>spawn(3)</b>     |
| execute a process on a          | specific Application/           | <b>spawn(1)</b>     |
| fspec: format                   | specific Application/ /spawnvp: | <b>spawn(3)</b>     |
| receipt of a signal. signal:    | specification in text files.    | <b>fspec(4)</b>     |
| /set terminal type, modes,      | specify what to do upon         | <b>signal(2)</b>    |
| used by getty. gettydefs:       | speed, and line discipline.     | <b>getty(1)</b>     |
| hashcheck: find spelling/       | speed and terminal settings     | <b>gettydefs(4)</b> |
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| spellin, hashcheck: find        | spellin, hashcheck: find        | <b>spell(1)</b>     |
| split:                          | spelling errors. /hashmake,     | <b>spell(1)</b>     |
| csplit: context                 | split a file into pieces.       | <b>split(1)</b>     |
| efl files. fsplit:              | split.                          | <b>csplit(1)</b>    |
|                                 | split fortran, ratfor, or       | <b>fsplit(1)</b>    |

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| pieces.                           | split: split a file into          | <b>split(1)</b>   |
| uuclean: uucp                     | spool directory clean-up.         | <b>uclean(1)</b>  |
| lpr: line printer                 | spooler.                          | <b>lpr(1)</b>     |
| lpadmin: configure the LP         | spooling system.                  | <b>lpadmin(1)</b> |
| output, printf, fprintf,          | sprintf: print formatted          | <b>printf(3)</b>  |
| integer data in a/                | sputl, sgetl: access long         | <b>sputl(3)</b>   |
| power,/ exp, log, log10,<br>pow,  | sqrt: exponential,<br>logarithm,  | <b>exp(3)</b>     |
| exponential, logarithm,<br>power  | square root functions.<br>/sqrt:  | <b>exp(3)</b>     |
| generator, rand,                  | srand: simple<br>random-number    | <b>rand(3)</b>    |
| nrnd48, mrand48,<br>jrand48,      | srand48, seed48,<br>lcong48:/     | <b>drand48(3)</b> |
| input. scanf, fscanf,             | sscanf: convert formatted         | <b>scanf(3)</b>   |
| signals.                          | ssignal, gsignal: software        | <b>ssignal(3)</b> |
| package. stdio:                   | standard buffered<br>input/output | <b>stdio(3)</b>   |
| communication package/<br>stdipc: | standard interprocess             | <b>stdipc(3)</b>  |
| sh, rsh: shell, the               | standard/restricted<br>command/   | <b>sh(1)</b>      |
| lpsched, lpshut, lpmove:          | start/stop the LP request/        | <b>lpsched(1)</b> |
| system call.                      | stat: data returned by stat       | <b>stat(5)</b>    |
| stat: data returned by            | stat, fstat: get file status.     | <b>stat(2)</b>    |
| ff: list file names and           | stat system call.                 | <b>stat(5)</b>    |
| processor. pstat: ICC             | statistics for a file<br>system.  | <b>ff(1)</b>      |
| ustat: get file system            | statistics for                    | <b>pstat(1)</b>   |
|                                   | statistics.                       | <b>ustat(2)</b>   |

