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Ultra C Library Reference

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Contents

1 Overview

Ultra C library calls perform a variety of functions, from classifying characters to managing memory. This section contains information helpful for using the Ultra C library. This information includes:

- Using Functions and Macros
- Library Files
- Program Globals
- Header Files
- The C Library
- C Shared Library

Using Functions and Macros

Ultra C supports both functions and macros. A function consists of compiled C statements. A macro is an identifier defined to represent a value or expression.

Textual replacement in macro expansion can cause arguments of macros to be evaluated repeatedly. Macro implementations of ANSI Standard Library functions are required to evaluate arguments exactly once and to have sufficient parentheses to avoid operator precedence trouble.

You can bypass the macro replacement when you compile. This may be desirable when a large macro is used many times and the space saved by calling the function is outweighed by the extra time needed to call the function. For example, to override the replacement/instantiation of the `putc` macro use:

```
(putc)(c, fp);
```

or

```
#undef putc
```

This results in a call to the `putc` function in the library rather than the replacement of the `putc` macro.

All American National Standards Institute (ANSI) macros have a library counterpart of the same name, with the exception of the following:

- `assert()`
- `setjmp()`
- `va_arg()`
- `va_end()`
- `va_start()`

This is not true for non-ANSI macros.

Library Files

The following are important files used during the compilation process. These files are located in the `MWOS` structure under `LIB` for the hardware platform. Ultra C libraries are listed in Table 1-1.

Table 1-1. Ultra C Libraries

Library	Contains
`clib.l`	The ANSI standard library
`cstart.r`	Start-up code for compiled programs (with `-bc` option K & R compatible source mode)
`acstart.r`	By default (same as `cstart.r` but compiled with ANSI defined)
`acstarta.r`	icode linked version of the above
`ansi_cstart.r`	Same as `acstart.r`, mainly for the 8.3 filenames on DOS

Table 1-1. Ultra C Libraries (Continued)

Library	Contains
`ansi_cstarta.r`	Same as `acstarta.r`
`cstarta.r`	With `-bc -j` option (icode linked version, backward compatibility - K&R mode)
`sacstart.r`	ANSI version of `syscstart.r`
`scstart.r`	Used to make system state processes
`scstarta.r`	Version of `scstart.r` used when `-j` option used
`sysansi_cstart.r`	Same as `sacstart.r`
`sysansi_cstarta.r`	Same as `sacstrta.r`
`syscstart.r`	Same as `scstart.r` (8.3 format)
`syscstarta.r`	same as `scstarta.r` (8.3 format)
`cpu.l`	CPU dependent functions
`mq.l`	POSIX messaging functions
`os_lib.l`	The system call functions
`sys_clib.l`	The non-ANSI C library functions
`termlib.l`	The termcap database screen manipulation functions
`sclib.l`	To minimize code size, smaller versions of some library functions are available in the libraries `sclib.l` and `sclib.il`.
`unix.l`	The UNIX-like library functions

The primary purpose of the `sys_clib.l` library is to provide a library for compatibility with the Microware K&R C compiler. For additional information, refer to *Appendix A, Prototyping sys_clib.l Functions*.

For information on `sclib.l`, small library functions, refer to Chapter 2 of *Using Ultra C/C++*.

Program Globals

Ultra C defines a number of globals for use by library functions and/or the application. They are divided into two classes:

1. Globals that are unlikely to change from release to release, and
2. Globals that are used by library functions that may change from release to release (see header file `cglob.h` for current information).

Class 1 Globals

`u_int32 _totmem`

Total number of bytes that are in the data area for the program (includes stack, global data, and parameters)

`u_int16 _pathcnt`

Number of open paths the process inherited from the parent process (usually three).

`void *_sysglob`
: Pointer to the kernel's system globals. This variable is only initialized when the program is a system state process (otherwise it is NULL). OS-9 for 68K only.

`mh_exec *_modhead`
: Pointer to the primary module for the current process

`char *_modname`
: Pointer to the module name for the current process (unmodifiable).

`u_int32 _procid`
: Process ID of the current process

`u_int32 _maxstack`
: Maximum number of bytes consumed from the stack so far. This variable does not contain a useful value unless stack checking is enabled. Print this variable prior to exiting to examine how much stack space your application required.

`void *_glob_data`
: Pointer to the current processes global static storage. `_glob_data` can be used as an argument to `_os_intercept()`.

`char **_environ`
: Pointer to the environment variable strings for the current process. This variable is used when forking other processes to pass the current environment along.

`char **environ`
: Same as `_environ`, except that it is available only in K & R source mode for OS-9 for 68K. `environ` is provided for compatibility with Microware K & R C-compiler.

Class 2 Globals

`void *_sttop`
: Address of the top of the stack.

`void *_mtop`
: Address of data memory. `_mtop` is used to check for stack overflow.

`void *_stbot`
: Deepest stack pointer so far.

`void *_csl_a6`
: Global static storage pointer for attached `csl`. OS-9 for 68K only.

`void *_csl_glob`
: Global static storage pointer for attached `csl`. OS-9 only.

`u_int32 _sbsize`
: Size of process memory area. `_sbsize` is used by `sbrk()`.

`FILE (*_fcbs)[ ]`
Pointer to `_niob` array.

`void *_ofcbs`
Pointer to compatibility `_iob` array.

`int32 _stklimit`
Amount of verified area left on stack. This value contains the number of bytes that can be consumed from the stack before further checking needs to be done.

`_mainid`
The process ID of the original process.

For non-threaded programs, `_mainid==procid`. For threaded programs, one thread is `_mainid==_procid` and all others contain different IDs.

Header Files

Most of the Ultra C library calls are declared in header files. A header file declares a set of related functions and includes any necessary types and additional macros needed to use the functions. The contents of these header files are available through the `#include` preprocessing directive. Header files may be included in any order.

Ultra C provides the following header files.

Table 1-2. Ultra C Header Files

File	Description

`alarm.h`	Used by functions that use OS-9 alarm functions. `alarm.h` contains prototypes for :
	`alm_atdate()alm_atjul()`
	`alm_cycle()alm_delete()`
	`alm_set()_os9_alarm_atdate()`
	`_os_alarm_atime()_os9_alarm_atjul()`
	`_os_alarm_cycle() _os_alarm_delete()`
	`_os_alarm_reset()_os_alarm_set()`
	`_os9_salarm_atdate() _os_salarm_atime()`
	`_os9_salarm_atjul()_os_salarm_cycle()`
	`_os9_salarm_cycle()_os_salarm_delete()`
	`_os_salarm_reset()_os_salarm_set()`
	`_os9_salarm_set()`

`assert.h` †	Defines the `assert` macro. `assert.h` contains prototypes for: `assert()`
`aton.h`	Used for converting alphabetic characters to numeric values. `aton.h` contains prototypes for the following function: `_aton()`

† Indicates a standard ANSI header.

Table 1-2. Ultra C Header Files (Continued)

File	Description

`cache.h`	Defines the CPU internal cache control information. `cache.h` contains prototypes for the following functions:
	`_os_cache()`
	`_os_scache()`

`cdi.h` (OS-9 for 68K only)	Contains CD-I specific functions. `cdi.h` contains prototypes for the following function: `_os9_gs_cdfd()`
`cglob.h`	Declares Ultra C global variables.

`ctype.h` †	Declares functions that are useful for testing and mapping characters. `ctype.h` contains prototypes for the following functions:
	`isalnum()isalpha()`
	`_isascii(), isascii()iscntrl()`
	`isdigit()_iseuc_kana()`
	`_iseuc1(), _iseuc2()isgraph()`
	`_isjis_kana()islower()`
	`isprint()ispunct()`
	`_issjis1()_issjis2()`
	`isspace()isupper()`
	`isxdigit()toascii(), _toascii()`
	`tolower()_tolower()`
	`toupper()_toupper()`

`dexec.h`	Defines information related to debugger controlled processes. `dexec.h` contains prototypes for the following functions:
	`_os_dexec()_os_dexit()`
	`_os_dfork()_os_dforkm()`
	`_os9_dfork()`

`dir.h`	Defines structures and functions for BSD 4.2 directory calls. `dir.h` contains prototypes for the following functions:
	`closedir()opendir()`
	`readdir()rewinddir()`
	`seekdir()telldir()`

`direct.h`	Defines the RBF data structures. This is obsolete; it has been replaced with `rbf.h`. *OS-9 for 68k only.*

`err.h`	Contains definitions for dealing with warnings and errors. This file contains prototypes for the following functions:
	`err(), errx()verr(), verrx()`
	`vwarn(), vwarnx()warn(), warnx()`

`errno.h` †	Defines macros relating to error reporting. `errno.h` contains a prototype for the following function: `_os_perr()`

† Indicates a standard ANSI header.