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| control. uustat: uucp                                   | status inquiry and job                                | uustat(1)   |
| communication facilities                                | status. /report<br>inter-process                      | ipcs(1)     |
| ofSetFileStatus: BTOS<br>File                           | Status. ofGetFileStatus.                              | ofstatus(3) |
| ps: report process                                      | status.   | ps(1)       |
| stat, fstat: get file                                   | status.   | stat(2)     |
| input/output package.                                   | stdio: standard buffered                              | stdio(3)    |
|   | stime: set time.                                      | stime(2)    |
| wait for child process to                               | stop or terminate. wait:                              | wait(2)     |
| strncmp, strcpy,<br>strncpy,/                           | strcat, strncat, strcmp,                              | string(3)   |
| /strcpy, strncpy, strlen,<br>strncpy,/ strcat, strncat, | strchr, strchr, strpbrk,/                             | string(3)   |
| /strncat, strcmp,<br>strncmp,                           | strcmp, strncmp, strcpy,<br>strcpy, strncpy, strlen,/ | string(3)   |
| /strchr, strpbrk, strspn,                               | strcpn, strtok: string/                               | string(3)   |
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| fflush: close or flush a                                | stream. fclose,                                       | fclose(3)   |
| fopen, freopen, fdopen:<br>open a                       | stream.   | fopen(3)    |
| reposition a file pointer<br>in a                       | stream. fseek, rewind,<br>ftell:                      | fseek(3)    |
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| puts, fputs: put a string<br>on a  | stream.  | <b>puts(3)</b>   |
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| number. atof: convert<br>ASCII   | string to floating-point   | <b>atof(3)</b>   |
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| strchr, strrchr, strpbrk,          | strspn, strcspn, strtok:/         | <b>string(3)</b>    |
| to double-precision<br>number.     | strtod, atof: convert string      | <b>strtod(3)</b>    |
| /strpbrk, strspn, strcspn,         | strtok: string operations.        | <b>string(3)</b>    |
| string to integer.                 | strtol, atol, atoi: convert       | <b>strtol(3)</b>    |
| terminal.                          | stty: set the options for a       | <b>stty(1)</b>      |
| another user.                      | su: become super-user or          | <b>su(1)</b>        |
| intro: introduction to             | subroutines and libraries.        | <b>intro(3)</b>     |
| plot: graphics interface           | subroutines.                      | <b>plot(3)</b>      |
| /same lines of several<br>files or | subsequent lines of one file.     | <b>paste(1)</b>     |
| count of a file.                   | sum: print checksum and<br>block  | <b>sum(1)</b>       |
| du:                                | summarize disk usage.             | <b>du(1)</b>        |
| sync: update the                   | super block.                      | <b>sync(1)</b>      |
| sync: update                       | super-block.                      | <b>sync(2)</b>      |
| su: become                         | super-user or another<br>user.    | <b>su(1)</b>        |
| interval. sleep:                   | suspend execution of an           | <b>sleep(1)</b>     |
| interval. sleep:                   | suspend execution for             | <b>sleep(3)</b>     |
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| information from/ strip: strip  | symbol and line number          | <b>strip(1)</b>     |
| file/ ldgetname: retrieve       | symbol name for common object   | <b>ldgetname(3)</b> |
| name for common object file     | symbol table entry. /symbol     | <b>ldgetname(3)</b> |
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| ldtbread: read an indexed       | symbol table entry of a common/ | <b>ldtbread(3)</b>  |
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| sdb:                            | symbolic debugger.              | <b>sdb(1)</b>       |
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|                                 | sync: update the super block. . | <b>sync(1)</b>      |
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| ldtbseek: seek to the symbol  | table of a common object file. | <b>ldtbseek(3)</b> |
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| hdestroy: manage hash search  | tables. hsearch, hcreate,      | <b>hsearch(3)</b>  |
| tabs: set                     | tabs on a terminal.            | <b>tabs(1)</b>     |
|                               | tabs: set tabs on a terminal.  | <b>tabs(1)</b>     |
| expand, unexpand: expand      | tabs to spaces, and vice/      | <b>expand(1)</b>   |
| a file.                       | tail: deliver the last part of | <b>tail(1)</b>     |
| request. quRemove:            | take back a BTOS queue         | <b>quremove(3)</b> |
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| sinh, cosh,                   | tanh: hyperbolic functions.    | <b>sinh(3)</b>     |
| tar:                          | tape file archiver.            | <b>tar(1)</b>      |
| recover files from a backup   | tape. frec:                    | <b>frec(1)</b>     |
| mt: interface for magnetic    | tape.                          | <b>mt(6)</b>       |
|                               | tar: tape file archiver.       | <b>tar(1)</b>      |
| programs for simple lexical   | tasks. lex: generate           | <b>lex(1)</b>      |
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|                               | tdl: rs232 terminal download.  | <b>tdl(1)</b>      |

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|                                   | tee: pipe fitting.                  | <b>tee(1)</b>      |
| initialization. init, icode,      | telinit: process control            | <b>init(1)</b>     |
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| terminals.                        | term: conventional names<br>for     | <b>term(5)</b>     |
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|                                   | term: format of compiled<br>term    | <b>term(4)</b>     |
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| ct: spawn getty to a<br>remote    | terminal.                           | <b>ct(1)</b>       |
| generate file name for            | terminal. ctermid:                  | <b>ctermid(3)</b>  |
| tdl: rs232                        | terminal download.                  | <b>tdl(1)</b>      |
| /terminal interface, and          | terminal environment.               | <b>tset(1)</b>     |
| /tgetstr, tgoto, tputs:           | terminal independent/               | <b>termcap(3)</b>  |
| terminal/ tset: set<br>terminal,  | terminal interface, and             | <b>tset(1)</b>     |
| termio: general                   | terminal interface.                 | <b>termio(6)</b>   |
| tty: controlling                  | terminal interface.                 | <b>tty(6)</b>      |
| dial: establish an<br>out-going   | terminal line connection.           | <b>dial(3)</b>     |

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| <b>script:</b> make typescript of   | terminal session.             | <b>script(1)</b>    |
| <b>getty.</b> gettydefs: speed and  | terminal settings used by     | <b>gettydefs(4)</b> |
| <b>stty:</b> set the options for a  | terminal.                     | <b>stty(1)</b>      |
| <b>tabs:</b> set tabs on a          | terminal.                     | <b>tabs(1)</b>      |
| and terminal/ tset: set             | terminal, terminal interface, | <b>tset(1)</b>      |
| <b>tty:</b> get the name of the     | terminal.                     | <b>tty(1)</b>       |
| <b>isatty:</b> find name of a       | terminal. ttyname,            | <b>ttyname(3)</b>   |
| and line/ getty: set                | terminal type, modes, speed,  | <b>getty(1)</b>     |
| <b>vt:</b> virtual                  | terminal.                     | <b>vt(6)</b>        |
| <b>channels.</b> tp: controlling    | terminal's local RS-232       | <b>tp(6)</b>        |
| perusal filter for soft-copy        | terminals. pg: file           | <b>pg(1)</b>        |
| <b>term:</b> conventional names for | terminals.                    | <b>term(5)</b>      |
| <b>wmlayout:</b> get                | terminal's window layout.     | <b>wmlayout(3)</b>  |
| <b>kill:</b>                        | terminate a process. _____    | <b>kill(1)</b>      |
| <b>shutdown,</b> halt:              | terminate all processing.     | <b>shutdown(1)</b>  |
| <b>exit,</b> _____exit:             | terminate process.            | <b>exit(2)</b>      |
| for child process to stop or        | terminate. wait: wait         | <b>wait(2)</b>      |
| <b>tic:</b>                         | terminfo compiler.            | <b>tic(1)</b>       |
| <b>tput:</b> query                  | terminfo database.            | <b>tput(1)</b>      |
| <b>tic;</b>                         | terminfo compiler.            | <b>terminfo(4)</b>  |
| <b>interface:</b>                   | termio: general terminal      | <b>termio(6)</b>    |
| <b>command.</b>                     | test: condition evaluation    | <b>test(1)</b>      |
| <b>ed,</b> red:                     | text editor.                  | <b>ed(1)</b>        |