Table 1-2. Ultra C Header Files (Continued)

File	Description

`events.h`	Used for functions using the OS-9 event functions. `events.h` contains prototypes for the following functions:
	`_ev_creat()_ev_delete()`
	`_ev_info()_ev_link()`
	`_ev_pulse()_ev_read()`
	`_ev_set()_ev_setr()`
	`_ev_signal()_ev_unlink()`
	`_ev_wait()_ev_waitr()`
	`_os_ev_allclr()_os_ev_allset()`
	`_os_ev_anyclr()_os_ev_anyset()`
	`_os_ev_change()_os_ev_creat()`
	`_os_ev_delete()_os_ev_info()`
	`_os_ev_link()_os_ev_pulse()`
	`_os_ev_read()_os_ev_set()`
	`_os_ev_setand()_os_ev_setor()`
	`_os_ev_setr()_os_ev_setxor()`
	`_os_ev_signal()_os_ev_tstset()`
	`_os_ev_unlink()_os_ev_wait()`
	`_os9_ev_wait()_os_ev_waitr()`
	`_os9_ev_waitr()_os9_ev_info()`

`float.h` †	Defines the limits for floating point numbers.
`funcs.h`	Symbolic names for the system calls. `funcs.h` contains a prototype for the following function: `_os9_setsvc()`

`getset.h`	Used to read and set values of special purpose registers, device control registers, processor registers, and time-based registers. `getset.h` contains prototypes for the following functions:
	`_get_<name>()`
	`_set_<name>()`

`glob.h`	Contains definitions for generating file lists using regular expressions. This file contains prototypes for the following functions: `glob(), globfree()`

`io.h`	Used for functions performing input/output. `io.h` contains prototypes for the following functions:
	`_os_alias()_os_attach()`
	`_os_detach()_os_get_ioproc()`
	`_os_getdl()_os_getpd()`
	`_os_rdalst()_os_tranpn()`

† Indicates a standard ANSI header.

Table 1-2. Ultra C Header Files (Continued)

File	Description
ioctl.h	Contains definitions for ioctl() library function.
ioedt.h	Defines the current I/O interface editions. ioedt.h contains a prototype for the following function: _os_gs_edt()
limits.h †	Defines macros that expand to various limits and parameters.
locale.h †	Used for localization. locale.h contains prototypes for the following functions: localeconv() setlocale()
lock.h	Used for the OS-9 resource lock functions. lock.h contains prototypes for the following functions: _os_acqlk()_os_caqlk() _os_crlk()_os_dellk() _os_rellk()_os_waitlk()
math.h †	Defines the mathematical functions and macros available with Ultra C. math.h contains prototypes for the following functions: acos()asin() atan()atan2() ceil()cos() cosh()exp() fabs()floor() fmod()frexp() hypot()ldexp() log()log10() modf()pow() sin()sinh() sqrt()tan() tanh()
memory.h	Functions related to acquiring, examining, and releasing memory. memory.h contains prototypes for: _os9_allbit()_os9_delbit() _os_get_blkmap()_os_mem() _os_move()_os9_schbit() _os_srqmem()_os9_srqmem() _os_srtmem()_os9_translate() _srqmem()_srtmem() srqcmem()

† Indicates a standard ANSI header.

Table 1-2. Ultra C Header Files (Continued)

File	Description
moddir.h	Module directory information. moddir.h contains prototypes for the following functions: _os_altmdir()_os_chmdir() _os_cmdperm()_os_delmdir() _os_fmod()_os_get_mdp() _os_makmdir()
modes.h	Defines the access modes and permissions for files and directories. modes.h contains prototypes for: access()attach() chdir()chown() chmod()chxdir() close()creat() create()detach() dup()lseek() makdir()mknod() open()_os_chdir() _os_close()_os_create() _os9_create()_os_delete() _os_dup()_os_ioconfig() _os_makdir()_os_open() _os_read()_os_readln() _os_seek()_os9_ss_close() _os9_ss_open()_os_write() _os_writeln()read() readln()unlink() unlinkx()write() writeln()

† Indicates a standard ANSI header.

Table 1-2. Ultra C Header Files (Continued)

File	Description
module.h	Module-related data structures and functions. module.h contains prototypes for: crc()_get_module_dir() make_module()modcload() _mkdata_module()modlink() modload()modloadp() munlink()munload() _os_crc()_os_datmod() _os_get_moddir()_os_initdata() _os_iodel()_os_link() _os_linkm()_os_load() _os_loadp()_os_mkmodule() _os_modaddr()_os_setcrc() _os_slink()_os_slinkm() _os_tlinkm()_os_tlink() _os_unlink()_os_unload() _os_vmodul()_os9_vmodul() _prgname()_setcrc() _sliblink()_subcall()
mqueue.h	POSIX messaging data structures and functions. mqueue.h contains prototypes for: mq_close mq_getattr mq_notify_mq_notify_write mq_openmq_receive mq_sendmq_setattr mq_unlink

† Indicates a standard ANSI header.

Table 1-2. Ultra C Header Files (Continued)

File	Description

`os9def`	A series of macros mapping UNIX macros and function calls to their OS-9 versions.
	`alarm()alloca()`
	`bcmp()bcopy()`
	`buildpath()bzero()`
	`cbrt()crtolf()`
	`dup2()execl()`
	`execle()execv()`
	`execve()execvp()`
	`ffs()getgid()`
	`getopt()getppid()`
	`getcwd()getwd()`
	`ioctl()isatty()`
	`lftocr()pclose()`
	`pipe()popen()`
	`putenv()readv()`
	`setgid()tempnam()`
	`writev()`

`os9time.h`	Defines interval timer support for OS-9. (UNIX)
	`gettimeofday()`
	`setitimer()`

`os9types.h`	Synchronous I/O multiplexing. `os9types.h` contains a prototype for the following function: `select()`
`pmodes.h`	POSIX file access and permission modes for OS9000.

† Indicates a standard ANSI header.

Table 1-2. Ultra C Header Files (Continued)

File	Description

`process.h`	Process descriptor and functions that manipulate processes. `process.h` contains prototypes for:
	`chainc(), chain()_cpymem()`
	`getpid()_get_process_desc()`
	`_get_process_table()getuid()_os9_allpd()`
	`_os_alltsk()_os_alocproc()`
	`_os_aproc()_os9_aproc()`
	`_os_chain()_os_chainm()`
	`_os_chkmem()_os_cpy_ioproc()`
	`_os_cpymem()_os_ddlk()`
	`_os_deltsk()_os_exec()`
	`os9exec()_os_exit()`
	`_os_findpd()_os9_findpd()`
	`_os_fork()os9fork(), os9forkc()`
	`_os_forkm()_os_get_prtbl()`
	`_os_gprdsc()_os9_gspump()`
	`_os_id()_os9_id()`
	`_os_ioexit()_os_iofork()`
	`_os9_ioqueue()_os_nproc()`
	`_os9_panic()_os_permit()`
	`_os_protect()_os9_retpd()`
	`_os_rtnprc()_os_setpr()`
	`_os_setuid()_os_suspend()`
	`_os_sysdbg()_os_uacct()`
	`_os_wait()setpr()`
	`setuid()_sysdbg()`
	`wait() _os_waitid()`

`procid.h`	Process descriptor data structure. `procid.h` is obsolete; it has been replaced with `process.h`.

† Indicates a standard ANSI header.

Table 1-2. Ultra C Header Files (Continued)

File	Description
pthread.h	POSIX thread support routines. The following functions are included in pthread.h: pthread_attr_destroy() pthread_attr_getdetachstate() _pthread_attr_getinitfunction() _pthread_attr_getpriority() pthread_attr_getstackaddr() pthread_attr_setdetachstate() _pthread_attr_setinitfunction() _pthread_attr_setpriority() pthread_attr_setstackaddr() pthread_attr_setstacksize() pthread_cleanup_push() pthread_cond_broadcast() pthread_cond_signal() pthread_condattr_destroy() pthread_condattr_getpshared() pthread_condattr_init() pthread_condattr_setpshared() _pthread_interrupt() pthread_mutex_destroy() pthread_mutex_getprioceiling() pthread_attr_getstacksize() pthread_attr_init() pthread_cancel() pthread_cleanup_pop() pthread_cond_timedwait() pthread_cond_wait() _pthread_interrupt_clear() pthread_join()

† Indicates a standard ANSI header.

Table 1-2. Ultra C Header Files (Continued)

File	Description
`pthread.h` (continued)	`pthread_key_create()`
	`pthread_key_delete()`
	`pthread_create()`
	`pthread_detach()`
	`pthread_equal()`
	`pthread_exit()`
	`pthread_getspecific()`
	`_pthread_getstatus()`
	`pthread_cond_destroy()`
	`pthread_cond_init()`
	`pthread_mutex_init()`
	`pthread_mutex_lock()`
	`pthread_mutex_setprioceiling()`
	`pthread_mutex_trylock()`
	`pthread_mutex_unlock()`
	`pthread_mutexattr_destroy()`
	`pthread_mutexattr_getprioceiling()`
	`pthread_mutexattr_getprotocol()`
	`pthread_mutexattr_getpshared()`
	`pthread_mutexattr_init()`
	`pthread_mutexattr_setprioceiling()`
	`pthread_mutexattr_setprotocol()`
	`pthread_mutexattr_setpshared()`
	`pthread_once()`
	`_pthread_resume()`
	`pthread_self()`
	`pthread_setcancelstate()`
	`pthread_setcanceltype()`
	`_pthread_setpr()`
	`_pthread_setsignalrange()`
	`pthread_setspecific()`
	`_pthread_setsuspendable()`
	`_pthread_setunsuspendable()`
	`_pthread_suspend()`
	`pthread_testcancel()`

† Indicates a standard ANSI header.

Table 1-2. Ultra C Header Files (Continued)

File	Description

`pwd.h`	Contains the password file definitions.
	`endpwent()fgetpwent()`
	`getnextpwnam()getpw()`
	`getpwent()getpwnam()`
	`getpwuid()setpwent()`

`rbf.h`	Used for functions using the random block file manager (RBF). `rbf.h` contains prototypes for the following functions:
	`_gs_gfd()_os_gs_cstats()`
	`_os_gs_dsize()_os_gs_fd()`
	`_os_gs_fdaddr()_os_gs_fdinf()`
	`_os_gs_parity()_os_ss_cache()`
	`_os_ss_fd()_os_ss_flushmap()`
	`_os_ss_hdlink()_os_ss_lock()`
	`_os_ss_ticks()_os_ss_wtrack()`
	`_ss_lock()_ss_pfd()`
	`_ss_tiks()_ss_wtrk()`

`regexp.h`	Contains definitions for regular expression support.
	`regcomp()regerror()`
	`regex(), regexec()`

`regs.h`	Used to include the proper register header file for the target processor. `regs.h` contains prototypes for the following functions:
	`change_const()change_static()`
	`get_const()get_static()`
	`inc()inl()`
	`inw()irq_change()`
	`irq_disable()irq_enable()`
	`irq_maskget()irq_restore()`
	`irq_save()make_gdesc()`
	`_os_cache()`(OS-9 only)`_os_firq()_os_irq()`
	`_os9_irq()`(OS-9 for 68K only)`_os_scache()_os_sysid()` `outc()`
	`outl()outw()`

† Indicates a standard ANSI header.

Table 1-2. Ultra C Header Files (Continued)

File	Description

`sbf.h`	Used for functions using the sequential block file manager (SBF). `sbf.h` contains prototypes for the following functions:
	`_os_ss_erase()_os_ss_rfm()`
	`_os_ss_reten()_os_ss_skipend()`
	`_os_ss_skip()_os_ss_wfm()`

`scf.h`	Used for functions using the sequential character file manager (SCF). `scf.h` contains prototypes for the following functions:
	`_os_ss_dcoff()_os_ss_dcon()`
	`_os_ss_dopt()_os_ss_dsrts()`
	`_os_ss_enrts()_os_ss_fillbuff()`
	`_ss_dcoff()_ss_dcon()`
	`_ss_dsrts()_ss_enrts()`

`sched.h`	Used for the POSIX schedule family of functions. `sched.h` contains prototypes for the following function: `sched_yield()`

`semaphore.h`	Used for functions using binary semaphores. `semaphore.h` contains prototypes for the following functions:
	`_os_sema_init()_os_sema_p()`
	`_os_sema_term()_os_sema_v()`

`setjmp.h` †	Used for bypassing the normal function call and return mechanism. `setjmp.h` contains prototypes for the following functions:
	`longjmp()`
	`setjmp()`

`setsys.h`	System global symbolic names. This is obsolete. It has been replaced with `sysglob.h`.

`settrap.h`	Data structures and functions used to trap user-state exceptions. `settrap.h` contains prototypes for the following functions:
	`_os_strap()`
	`_os9_strap()`

† Indicates a standard ANSI header.

Table 1-2. Ultra C Header Files (Continued)

File	Description
sg_codes.h	Symbolic names for SetStats and GetStats. sg_codes.h contains prototypes for the following functions: getstat()_gs_devn() _gs_eof()_gs_opt() _gs_pos()_gs_rdy() _gs_size()_os_getstat() _os_gs_cpypd()_os_gs_devnm() _os_gs_devtyp()_os_gs_dopt() _os_gs_eof()_os9_gs_free() _os_gs_luopt()_os_gs_popt() _os_gs_pos()_os_gs_ready() _os_gs_size()_os_setstat() _os_sgetstat()_os_sgs_devnm() _os_ss_attr()_os_ss_break() _os_ss_dopt()_os_ss_link_adj() _os_ss_luopt()_os_ss_popt() _os_ss_relea()_os_ss_rename() _os_ss_reset()_os_ss_sendsig() _os_ss_size()setstat() _ss_attr()_ss_opt() _ss_rel()_ss_rest() _ss_size()_ss_ssig()
sgstat.h	Path descriptor option section definitions.
signal.h †	Used for handling various signals. signal.h contains prototypes for the following functions: intercept()kill() _os_clrsigs()_os_intercept() _os_rte()_os_send() _os_siglngj()_os_sigmask()\ _os_sigreset()_os_sigrs() _os_sleep()_os9_sleep() pause()raise() sigmask()signal() sleep()tsleep()

† Indicates a standard ANSI header.

Table 1-2. Ultra C Header Files (Continued)

File	Description

`stat.h`	Contains definitions for the following functions:
	`stat()`
	`fstat()`
	`lstat()`

`stdarg.h` †	Used for advancing through a list of arguments of variable length and type. `stdarg.h` contains the macros for:
	`va_arg()`
	`va_end()`
	`va_start()`

`stddef.h` †	Used for common definitions (`ptrdiff_t`, `size_t`, and `wchar_t`) and the following macro: `offsetof()`

† Indicates a standard ANSI header.

Table 1-2. Ultra C Header Files (Continued)

File	Description

`stdio.h` †	Used for performing input and output. `stdio.h` contains prototypes for the following functions:
	`_cleareof(), cleareof()clearerr()_errmsg()`
	`fclose()fdopen()`
	`feof()ferror()`
	`fflush()fgetc()`
	`fgetpos()fgets()`
	`_fileno(), fileno()fopen()`
	`fprintf()fputc()`
	fputs()`fread()`
	`freopen()fscanf()`
	`fseek()fsetpos()`
	`ftell()fwrite()`
	`getc(), getchar()gets()getw()`
	`mkstemp()mktemp()`
	`perror()prerr()`
	`printf()putc(), putchar()`
	`puts()putw()`
	`remove()rename()`
	`rewind()scanf()`
	`setbuf()setvbuf()`
	`snprintf()sprintf()`
	`sscanf()tmpfile()`
	`tmpnam()ungetc()`
	`vfprintf()vprintf()`
	`vsprintf()`

† Indicates a standard ANSI header.

Table 1-2. Ultra C Header Files (Continued)

File	Description

`stdlib.h` †	Used for the standard library functions. `stdlib.h` contains prototypes for the following functions:
	`abort()abs()`
	`atexit()atof()`
	`atoi()atol()`
	`_atou()bsearch()`
	`calloc()div()`
	`_dtoa()ebrk()`
	`exit()_exit()`
	`free()_freemem(), freemem()`
	`_freemin()ibrk()`
	`getenv()labs()`
	`_lcalloc()ldiv()`
	`_lfree()_lmalloc()`
	`_lrealloc()malloc()`
	`_mallocmin()mblen()`
	`mbstowcs()mbtowc()`
	`qsort()_prealloc_rand()`
	`rand()realloc()`
	`sbrk()srand()`
	`stacksiz(), _stacksiz()strtod()strtoll()`
	`strtoul()system()`
	`wcstombs()wctomb()`

† Indicates a standard ANSI header.

Table 1-2. Ultra C Header Files (Continued)

File	Description

`string.h` †	Used for manipulating arrays of character type. `string.h` contains prototypes for the following functions:
	`memchr()memcmp()`
	`memcpy()memmove()`
	`memset()strcasecmp(), strncasecmp()`
	`strcat()strchr()`
	`strcmp()strcoll()`
	`strcpy()strcspn()`
	`strerror() strlcat()`
	`strlcpystrlen()`
	`strncat()strncmp()`
	`strncpy()strdup()`
	`strpbrk()strrchr()`
	`strspn()strsep()`
	`strstr()strtok()`
	`strxfrm()`

`stringlist.h`	Contains definitions for manipulating lists of strings. This file contains prototypes for the following functions: `sl_add(), sl_find(), sl_free(), sl_init()`

`strings.h`	Used for non-ANSI string functions. `strings.h` contains prototypes for the following functions:
	`_cmpnam()findnstr()`
	`findstr()index()`
	`_os_cmpnam()_os_prsnam()`
	`pause()_prsnam()`
	`rindex()_strass()`
	`strhcpy()`

`svctbl.h`	Contains information for the service table. `svctbl.h` contains a prototypes for the following function: `_os_setsvc()`

`sysglob.h`	Defines the system global variables. `sysglob.h` contains prototypes for the following functions:
	`_getsys()_os_config()`
	`_os_getsys()_os_setsys()`
	`_setsys()`

`sys/time.h`	Contains the file time modification function `utimes()`.

† Indicates a standard ANSI header.

Table 1-2. Ultra C Header Files (Continued)

File	Description
sys/wait.h	Contains prototype for the following function: waitpid()
termcap.h	Used for the terminal capability functions. termcap.h contains prototypes for the following functions: tgetent()tgetflag() tgetnum()tgetstr() tgoto()tputs()
termio.h	Contains definition to support ioctl.
threads.h	Process thread support routines. threads.h contains prototypes for the following functions: _os_thexit() _os_thfork() _os_thread()
time.h †	Used for manipulating time. time.h contains prototypes for the following functions: asctime()clock() ctime()difftime() getime()gmtime() _gregorian()_julian() localtime()mktime() _os_getime()_os9_getime() _os_gregorian()_os_julian()_os_setime() _os9_setime()setime() strftime() strptime() _sysdate()sys_mktime() time()
times.h	Contains definitions to support times. times()
types.h	Defines typedefs for consistently sized and signed types.
util.h	Contains the definition of fparseln(), which is used to read logical lines from an input stream.
un.h	Contains the sockaddr_un structure definition.
virtual.h	Contains prototype for the following functions: _os_transadd()

† Indicates a standard ANSI header.

The C Library

This section includes a listing of the available C functions, grouped according to functionality. Each listing includes the function's name, description, and the header file in which it is defined.