|   |                                   |                    |
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| ex:   | text editor.                      | <b>ex(1)</b>       |
| ex for casual/ edit:                        | text editor (variant of           | <b>edit(1)</b>     |
| change the format of a                      | text file. newform:               | <b>newform(1)</b>  |
| fspec: format<br>specification in           | text files.                       | <b>fspec(4)</b>    |
| plock: lock process                         | text, or data in memory.          | <b>plock(2)</b>    |
| more, page:                                 | text persual.                     | <b>more(1)</b>     |
| strings: extract the<br>ASCII               | text strings in a file.           | <b>strings(1)</b>  |
| binary search types.<br>tsearch,            | tfind, tdelete, twalk:<br>manage  | <b>tsearch(3)</b>  |
| tgetstr, tgoto, tputs:/                     | tgetent, tgetnum, tgetflag,       | <b>termcap(3)</b>  |
| tputs:/ tgetent, tgetnum,                   | tgetflag, tgetstr, tgoto,         | <b>termcap(3)</b>  |
| tgoto, tputs:/ tgetent,                     | tgetnum, tgetflag, tgetstr,       | <b>termcap(3)</b>  |
| tgetent, tgetnum,<br>tgetflag,              | tgetstr, tgoto, tputs:/           | <b>termcap(3)</b>  |
| /tgetnum, tgetflag,<br>tgetstr,             | tgoto, tputs: terminal/           | <b>termcap(3)</b>  |
| data and system/ timex:                     | tic: terminfo compiler.           | <b>tic(1)</b>      |
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| profil: execution                           | time. /up a C shell               | <b>cprofile(4)</b> |
| up an environment at<br>login               | time. dcopy: copy file            | <b>dcopy(1)</b>    |
|   | time: get time.                   | <b>time(2)</b>     |
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|                         | time: time a command.        | <b>time(1)</b>    |
| time: get               | time.                        | <b>time(2)</b>    |
| tzset: convert date and | time to string. /asctime,    | <b>ctime(3)</b>   |
| clock: report CPU       | time used.                   | <b>clock(3)</b>   |
| process times.          | times: get process and child | <b>times(2)</b>   |
| update access and       | times of a file. touch:      | <b>touch(1)</b>   |
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| get process and child   | times. times:                | <b>times(2)</b>   |
| process                 |                              |                   |
| file access and         | times. utime: set            | <b>utime(2)</b>   |
| modification            |                              |                   |
| process data and        | timex: time a command;       | <b>timex(1)</b>   |
| system/                 | report                       |                   |
| file.                   | tmpfile: create a            | <b>tmpfile(3)</b> |
|                         | temporary                    |                   |
| for a temporary file.   | tmpnam, tmpnam: create       | <b>tmpnam(3)</b>  |
|                         | a name                       |                   |
| /tolower, __toupper,    | toascii: translate           | <b>conv(3)</b>    |
| __tolower,              | characters.                  |                   |
| popen, pclose: initiate | to/from a process.           | <b>popen(3)</b>   |
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| toupper, tolower,       | __tolower, toascii:          | <b>conv(3)</b>    |
| __toupper,              | translate/                   |                   |
| toascii: translate/     | tolower, __toupper,          | <b>conv(3)</b>    |
| toupper,                | __tolower,                   |                   |
| tsort:                  | topological sort.            | <b>tsort(1)</b>   |
| modification times of a | touch: update access and     | <b>touch(1)</b>   |
| file.                   |                              |                   |
| translate/ toupper,     | __toupper, __tolower,        | <b>conv(3)</b>    |
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| __tolower, toascii:     | toupper, tolower,            | <b>conv(3)</b>    |
| translate/              | __toupper,                   |                   |
| local RS-232 channels.  | tp: controlling terminal's   | <b>tp(6)</b>      |

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| /tgetflag, tgetstr, tgoto,      | tputs: terminal independent/   | <b>termcap(3)</b>   |
|                                 | tr: translate characters.      | <b>tr(1)</b>        |
| ptrace: process                 | trace.                         | <b>ptrace(2)</b>    |
| swapshort, swaplong:            | translate byte orders to/      | <b>swapshort(3)</b> |
| /__toupper, __tolower, toascii: | translate characters.          | <b>conv(3)</b>      |
| tr:                             | translate characters.          | <b>tr(1)</b>        |
| ftw: walk a file                | tree.                          | <b>ftw(3)</b>       |
| twalk: manage binary search     | trees: /tfind, tdelete,        | <b>tsearch(3)</b>   |
| tan, asin, acos, atan, atan2:   | trigonometric functions. /cos, | <b>trig(3)</b>      |
| typesetting view/ mv: a values. | troff macro package for        | <b>mv(5)</b>        |
| /u3b, u3b5, vax: provide        | true, false: provide truth     | <b>true(1)</b>      |
| true, false: provide            | truth value about your/        | <b>machid(1)</b>    |
| twalk: manage binary search/    | truth values.                  | <b>true(1)</b>      |
| interface, and terminal/        | tsearch, tfind, tdelete,       | <b>tsearch(3)</b>   |
|                                 | tset: set terminal, terminal   | <b>tset(1)</b>      |
| interface.                      | tsort: topological sort.       | <b>tsort(1)</b>     |
|                                 | tty: controlling terminal      | <b>tty(6)</b>       |
|                                 | tty: get the terminal's name.  | <b>tty(1)</b>       |
| a terminal.                     | ttyname, isatty: find name of  | <b>ttyname(3)</b>   |
| utmp file of the current/       | ttyslot: find the slot in the  | <b>ttyslot(3)</b>   |
| tsearch, tfind, tdelete,        | twalk: manage binary search/   | <b>tsearch(3)</b>   |

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|                                 |                                   |                   |
|---------------------------------|-----------------------------------|-------------------|
| file: determine file            | type.                             | <b>file(1)</b>    |
| pdp11, u3b, vax:<br>processor   | type. mc68k,                      | <b>machid(1)</b>  |
| getty: set terminal             | type, modes, speed, and<br>line/  | <b>getty(1)</b>   |
| ttytype: list of terminal       | types by terminal number.         | <b>ttytype(4)</b> |
| types.                          | types: primitive system<br>data   | <b>types(5)</b>   |
| types: primitive system<br>data | types.                            | <b>types(5)</b>   |
| session. script: make           | typescript of terminal            | <b>script(1)</b>  |
| /troff macro package for        | typesetting view graphs/          | <b>mv(5)</b>      |
| /localtime, gmtime,<br>asctime, | tzset: convert date and<br>time/  | <b>ctime(3)</b>   |
| truth/ mc68k, pdp11,            | u3b, u3b5, vax: provide           | <b>machid(1)</b>  |
| mc68k, pdp11, u3b,              | u3b5, vax: provide truth/         | <b>machid(1)</b>  |
| getpw: get name from            | UID.                              | <b>getpw(3)</b>   |
| limits.                         | ulimit: get and set user          | <b>ulimit(2)</b>  |
| creation mask.                  | umask: set and get file           | <b>umask(2)</b>   |
| mask.                           | umask: set file-creation<br>mode  | <b>umask(1)</b>   |
| file system. mount,             | umount: mount and<br>dismount     | <b>mount(1)</b>   |
|                                 | umount: unmount a file<br>system. | <b>umount(2)</b>  |
| CTIX system.                    | uname: get name of<br>current     | <b>uname(2)</b>   |
|                                 | uname: print name of<br>system.   | <b>uname(1)</b>   |
| an SCCS file.                   | unget: undo a previous<br>get of  | <b>unget(1)</b>   |

|   |                                   |                   |
|---|-----------------------------------|-------------------|
| spaces, and/ expand,                        | unexpand: expand tabs to          | <b>expand(1)</b>  |
| get of an SCCS file                         | unget: undo a previous            | <b>unget(1)</b>   |
| into input stream.                          | ungetc: push character<br>back    | <b>ungetc(3)</b>  |
| /seed48, lcong48:<br>generate               | uniformly distributed/            | <b>drand48(3)</b> |
| a file.                                     | uniq: report repeated lines<br>in | <b>uniq(1)</b>    |
| mktemp: make a                              | unique file name.                 | <b>mktemp(3)</b>  |
|   | units: conversion program.        | <b>units(1)</b>   |
| unlink system calls. link,<br>entry.        | unlink: exercise link and         | <b>link(1)</b>    |
| unlink: exercise link and                   | unlink: remove directory          | <b>unlink(2)</b>  |
| umount:                                     | unlink system calls. link,        | <b>link(1)</b>    |
| files. pack, pcat,                          | unmount a file system.            | <b>umount(2)</b>  |
|   | unpack: compress and<br>expand    | <b>pack(1)</b>    |
| times of a file. touch:                     | update access and<br>modification | <b>touch(1)</b>   |
| of programs. make:<br>maintain,             | update, and regenerate<br>groups  | <b>make(1)</b>    |
| lfind: linear search and<br>synchronization | update. lsearch,                  | <b>lsearch(3)</b> |
| sync:                                       | update: provide disk              | <b>update(1)</b>  |
| sync:                                       | update super-block.               | <b>sync(2)</b>    |
| du: summarize disk                          | update the super block.           | <b>sync(1)</b>    |
| id: print                                   | usage.                            | <b>du(1)</b>      |
|   | user and group IDs and<br>names.  | <b>id(1)</b>      |
| setuid, setgid: set                         | user and group IDs.               | <b>setuid(2)</b>  |
| crontab--                                   | user crontab file.                | <b>crontab(1)</b> |
| character login name of<br>the              | user. cuserid: get                | <b>cuserid(3)</b> |