Documented features and/or functionality classified as "undefined" by the relevant ANSI/ISO C specification are subject to change in future version of the Ultra C libraries. Be certain that the code you are using does not depend on the behavior of undefined situations, as documented by the ANSI/ISO specification.

Communicating with Environment Functions

The Ultra C libraries contain the functions listed in Table 1-3 for communicating with the environment.

Table 1-3. Environment Communications Functions

Function	ANSI Standard	Description	Header File
`abort()`	•	Abnormal program termination	`stdlib.h`
`atexit()`	•	Register function to call at normal program termination	`stdlib.h`
`_exit()`		Task termination	`stdlib.h`
`exit()`	•	Task termination	`stdlib.h`
`getenv()`	•	Get value for environment name	`stdlib.h`
`_os_exit()`		Terminate calling process	`process.h`
`system()`	•	Shell command execution	`stdlib.h`

Character Classification Functions

The character classification functions are macros defined in `<ctype.h>`. Be careful when using these macros to avoid macro expansion side-effects. The macros provide a platform independent method of character classification. Table 1-4 identifies character classification functions.

Table 1-4. Character Classification Functions

Function	ANSI Standard	Description	Header File
`isalnum()`	•	Test if parameter is alphanumeric	`ctype.h`
`isalpha()`	•	Test if parameter is alphabetic	`ctype.h`
`_isascii()`, `isascii()`		Test if parameter is ASCII	`ctype.h`
`iscntrl()`	•	Test if parameter is control code	`ctype.h`
`isdigit()`	•	Test if parameter is digit	`ctype.h`
`isgraph()`	•	Test if parameter is printing character	`ctype.h`
`_isjis_kana()`		Test if parameter is Hankaku-Kana	`ctype.h`
`islower()`	•	Test if parameter is lowercase	`ctype.h`

Table 1-4. Character Classification Functions (Continued)

Function	ANSI Standard	Description	Header File
`isprint()`	•	Test if parameter is printable character	`ctype.h`
`ispunct()`	•	Test if parameter is punctuation character	`ctype.h`
`_issjis1()`		Test if parameter is the first byte of Kanji	`ctype.h`
`_issjis2()`		Test if parameter is the second byte of Kanji	`ctype.h`
`isspace()`	•	Test if parameter is white space	`ctype.h`
`isupper()`	•	Test if parameter is uppercase	`ctype.h`
`isxdigit()`	•	Test if parameter is hexadecimal	`ctype.h`

Character Conversion Functions

The character conversion functions allow you to convert a string of characters to their numeric representation and to change the case of characters. Table 1-5 identifies character conversion functions.

Table 1-5. Character Conversion Functions

Function	ANSI Standard	Description	Header File
`atof()`	•	Alpha to floating conversion	`stdlib.h`
`atoi()`	•	Alpha to integer conversion	`stdlib.h`
`atol()`	•	Alpha to long conversion	`stdlib.h`
`_aton()`		Alpha to numeric translation	`aton.h`
`_atou()`		Alpha to unsigned conversion	`stdlib.h`
`_dtoa()`		Double to ASCII conversion	`stdlib.h`
`toascii()`, `_toascii()`		Integer to ASCII translation	`ctype.h`
`_tolower()`		Convert character to lowercase	`ctype.h`
`tolower()`	•	Convert character to lowercase	`ctype.h`
`_toupper()`		Convert character to uppercase	`ctype.h`
`toupper()`	•	Convert character to uppercase	`ctype.h`

File Positioning Functions

The functions in Table 1-6 are provided for file positioning.

Table 1-6. File Positioning Functions

Function	ANSI Standard	Description	Header File
`fgetpos()`	•	Get current position in file	`stdio.h`
`fseek()`	•	Reposition file pointer	`stdio.h`
`fsetpos()`	•	Reposition file pointer	`stdio.h`

Table 1-6. File Positioning Functions (Continued)

Function	ANSI Standard	Description	Header File
`ftell()`	•	Get current position in file	`stdio.h`
`_os_seek()`		Reposition file pointer	`modes.h`
`rewind()`	•	Return file pointer to zero	`stdio.h`

GetStat/SetStat Functions

The standard library provides the `GetStat` and `SetStat` functions for determining and setting individual device parameters that are not uniform on all devices or that are highly hardware dependent.

Table 1-7. GetStat/SetStat Functions

Function	Description	Header File
`getstat()`	Get file status	`sg_codes.h`
`_gs_devn()`	Get device name	`sg_codes.h`
`_gs_eof()`	Check for end of file	`sg_codes.h`
`_gs_gfd()`	Get file descriptor sector	`none`
`_gs_opt()`	Get path options	`sg_codes.h`
`_gs_pos()`	Get current file position	`sg_codes.h`
`_gs_rdy()`	Test for data available	`sg_codes.h`
`_gs_size()`	Get current file size	`sg_codes.h`
`_os_getstat()`	Get file/device status	`sg_codes.h`
`_os_getsys()`	Examine system global variable	`sysglob.h`
`_os9_gs_cdfd()`	Return file descriptor	`cdi.h`
`_os_gs_cpypd()`	Copy contents of path descriptor	`sg_codes.h`
`_os_gs_cstats()`	Get cache status information	`rbf.h`
`_os_gs_devnm()`	Return device name	`sg_codes.h`
`_os_gs_devtyp()`	Return device type	`sg_codes.h`
`_os_gs_dopt()`	Read device path options	`sg_codes.h`
`_os_gs_dsize()`	Get size of SCSI devices	`rbf.h`
`_os_gs_edt()`	Get I/O interface edition number	`ioedt.h`
`_os_gs_eof()`	Test for end of file	`sg_codes.h`
`_os_gs_fd()`	Read file descriptor sector	`rbf.h`
`_os_gs_fdaddr()`	Get file descriptor block address for open file	`rbf.h`
`_os_gs_fdinf()`	Get specified file descriptor sector	`rbf.h`
`_os9_gs_free()`	Return amount of free space on device	`sg_codes.h`
`_os_gs_luopt()`	Read logical unit options	`sg_codes.h`
`_os_gs_parity()`	Calculate parity of file descriptor	`rbf.h`
`_os_gs_popt()`	Read path descriptor option section	`sg_codes.h`
`_os_gs_pos()`	Get current file position	`sg_codes.h`
`_os_gs_ready()`	Test for data ready	`sg_codes.h`

Table 1-7. GetStat/SetStat Functions (Continued)

Function	Description	Header File
_os_gs_size()	Return current file size	sg_codes.h
_os_setstat()	Set file/device status	sg_codes.h
_os_setsvc()	Adds or replaces a system service	funcs.h
_os_setsys()	Set system global variables	sysglob.h
_os_sgetstat()	GetStat call using system path number	sg_codes.h
_os_sgs_devnm()	Return device name	sg_codes.h
_os_ss_attr()	Set file attributes	sg_codes.h
_os_ss_break()	Break serial connection	sg_codes.h
_os_ss_cache()	Enable/disable RBF caching	rbf.h
_os9_ss_close()	Notify driver that path has been closed	modes.h
_os_ss_dcoff()	Send signal when data carrier detect line goes false	scf.h
_os_ss_dcon()	Send signal when data carrier detect line goes true	scf.h
_os_ss_dopt()	Set device path options	sg_codes.h
_os_ss_dsrts()	Disable RTS line	scf.h
_os_ss_enrts()	Enable RTS line	scf.h
_os_ss_erase()	Erase tape	sbf.h
_os_ss_fd()	Write file descriptor sector	rbf.h
_os_ss_fillbuff()	Fill path buffer with data	scf.h
_os_ss_flushmap()	Flush cached bit map information for RBF device	rbf.h
_os_ss_hdlink()	Make hard link to existing file	rbf.h
_os_ss_lock()	Lock out record	rbf.h
_os_ss_luopt()	Write logical unit options	sg_codes.h
_os9_ss_open()	Notify driver that path has been opened	modes.h
_os_ss_popt()	Write option section of path descriptor	sg_codes.h
_os_ss_relea()	Release device	sg_codes.h
_os_ss_rename()	Rename file	sg_codes.h
_os_ss_reset()	Restore head to track zero	sg_codes.h
_os_ss_reten()	Retension pass on tape drive	sbf.h
_os_ss_rfm()	Skip tape marks	sbf.h
_os_ss_sendsig()	Send signal on data ready	sg_codes.h
_os_ss_size()	Set file size	sg_codes.h
_os_ss_skip()	Skip blocks	sbf.h
_os_ss_skipend()	Skip to end of tape	sbf.h
_os_ss_ticks()	Wait specified number of ticks for record release	rbf.h
_os_ss_wfm()	Write tape marks	sbf.h
_os_ss_wtrack()	Write (format) track	rbf.h
setstat()	Set file status	sg_codes.h

Table 1-7. GetStat/SetStat Functions (Continued)

Function	Description	Header File
`_ss_attr()`	Set file attributes	`sg_codes.h`
`_ss_dcoff()`	Send data carrier lost signal to process	`scf.h`
`_ss_dcon()`	Send data carrier present signal to process	`scf.h`
`_ss_dsrts()`	Disable RTS line	`scf.h`
`_ss_enrts()`	Enable RTS line	`scf.h`
`_ss_lock()`	Lock out record	`rbf.h`
`_ss_opt()`	Set path options	`sg_codes.h`
`_ss_pfd()`	Put file descriptor sector	`rbf.h`
`_ss_rel()`	Release device	`sg_codes.h`
`_ss_rest()`	Restore device	`sg_codes.h`
`_ss_size()`	Set current file size	`sg_codes.h`
`_ss_ssig()`	Send signal on data ready	`sg_codes.h`
`_ss_tiks()`	Wait for record release	`rbf.h`
`_ss_wtrk()`	Write track	`rbf.h`

Input/Output Device Functions

The following functions are available for performing input/output on devices.

Table 1-8. Input/Output Functions

Function	Description	Header File
`inc()`	Get character from I/O address	`regs.h`
`inl()`	Get integer from I/O address	`regs.h`
`inw()`	Get word from I/O address	`regs.h`
`outc()`	Write character to I/O address	`regs.h`
`outl()`	Write integer to I/O address	`regs.h`
`outw()`	Write word to I/O address	`regs.h`

Input/Output Functions

The following functions make up the I/O functions of the Ultra C libraries. ANSI prototypes for non-ANSI functions are achieved by defining the macro name `_OPT_PROTOS` during the compile.

Table 1-9. Ultra C I/O Functions

Function	ANSI Standard	Description	Header File
`access()`		Determine file accessibility	`modes.h`
`attach()`		Attach to device	`modes.h`
`chdir()`		Change current data directory	`modes.h`
`chmod()`		Change file access permissions	`modes.h`

Table 1-9. Ultra C I/O Functions (Continued)

Function	ANSI Standard	Description	Header File
`chown()`		Change owner of file	`modes.h`
`chxdir()`		Change current execution directory	`modes.h`
`_cleareof()`, `cleareof()`		Clear end of file condition	`stdio.h`
`clearerr()`	•	Clear error condition	`stdio.h`
`close()`		Close path	`modes.h`
`closedir()`		Close named directory stream	`dir.h`
`creat()`		Create file	`modes.h`
`create()`		Create file	`modes.h`
`detach()`		Detach device	`modes.h`
`dup()`		Duplicate path	`modes.h`
`fclose()`	•	Close file	`stdio.h`
`fdopen()`		Attach path to file pointer	`stdio.h`
`feof()`	•	Check buffered file for end of file	`stdio.h`
`ferror()`	•	Check buffered file for error condition	`stdio.h`
`fflush()`	•	Flush file's buffer	`stdio.h`
`fgetc()`	•	Get character from file	`stdio.h`
`fgets()`	•	Get string from file	`stdio.h`
`_fileno()`, `fileno()`		Determine path number from file	`stdio.h`
`fopen()`	•	Open file	`stdio.h`
`fprintf()`	•	Formatted output	`stdio.h`
`fputc()`	•	Output character to file	`stdio.h`
`fputs()`	•	Output string to file	`stdio.h`
`fread()`	•	Read data from file	`stdio.h`
`freopen()`	•	Re-open file	`stdio.h`
`fscanf()`	•	Input string conversion	`stdio.h`
`fwrite()`	•	Write data to file	`stdio.h`
`getc()`, `getchar()`	•	Get next character from file/standard input	`stdio.h`
`gets()`	•	Get string from file	`stdio.h`
`getw()`		Read word from file	`stdio.h`
`lseek()`		Position file pointer	`modes.h`
`makdir()`		Create directory	`modes.h`
`mknod()`		Create directory	`modes.h`
`mktemp()`		Create unique file name	`stdio.h`

Table 1-9. Ultra C I/O Functions (Continued)

Function	ANSI Standard	Description	Header File
open()		Open file	modes.h
opendir()		Open directory	dir.h
_os_alias()		Create device alias	io.h
_os_attach()		Attach new device to system	io.h
_os_chdir()		Change working directory	modes.h
_os_close()		Close path to file/device.	modes.h
_os_cpy_ioproc()		Get pointer to I/O process descriptor.	process.h
_os_create()		Create path to new file	modes.h
_os9_create()		Create path to new file	modes.h
_os_delete()		Delete file	modes.h
_os_detach()		Remove device from system	io.h
_os_dup()		Duplicate path	modes.h
_os_get_ioproc()		Get pointer to I/O process descriptor	io.h
_os_getdl()		Get system I/O device list head pointer	io.h
_os_ioconfig()		Configure an element of process/system I/O	modes.h
_os_iodel()		Check for use of I/O module	module.h
_os_ioexit()		Terminate I/O for exiting process	process.h
_os_iofork()		Set up I/O for new process	process.h
_os9_ioqueue()		Enter I/O queue	process.h
_os_makdir()		Make new directory	modes.h
_os_open()		Open path to file or device	modes.h
_os_rdalst()		Copy system alias list	io.h
_os_read()		Read data from file or device	modes.h
_os_readln()		Read text line with editing	modes.h
_os_tranpn()		Translate user path to system path	io.h
_os_write()		Write data to file or device	modes.h
_os_writeln()		Write line of text with editing	modes.h
pffinit()		Initialize for float output (obsolete)	none
pflinit())		Initialize for longs output (obsolete)	none
printf()	•	Formatted output	stdio.h
putc(), putchar()	•	Put next character to file/standard out	stdio.h

Table 1-9. Ultra C I/O Functions (Continued)

Function	ANSI Standard	Description	Header File
`puts()`	•	Output string to file	`stdio.h`
`putw()`		Output word to file	`stdio.h`
`read()`		Read bytes from path	`modes.h`
`readdir()`		Return pointer	`dir.h`
`readln()`		Read bytes from path	`modes.h`
`remove()`	•	Remove file	`stdio.h`
`rename()`	•	Rename file	`stdio.h`
`seekdir()`		Set position of next readdir	`dir.h`
`scanf()`	•	Input strings conversion	`stdio.h`
`setbuf()`	•	Fix file buffer	`stdio.h`
`setvbuf()`	•	Set up buffer for I/O stream	`stdio.h`
`snprintf()`		Write to character str	`stdio.h`
`sprintf()`	•	Formatted strings output	`stdio.h`
`sscanf()`	•	Input strings conversion	`stdio.h`
`telldir()`		Return current location	`dir.h`
`tmpfile()`	•	Create temporary binary file	`stdio.h`
`ungetc()`	•	Unget character	`stdio.h`
`unlink()`		Unlink (delete) file	`modes.h`
`unlinkx()`		Unlink (delete) file	`modes.h`
`vfprintf()`	•	Print to file	`stdio.h`
`vprintf()`	•	Print to standard output	`stdio.h`
`vsprintf()`	•	Print to string	`stdio.h`
`write()`		Write bytes to path	`modes.h`
`writeln()`		Write bytes to path	`modes.h`

Interprocess Communication Functions

Functions available for interprocess communication are shown in Table 1-10. ANSI prototypes for non-ANSI functions are achieved by defining the macro name `_OPT_PROTOS` during the compile.

Table 1-10. Interprocess Communication Functions

Function	ANSI Standard	Description	Header File
`alm_atdate()`		Send signal at Gregorian date/time	`alarm.h`
`alm_atjul()`		Send signal at Julian date/time	`alarm.h`
`alm_cycle()`		Send signal at specified time intervals	`alarm.h`
`alm_delete()`		Remove pending alarm request	`alarm.h`

Table 1-10. Interprocess Communication Functions (Continued)

Function	ANSI Standard	Description	Header File
alm_set()		Send signal after specified time interval	alarm.h
_ev_creat()		Create event	events.h
_ev_delete()		Delete event	events.h
_os9_ev_info()		Returns event information in the caller's buffer	events.h
_ev_info()		Get event information	events.h
_ev_link()		Link to existing event	events.h
_ev_pulse()		Signal event occurrence	events.h
_ev_read()		Read event without waiting	events.h
_ev_set()		Set event variable and signal event occurrence	events.h
_ev_setr()		Set relative event variable and signal event occurrence	events.h
_ev_signal()		Signal event occurrence	events.h
_ev_unlink()		Unlink event	events.h
_ev_wait()		Wait for event	events.h
_ev_waitr()		Wait for relative event	events.h
intercept()		Set up process signal handler	signal.h
_os9_alarm_atdate()		Send signal at Gregorian date/time	alarm.h
_os9_alarm_atjul()		Send signal at Julian date/time	alarm.h
_os_alarm_atime()		Send signal at specified time	alarm.h
_os_alarm_cycle()		Send signal at specified time intervals	alarm.h
_os_alarm_delete()		Remove pending alarm request	alarm.h
_os_alarm_reset()		Reset existing alarm request	alarm.h
_os_alarm_set()		Send signal after specified time interval	alarm.h
_os_clrsigs()		Clear process signal queue	signal.h
_os_ev_allclr()		Wait for all bits defined by mask to become clear	events.h
_os_ev_allset()		Wait for event to occur	events.h
_os_ev_anyclr()		Wait for event to occur	events.h
_os_ev_anyset()		Wait for event to occur	events.h
_os_ev_change()		Wait for event to occur	events.h
_os_ev_creat()		Create new event	events.h
_os_ev_delete()		Delete existing event	events.h
_os_ev_info()		Return event information	events.h
_os_ev_link()		Link to existing event by name	events.h

Table 1-10. Interprocess Communication Functions (Continued)