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|                               |                                |                   |
|-------------------------------|--------------------------------|-------------------|
| /getgid, getegid: get real    | user, effective user, read/    | <b>getuid(2)</b>  |
| environ:                      | user environment.              | <b>environ(5)</b> |
| ulimit: get and set           | user limits.                   | <b>ulimit(2)</b>  |
| logname: return login name of | user.                          | <b>logname(3)</b> |
| /get real user, effective     | user, real group, and/         | <b>getuid(2)</b>  |
| become super-user or another  | user. su:                      | <b>su(1)</b>      |
| the utmp file of the current  | user. /find the slot in        | <b>ttyslot(3)</b> |
| write: write to another       | user.                          | <b>write(1)</b>   |
| of ex for casual              | users). /editor (variant       | <b>edit(1)</b>    |
| mail, rmail: send mail to     | users or read mail.            | <b>mail(1)</b>    |
| wall: write to all            | users.                         | <b>wall(1)</b>    |
| statistics.                   | ustat: get file system         | <b>ustat(2)</b>   |
| modification times.           | utime: set file access and     | <b>utime(2)</b>   |
| utmp, wtmp:                   | utmp and wtmp entry formats.   | <b>utmp(4)</b>    |
| endutent, utmpname: access    | utmp file entry. /setutent,    | <b>getut(3)</b>   |
| ttyslot: find the slot in the | utmp file of the current user. | <b>ttyslot(3)</b> |
| entry formats.                | utmp, wtmp: utmp and wtmp      | <b>utmp(4)</b>    |
| /putline, setutent, endutent, | utmpname: access utmp file/    | <b>getut(3)</b>   |
| clean-up.                     | uuclean: uucp spool directory  | <b>uuclean(1)</b> |
| uusub: monitor                | uucp network.                  | <b>uusub(1)</b>   |
| uuclean:                      | uucp spool directory clean-up. | <b>uuclean(1)</b> |

|                              |                                |                   |
|------------------------------|--------------------------------|-------------------|
| control. uustat:             | uucp status inquiry and job    | <b>uustat(1)</b>  |
| between computer systems.    | uucp, uulog, uuname: copy data | <b>uucp(1)</b>    |
| between computer/ uucp,      | uulog, uuname: copy data       | <b>uucp(1)</b>    |
| computer/ uucp, uulog,       | uuname: copy data between      | <b>uucp(1)</b>    |
| system-to-computer/ uuto,    | uupick: public computer        | <b>uuto(1)</b>    |
| and job control.             | uustat: uucp status inquiry    | <b>uustat(1)</b>  |
|                              | uusub: monitor uucp network.   | <b>uusub(1)</b>   |
| system-to-computer system/   | uuto, uupick: public computer  | <b>uuto(1)</b>    |
| execution.                   | uux: remote system command     | <b>uux(1)</b>     |
|                              | val: validate SCCS file.       | <b>val(1)</b>     |
| val:                         | validate SCCS file.            | <b>val(1)</b>     |
| u3b5, vax: provide truth     | value about your/ /u3b,        | <b>machid(1)</b>  |
| abs: return integer absolute | value.                         | <b>abs(3)</b>     |
| getenv: return               | value for environment name.    | <b>getenv(3)</b>  |
| ceiling, remainder, absolute | value functions. /fabs: floor, | <b>floor(3)</b>   |
| putenv: change or add        | value to environment.          | <b>putenv(3)</b>  |
| values.                      | values: machine-dependent      | <b>values(5)</b>  |
| true, false: provide truth   | values.                        | <b>true(1)</b>    |
| values: machine-dependent    | values.                        | <b>values(5)</b>  |
| /print formatted output of a | varargs argument list.         | <b>vprintf(3)</b> |
| argument list.               | varargs: handle variable       | <b>varargs(5)</b> |

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|   |                                   |                    |
|---|-----------------------------------|--------------------|
| varargs: handle                                     | variable argument list.           | <b>varargs(5)</b>  |
| edit: text editor                                   | (variant of ex for/               | <b>edit(1)</b>     |
| mc68k, pdp11, u3b,                                  | vax: processor type.              | <b>machid(1)</b>   |
|   | vc: version control.              | <b>vc(1)</b>       |
| option letter from<br>argument                      | vector. getopt: get               | <b>getopt(3)</b>   |
| assert:   | verify program assertion.         | <b>assert(3)</b>   |
| vc:   | version control.                  | <b>vc(1)</b>       |
| get: get a  | version of an SCCS file.          | <b>get(1)</b>      |
| sccsdiff: compare two                               | versions of an SCCS file.         | <b>sccsdiff(1)</b> |
| formatted output<br>of/vprintf,                     | vprintf, vsprintf: print          | <b>vprintf(3)</b>  |
| display editor based on ex.                         | vi: screen-oriented (visual)      | <b>vi(1)</b>       |
| /package for typesetting                            | view graphs and slides.           | <b>mv(5)</b>       |
| on ex. vi: screen-oriented                          | (visual) display editor<br>based  | <b>vi(1)</b>       |
| systems with label<br>checking.                     | volcopy, labelit: copy file       | <b>volcopy(1)</b>  |
| print formatted output of<br>a/                     | vprintf, vfprintf, vsprintf:      | <b>vprintf(3)</b>  |
| output of/ vprintf,<br>vfprintf,                    | vsprintf: print formatted         | <b>vprintf(3)</b>  |
| process.  | wait: await completion of         | <b>wait(1)</b>     |
| or terminate. wait:                                 | wait for child process to<br>stop | <b>wait(2)</b>     |
| exCall: Send a request and<br>to stop or terminate. | wait for the response.            | <b>excall(2)</b>   |
|   | wait: wait for child<br>process   | <b>wait(2)</b>     |
| ftw:  | walk a file tree.                 | <b>ftw(3)</b>      |
|   | wall: write to all users.         | <b>wall(1)</b>     |