Function	ANSI Standard	Description	Header File
_os_ev_pulse()		Signal event occurrence	events.h
_os_ev_read()		Read event value without waiting	events.h
_os_ev_set()		Set event variable and signal event occurrence	events.h
_os_ev_setand()		Set event variable and signal event occurrence	events.h
_os_ev_setor()		Set event variable and signal event occurrence	events.h
_os_ev_setr()		Set relative event variable and signal event occurrence	events.h
_os_ev_setxor()		Set event variable and signal event occurrence	events.h
_os_ev_signal()		Signal event occurrence	events.h
_os_ev_tstset()		Wait for event to occur	events.h
_os_ev_unlink()		Unlink event	events.h
_os_ev_wait()		Wait for event to occur	events.h
_os9_ev_wait()		Wait for event to occur	events.h
_os_ev_waitr()		Wait for relative event to occur	events.h
_os9_ev_waitr()		Wait for relative event to occur	events.h
_os_intercept()		Set up signal intercept trap	signal.h
_os9_salarm_atdate()		Execute system-state subroutine at Gregorian date/time	alarm.h
_os_salarm_atime()		Execute system-state subroutine at specified time	alarm.h
_os9_salarm_atjul()		Execute system-state subroutine at Julian date/time	alarm.h
_os_salarm_cycle()		Set cyclic alarm clock	alarm.h
_os9_salarm_cycle()		Execute system-state subroutine every n ticks/seconds	alarm.h
_os_salarm_delete()		Remove pending alarm request	alarm.h
_os_salarm_reset()		Reset alarm clock	alarm.h
_os_salarm_set()		Set alarm clock	alarm.h
_os9_salarm_set()		Execute system-state subroutine after specified time interval	alarm.h
_os_sema_init()		Initialize semaphore data structure for use	semaphore.h
_os_sema_p()		Reserve semaphore (acquire exclusive access)	semaphore.h
_os_sema_term()		Terminate use of semaphore data structure	semaphore.h

Table 1-10. Interprocess Communication Functions (Continued)

Function	ANSI Standard	Description	Header File
`_os_sema_v()`		Release semaphore (release exclusive access)	`semaphore.h`
`_os_send()`		Send signal to another process	`signal.h`
`_os_siglngj()`		Set signal mast value and return on specified stack image	`signal.h` `types.h`
`_os_sigmask()`		Mask/unmask signals during critical code	`signal.h`
`_os_sigreset()`		Reset signal intercept context stack	`signal.h`
`_os_sigrs()`		Resize current process' signal queue block	`signal.h`
`pause()`		Wait for signal	`signal.h`
`raise()`	•	Send signal to program	`signal.h`
`sigmask()`		Control process' signal handling	`signal.h`
`signal()`	•	Specify signal handling	`signal.h`

Interrupt Manipulation Functions

The following functions are provided for interrupt manipulation. ANSI prototypes for non-ANSI functions are achieved by defining the macro name `_OPT_PROTOS` during the compile.

Table 1-11. Interrupt Manipulation Functions

Function	Description	Header File
`irq_change()`	Set IRQ level	`regs.h`
`irq_disable()`	Mask interrupts	`regs.h`
`irq_enable()`	Unmask interrupts	`regs.h`
`irq_maskget()`	Mask interrupts; return previous level	`regs.h`
`irq_restore()`	Restore interrupt level	`regs.h`
`irq_save()`	Return current interrupt level	`regs.h`
`_os_firq()`	Add or remove device from fast IRQ table	`regs.h`
`_os_irq()`	Add or remove device from IRQ table	`regs.h`
`_os9_irq()`	Add or remove device from IRQ table	`regs.h`
`_os_rte()`	Return from interrupt exception	`signal.h`

Mathematical Functions

The following are the available mathematical functions.

Table 1-12. Mathematical Functions

Function	ANSI Standard	Description	Header File
`abs()`	•	Integer absolute value	`stdlib.h`
`acos()`	•	Arc cosine function	`math.h`
`asin()`	•	Arc sine function	`math.h`
`atan()`	•	Arc tangent function	`math.h`
`atan2()`	•	Arc tangent function	`math.h`
`ceil()`	•	Ceiling function	`math.h`
`cos()`	•	Cosine function	`math.h`
`cosh()`	•	Hyperbolic cosine function	`math.h`
`div()`	•	Compute quotient and remainder	`stdlib.h`
`exp()`	•	Exponential function	`math.h`
`fabs()`	•	Floating absolute value	`math.h`
`floor()`	•	Floor function	`math.h`
`fmod()`	•	Compute floating point remainder	`math.h`
`frexp()`	•	Return portions of floating point number	`math.h`
`hypot()`		Euclidean distance function	`math.h`
`labs()`	•	Compute absolute value	`stdlib.h`
`ldexp()`	•	Multiply float by exponent of two	`math.h`
`ldiv()`	•	Compute quotient and remainder	`stdlib.h`
`log()`	•	Natural logarithm	`math.h`
`log10()`	•	Base-ten logarithm	`math.h`
`modf()`	•	Return parts of real number	`math.h`
`pow()`	•	Power function	`math.h`
`rand()`	•	Return random integer	`stdlib.h`
`sin()`	•	Sine function	`math.h`
`sinh()`	•	Hyperbolic sine function	`math.h`
`sqrt()`	•	Square root function	`math.h`
`srand()`	•	Set seed for random number generator	`stdlib.h`
`tan()`	•	Tangent function	`math.h`
`tanh()`	•	Hyperbolic tangent function	`math.h`

Memory Management Functions

The memory management functions are provided for requesting and freeing memory in a machine and operating system independent manner. ANSI prototypes for non-ANSI functions are achieved by defining the macro name `_OPT_PROTOS` during the compile.

Table 1-13. Memory Management Functions

Function	ANSI Standard	Description	Header File
`calloc()`	•	Allocate storage for array	`stdlib.h`
`_cpymem()`		Copy external memory	`process.h`
`ebrk()`		Get external memory	`stdlib.h`
`free()`	•	Return memory	`stdlib.h`
`_freemem()`, `freemem()`		Determine size of unused stack area	`stdlib.h`
`_freemin()`		Set memory reclamation bound	`stdlib.h`
`ibrk()`		Request internal memory	`stdlib.h`
`_lcalloc()`		Allocate storage for array (low-overhead)	`stdlib.h`
`_lfree()`		Return memory (low-overhead)	`stdlib.h`
`_lmalloc()`		Allocate memory from arena (low-overhead)	`stdlib.h`
`_lrealloc()`		Resize block of memory (low-overhead)	`stdlib.h`
`malloc()`	•	Allocate memory from arena	`stdlib.h`
`_mallocmin()`		Set minimum allocation size	`stdlib.h`
`memchr()`	•	Memory search	`string.h`
`memcmp()`	•	Compare memory	`string.h`
`memcpy()`	•	Copy memory	`string.h`
`memmove()`	•	Move memory	`string.h`
`memset()`	•	Fill memory	`string.h`
`_os_alltsk()`		Allocate task	`process.h`
`_os_chkmem()`		Check memory block's accessibility	`process.h`
`_os_cpymem()`		Copy external memory	`process.h`
`_os_deltsk()`		Deallocate process descriptor	`process.h`
`_os_get_blkmap()`		Get free memory block map	`memory.h`
`_os_mem()`		Resize data memory area	`memory.h`
`_os_move()`		Move data (low bound first)	`memory.h`
`_os_permit()`		Allow access to memory block	`process.h`
`_os_protect()`		Prevent access to memory block	`process.h`
`_os_srqmem()`		System memory request	`memory.h`
`_os9_srqmem()`		System memory request	`memory.h`
`_os_srtmem()`		Return system memory	`memory.h`
`_os_transadd()`		Translate memory address (OS-9)	`virtual.h`
`_os9_translate()`		Translate memory address (OS-9 for 68K)	`memory.h`

Table 1-13. Memory Management Functions (Continued)

Function	ANSI Standard	Description	Header File
realloc()	•	Resize block of memory	stdlib.h
sbrk()		Extend data memory segment	stdlib.h
srqcmem()		Allocate colored memory	memory.h
_srqmem()		System memory request	memory.h
_srtmem()		System memory return	memory.h
strdup()		Allocate memory for copy of str and return pointer	string.h

Shared Data Access Functions

The following two C library functions can be helpful for porting an existing subroutine module. They access two different kinds of data: shared global data and thread-specific data.

The shared global data is automatically shared among all modules that have the same value of `_pthread` (i.e. the application and the subroutine module). The thread-specific data is unique to each thread and is visible to all modules that have the same value of `_pthread`.

The functions described below must be used to access this data.

Table 1-14. Shared Data Access Functions

Function	Description
_pthread_local_slot()	Used when reading or writing thread-specific versions of "core" C run-time variables.
_pthread_global_slot()	Used when reading or writing global versions of "core" C run-time variables.

Miscellaneous Functions

Miscellaneous functions in Table 1-15 appear in the Ultra C libraries to relieve you from routine tasks. ANSI prototypes for non-ANSI functions are achieved by defining the macro name `_OPT_PROTOS` during the compile.

Table 1-15. Miscellaneous Functions

Function	ANSI Standard	Description	Header File
assert()	•	Place diagnostics in programs	assert.h
change_static()		Change current static storage pointer	regs.h
_cmpnam()		Compare two strings	strings.h
err(), errx()		Display error message	err.h
_errmsg()		Print error message	stdio.h
fparseln()		Return next logical line from a stream	util.h
getcwd()		Copy pathname of specific directory	os9defs.h

Table 1-15. Miscellaneous Functions (Continued)

Function	ANSI Standard	Description	Header File
`get_static()`		Return current static storage pointer	`regs.h`
`getuid()`		Determine user ID number	`process.h`
`glob()`, `globfree()`		Implement rules for file name pattern matching	`glob.h`
`localeconv()`	•	Numeric formatting convention inquiry	`locale.h`
`longjmp()`	•	Non-local goto	`setjmp.h`
`lstat()`		Obtain information about a file.	`stat.h`
`mkstemp()`		Override template to create file	`stdio.h`
`_os9_allbit()`		Set bits in bit map	`memory.h`
`_os_cache()`		Cache control	`cache.h`
`_os_config()`		Configure an element	`sysglob.h`
`_os_cmpnam()`		Compare two names	`strings.h`
`_os9_delbit()`		Deallocate in bit map	`memory.h`
`_os_dexec()`		Execute debugged program	`dexec.h`
`_os_dexit()`		Exit debugged program	`dexec.h`
`_os9_findpd()`		Find fixed block of memory	`process.h`
`_os_getpd()`		Find path descriptor	`io.h`
`_os9_panic()`		System catastrophic occurrence	`process.h`
`_os_perr()`		Print error message	`errno.h`
`_os_prsnam()`		Parse path name	`strings.h`
`_os9_retpd()`		Return fixed block of memory	`process.h`
`_os_scache()`		Cache control	`regs.h`
`_os9_schbit()`		Search bit map for free area	`memory.h`
`_os_setsvc()`		Service request table initialization	`svctbl.h`
`_os9_setsvc()`		Service request table initialization	`funcs.h`
`_os_setuid()`		Set user ID number	`process.h`
`_os_strap()`		Set error trap handler	`settrap.h`
`_os9_strap()`		Set error trap handler	`settrap.h`
`_os_sysid()`		Return system identification	`regs.h`
`_os_uacct()`		User accounting	`process.h`
`pause()`		Parse disk file (RBF) pathlist	`strings.h`
`perror()`	•	Map error number	`stdio.h`
`prerr()`		Print error message	`stdio.h`
`_prgname()`		Get module name	`module.h`
`_prsnam()`		Parse path name segment	`strings.h`
`setjmp()`	•	Non-local goto	`setjmp.h`
`setlocale()`	•	Locale control	`locale.h`
`setuid()`		Set user ID	`process.h`
`_stacksiz()`, `_stacksiz()`		Get size of stack used	`stdlib.h`

Table 1-15. Miscellaneous Functions (Continued)

Function	ANSI Standard	Description	Header File
_strass()		Structure assignment	strings.h
tmpnam()	•	Generate unique valid filename	stdio.h
va_arg()	•	Get parameter in variable parameter list	stdarg.h
va_end()	•	End references to current variable parameter list	stdarg.h
va_start()	•	Initialize variable parameter list	stdarg.h
verr(), verrx()		Display error message	err.h
vwarn(), vwarnx()		Display warning message	err.h
warn(), warnx()		Display warning message	err.h

Module Manipulation Functions

Table 1-16 shows the module manipulation functions. ANSI prototypes for non-ANSI functions are achieved by defining the macro name `_OPT_PROTOS` during the compile.

Table 1-16. Module Manipulation Functions

Function	ANSI Standard	Description	Header File
crc()		Calculate module CRC	module.h
_get_module_dir()		Get module directory entry	module.h
make_module()		Create module	module.h
_mkdata_module()		Create data memory module	module.h
modcload()		Load module into colored memory	module.h
modlink()		Link to memory module	module.h
modload()		Load and link to memory module	module.h
modloadp()		Load and link to memory module using PATH	module.h
munlink()		Unlink from module	module.h
munload()		Unload module	module.h
_os_altmdir()		Set alternate working module directory	moddir.h
_os_chainm()		Execute new primary module given pointer to module	process.h
_os_chmdir()		Change process' current module directory	moddir.h
_os_cmdperm()		Change permissions of module directory	moddir.h
_os_crc()		Generate CRC	module.h
_os_datmod()		Create data module	module.h

Table 1-16. Module Manipulation Functions (Continued)

Function	ANSI Standard	Description	Header File
`_os_delmdir()`		Delete existing module directory	`moddir.h`
`_os_fmod()`		Find module directory entry	`module.h`
`_os_get_mdp()`		Get current and alternate module directory pathlists	`moddir.h`
`_os_get_moddir()`		Get copy of module directory	`module.h`
`_os_initdata()`		Initialize static storage from module	`module.h`
`_os_link()`		Link to memory module	`module.h`
`_os_linkm()`		Link to memory module by module pointer	`module.h`
`_os_load()`		Load module(s) from file	`module.h`
`_os_loadp()`		Load and link to a memory module using PATH	`module.h`
`_os_makmdir()`		Create new module directory	`moddir.h`
`_os_mkmodule()`		Create module of specified color type	`module.h`
`_os_modaddr()`		Find module given pointer	`module.h`
`_os_setcrc()`		Generate valid CRC in module	`module.h`
`_os_slink()`		Install subroutine module	`module.h`
`_os_slinkm()`		Install user subroutine library module by module pointer	`module.h`
`_os_tlink()`		Install system state trap handling module	`module.h`
`_os_tlinkm()`		Install user trap handling module by module pointer	`module.h`
`_os_unlink()`		Unlink module by address	`module.h`
`_os_unload()`		Unlink module by name	`module.h`
`_os_vmodul()`		Verify module	`module.h`
`_os9_vmodul()`		Validate module	`module.h`
`_setcrc()`		Re-validate module CRC	`module.h`
`_subcall()`		Call subroutine module	`module.h`

Multibyte Character and String Functions

Five functions, identified in Table 1-17, are available for handling multibyte characters and strings.

Table 1-17. Multi-byte Character/String Functions

Function	ANSI Standard	Description	Header File
`mblen()`	•	Determine number of bytes in multibyte character	`stdlib.h`
`mbstowcs()`	•	Convert sequence of multibyte characters	`stdlib.h`
`mbtowc()`	•	Determine number of bytes in multibyte characters	`stdlib.h`
`wcstombs()`	•	Convert sequence of wide characters to multibyte characters	`stdlib.h`
`wctomb()`	•	Convert wide character to multibyte character	`stdlib.h`

OS System Functions

The standard library provides a large number of functions directly accessing system calls. Functions available to provide access to selected system calls are identified in Table 1-18. ANSI prototypes for non-ANSI functions are achieved by defining the macro name `_OPT_PROTOS` during the compile.

Table 1-18. OS System Functions

Function	Description	Header File
`_getsys()`	Get system global variables	`setsys.h`
`_os_sysdbg()`	Call system debugger	`process.h`
`_setsys()`	Set/examine system global variables	`setsys.h`
`_sysdbg()`	Call system debugger	`process.h`

POSIX Messaging Functions

The OS-9 implementation of the POSIX specification supports a message queue that is either visible between process or between threads. Currently, only the threaded message queue is supported. You distinguish which type you wish to create by the message queue name passed to `mq_open`. If the name starts with a '`/`', then a process wide message queue is assumed. Otherwise, a threaded message queue is created.

There is a thread and non-thread version of the POSIX message library. At this time, OS-9 does not support process-wide message queues. Therefore, the non-threaded version of the library is merely a placeholder until the process-wide message queues are implemented. The functions all return `ENOSYS`—the POSIX error code that means not implemented.

The supported POSIX messaging functions are listed in Table 1-19.

Table 1-19. POSIX Messaging Functions

Function	POSIX Standard	Description	Header File
`mq_close`	•	Close a Message Queue	`mqueue.h`
`mq_getattr`	•	Get Message Queue Attributes	`mqueue.h`
`mq_notify`	•	Notify Process That a Message is Available on a Queue	`mqueue.h`
`_mq_notify_write`		Notify Process of Space Availability in Message Queue	`mqueue.h`
`mq_open`	•	Open a Message Queue	`mqueue.h`
`mq_receive`	•	Receive a Message From a Message Queue	`mqueue.h`
`mq_send`	•	Send a Message to a Message Queue	`mqueue.h`
`mq_setattr`	•	Set Message Queue Attributes	`mqueue.h`
`mq_unlink`	•	Remove a Message Queue	`mqueue.h`

Process Manipulation Functions

The standard library provides functions for manipulating processes as identified in Table 1-20. ANSI prototypes for non-ANSI functions are achieved by defining the macro name _OPT_PROTOS during the compile.