|  |                                   |             |
|--|-----------------------------------|-------------|
|  | wc: word count.                   | wc(1)       |
|  | what: identify SCCS files.        | what(1)     |
| signal. signal: specify                              | waht to do upon receipt<br>of a   | signal(2)   |
| whodo:   | who is doing what.                | whodo(1)    |
| who:   | who is on the system.             | who(1)      |
|  | who: who is on the<br>system.     | who(1)      |
|  | whodo: who is doing<br>what.      | whodo(1)    |
| fold long lines for finite<br>and floppy disks. dsk: | width output device. fold:        | fold(1)     |
| wmgetid: get   | winchester, cartridge,            | dsk(6)      |
| wmlayout: get terminal's                             | window ID.                        | wmgetid(3)  |
| wmop:  | window layout.                    | wmlayout(3) |
|  | window management<br>operations.  | wmop(3)     |
| window:  | window management<br>primitives.  | window(6)   |
| wm:  | window management.                | wm(1)       |
| primitives:  | window: window<br>management      | window(6)   |
| a file descriptor with a                             | window. /wmsetids:<br>associate   | wmsetid(3)  |
|  | wm: window<br>management.         | wm(1)       |
|  | wmgetid: get window ID.           | wmgetid(3)  |
| window layout.                                       | wmlayout: get terminal's          | wmlayout(3) |
| operations.  | wmop: window<br>management        | wmop(3)     |
| file descriptor with a/                              | wmsetid, wmsetids:<br>associate a | wmsetid(3)  |
| descriptor with a/<br>wmsetid,                       | wmsetids: associate a file        | wmsetid(3)  |

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|                           |                               |                    |
|---------------------------|-------------------------------|--------------------|
| cd: change                | working directory.            | <b>cd(1)</b>       |
| chdir: change             | working directory.            | <b>chdir(2)</b>    |
| get path-name of current  | working directory. getcwd:    | <b>getcwd(3)</b>   |
| pwd:                      | working directory name.       | <b>pwd(1)</b>      |
| swrite: synchronous       | write on a file.              | <b>swrite(2)</b>   |
| write:                    | write on a file.              | <b>write(2)</b>    |
| putpwent:                 | write password file entry.    | <b>putpwent(3)</b> |
| wall:                     | write to all users.           | <b>wall(1)</b>     |
| write:                    | write to another user.        | <b>write(1)</b>    |
|                           | write: write on a file.       | <b>write(2)</b>    |
|                           | write: write to another user. | <b>write(1)</b>    |
| open: open for reading or | writing.                      | <b>open(2)</b>     |
| utmp, wtmp: utmp and      | wtmp entry formats.           | <b>utmp(4)</b>     |
| formats. utmp,            | wtmp: utmp and wtmp           | <b>utmp(4)</b>     |
|                           | entry                         |                    |
| accounting records.       | wtmpfix: manipulate           | <b>fwtmp(1)</b>    |
| fwtmp,                    | connect                       |                    |
| list(s) and execute       | xargs: construct argument     | <b>xargs(1)</b>    |
| command.                  |                               |                    |
| j0, j1, jn,               | y0, y1, yn: Bessel            | <b>bessel(3)</b>   |
|                           | functions.                    |                    |
| j0, j1, jn, y0,           | y1, yn: Bessel functions.     | <b>bessel(3)</b>   |
| compiler-compiler.        | yacc: yet another             | <b>yacc(1)</b>     |
| j0, j1, jn, y0, y1,       | yn: Bessel functions.         | <b>bessel(3)</b>   |

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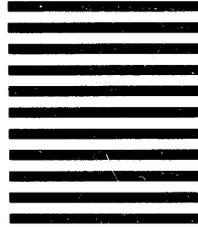
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