Table 1-20. Process Manipulation Functions

Function	Description	Header File
chainc(), chain()	Load and execute new module	process.h
getpid()	Determine process ID number	process.h
_get_process_desc()	Get process descriptor copy	process.h
_get_process_table()	Get process table entry	process.h
kill()	Send signal to process	signal.h
_os9_allpd()	Allocate fixed-length block of memory	process.h
_os_alocproc()	Allocate process descriptor	process.h
_os_aproc()	Insert process in active process queue	process.h
_os9_aproc()	Enter process in active process queue	process.h
_os_chain()	Execute new primary module	process.h
_os_dfork()	Fork process under control of debugger	dexec.h
_os9_dfork()	Fork process under control of debugger	dexec.h
_os_dforkm()	Fork process under control of debugger	dexec.h
_os_exec()	Start child process	process.h
_os_findpd()	Find process descriptor	process.h
_os_fork()	Create new process	process.h
_os_forkm()	Create new process by module pointer	process.h
_os_get_prtbl()	Get copy of process descriptor block table	process.h
_os_getstat()	Get file/device status	sg_codes.h
_os_getsys()	Examine system global variable	sysglob.h
_os_gprdsc()	Get process descriptor copy	process.h
_os9_gspump()	Return data for specified process' memory map	process.h
_os_id()	Get process ID/user ID	process.h
_os9_id()	Get process ID/user ID	process.h
_os_nproc()	Start next process	process.h
_os_rtnprc()	Deallocate process descriptor	process.h
_os_setpr()	Set process priority	process.h
_os_sleep()	Put calling process to sleep	signal.h
_os9_sleep()	Put calling process to sleep	signal.h
_os_suspend()	Suspend process	process.h
_os_wait()	Wait for child process to terminate	process.h
os9exec()	OS-9 for 68K system call processing	process.h
os9fork(), os9forkc()	Create process	process.h
os9kexec()	OS-9 create process	types.h

Table 1-20. Process Manipulation Functions (Continued)

Function	Description	Header File
`setpr()`	Set process priority	`process.h`
`sleep()`	Suspend execution for specified time	`signal.h`
`tsleep()`	Sleep for specified interval	`signal.h`
`wait()`	Wait for process termination	`process.h`

Resource Locks

On OS-9 for 68K systems, the functions identified in Table 1-21 are available for use with resource locks. For more information about resource locks, refer to the *OS-9 for 68K Technical Manual.*

Table 1-21. Resource Lock Functions

Function	Description	Header File
`_os_acqlk()`	Acquire ownership of resource lock	`lock.h`
`_os_caqlk()`	Conditionally acquire ownership of resource lock	`lock.h`
`_os_crlk()`	Create new resource lock descriptor	`lock.h`
`_os_ddlk()`	Check for deadlock situation	`process.h`
`_os_dellk()`	Delete existing lock descriptor	`lock.h`
`_os_rellk()`	Release ownership of resource lock	`lock.h`
`_os_waitlk()`	Activate next process waiting to acquire lock	`lock.h`

Searching and Sorting Functions

Functions included for searching and sorting are identified in Table 1-22.

Table 1-22. Search and Sort Functions

Function	ANSI Standard	Description	Header File
`bsearch()`	•	Search array	`stdlib.h`
`qsort()`	•	Quick sort	`stdlib.h`

String Handling Functions

The C language does not have a character string data type. Instead, it stores strings as character arrays and the standard library provides functions to manipulate them. The functions are identified in Table 1-23. ANSI prototypes for non-ANSI functions are achieved by defining the macro name `_OPT_PROTOS` during the compile.

Table 1-23. String Handling Functions

Function	ANSI Standard	Description	Header File
`findnstr()`		Search string for pattern	`strings.h`
`findstr()`		Search string for pattern	`strings.h`
`index()`		Search for character in string	`strings.h`

Table 1-23. String Handling Functions (Continued)

Function	ANSI Standard	Description	Header File
rindex()		Search for character in string	strings.h
sl_add(), sl_find(), sl_free(), sl_init()		Manipulate string lists	stringlist.h
strcasecmp(), strncasecmp()		Compare null-terminated strings	strings.h
strcat()	•	String catenation	string.h
strchr()	•	Locate string	string.h
strcmp()	•	String comparison	string.h
strcoll()	•	String comparison	string.h
strcpy()	•	String copy	string.h
strcspn()	•	Get string length	string.h
strerror()	•	Map error message string	string.h
strftime()	•	Place formatted time in buffer	time.h
strhcpy()		Copy old OS-9 for 68K strings	strings.h
strlen()	•	Determine string length	string.h
strlcat()		Concatenate string src	strings.h
strlcpy		Copy string src	strings.h
strncat()	•	String catenation	string.h
strncmp()	•	String comparison	string.h
strncpy()	•	String copy	string.h
strpbrk()	•	Locate first occurrence of string	string.h
strptime()		Convert character string in tmf	time.h
strrchr()	•	Locate last occurrence of string	string.h
strsep()		Replace character in *stringp	strings.h
strspn()	•	Compute string length	string.h
strstr()	•	Locate first occurrence of string	string.h
strtod()	•	String to double conversion	stdlib.h
strtok()	•	Break string into tokens	string.h
strtoll()	•	String to long conversion	stdlib.h
strtoul()	•	String to unsigned long conversion	stdlib.h
strxfrm()	•	Transform string	string.h

Terminal Manipulation Functions (Termcap)

The following table lists the terminal manipulation functions.

Table 1-24. Termcap Functions

Function	Description	Header File
`tgetent()`	Get termcap entries	`termcap.h`
`tgetflag()`	Check terminal capability presence	`termcap.h`
`tgetnum()`	Get terminal capability ID	`termcap.h`
`tgetstr()`	Get terminal capability	`termcap.h`
`tgoto()`	Get cursor movement capability	`termcap.h`
`tputs()`	Output capability string	`termcap.h`

Time Functions

The `TZ` environment variable is used to specify the time zone for the C functions to use. `TZ` should have the following format:

```
zzz[+/-n][:ddd]
```

zzz is one of the supported time zone names listed in Table 1-25.

Table 1-25. Time Zones and Descriptions

Zone	Description
`GMT/UTC`	Greenwich Mean Time (or Coordinated Universal Time)
`PST/PDT`	USA Pacific Standard Time/Daylight Saving Time
`MST/MDT`	USA Mountain Standard Time/Daylight Saving Time
`CST/CDT`	USA Central Standard Time/Daylight Saving Time
`EST/EDT`	USA Eastern Standard Time/Daylight Saving Time
`YST`	Yukon Standard Time (Most of Alaska)
`AST`	Aleutian/Hawaiian Standard Time
`EET`	Eastern European Time
`CET`	Central European Time
`WET`	Western European Time
`JST`	Japan Standard Time
`MIT`	Midway Islands Time
`HST`	Hawaii Standard Time
`PNT`	Phoenix Standard Time
`IET`	Indiana Eastern Standard Time
`PRT`	Puerto Rico Standard Time
`CNT`	Canada Newfoundland Time
`AGT`	Argentina Standard Time
`BEZ`	Brazillian Standard Time
`CAT`	Central Africa
`ECT`	European Central Time
`ART`	Arabic Standard Time

Table 1-25. Time Zones and Descriptions (Continued)

Zone	Description
`EAT`	Eastern African Time
`MET`	Middle Eastern Time
`NET`	Near East Time
`PLT`	Pakistan Lahore Time
`IST`	India Standard Time
`BST`	Bangladesh Standard Time
`VST`	Vietnam Standard Time
`CTT`	China Taiwan Standard Time
`ACT`	Australia Central Time
`AET`	Australian Eastern Time
`SST`	Solomon Standard Time
`NST`	New Zealand Standard Time

`n` is the optional number of minutes east (+) or west (-) of the time zone.

`ddd` is the option controlling Daylight Saving Time.

Recognized codes for `ddd` are shown in Table 1-26.

Table 1-26. Valid ddd Codes

Value	Description
`no`	Do not use Daylight Saving Time (DST)
`usa`	Conforms to the US Uniform Time Act of 1967 and its various amendments through 1987 DST begins the first Sunday in April and ends the last Sunday in October.
`eur`	Observe European DST, which begins the last Sunday in March and ends the last Sunday in October.
`bra`	Observe Brazilian DST, which begins the first Sunday in October and ends the first Sunday after February 11.
`aus`	Observe Australian DST, which begins the last Sunday in October and ends the last Sunday in March.
`nz`	Observe New Zealand DST, which begins the first Sunday in October and ends the first Sunday after March 15.

For example, the following command specifies that the compiler should use the USA Eastern Daylight Saving Time and should conform to the US Uniform Time Act of 1967:

```
setenv TZ EDT:usa
```

Each time zone has it's own default Daylight Saving Time setting:

- American time zones default to `usa`.

Daylight Saving Time, for the U.S. and its territories, is NOT observed in Hawaii (`HST`), American Samoa, Guam, the Virgin Islands (`MIT`), Puerto Rico (`PRT`), the Eastern Time Zone portion of the State of Indiana (`IET`), and the state of Arizona (not the Navajo Indian Reservation, which does observe) (`PNT`). Navajo Nation participates in the Daylight Saving Time policy, due to its large size and location in three states.

- European time zones default to `eur`.
- Brazilian time zone defaults to `bra`.
- Australian time zones default to `aus`.
- New Zealand time zone defaults to `nz`.
- `GMT/UTC` time zones default to `no`.

If the `TZ` environment variable is not set and, if on OS-9, `m_tmzone` is not set, `time()` uses USA Central Standard Time (CST).

In addition, the time functions, with the exception of `clock()`, can be used in both system and user state. However, to use the functions in system state, you will need to `define_environ` must be defined as follows:

```
void * xenviron;
void **_environ = &xenviron
```

Ultra C provides time functions identified in Table 1-27. ANSI prototypes for non-ANSI functions are achieved by defining the macro name _OPT_PROTOS during the compile.

Table 1-27. Time Functions

Function	ANSI Standard	Description	Header File
`asctime()`	•	Convert broken-down time to string format	`time.h`
`clock()`	•	Get processor time	`time.h`
`ctime()`	•	Convert calendar time to string format	`time.h`
`difftime()`	•	Find temporal difference	`time.h`
`getime()`	•	Get system time	`time.h`
`gmtime()`	•	Convert calendar time to Greenwich Mean Time	`time.h`
`_gregorian()`		Convert date/time to Gregorian value	`time.h`
`_julian()`		Convert date/time to Julian value	`time.h`

Table 1-27. Time Functions (Continued)

Function	ANSI Standard	Description	Header File
`localtime()`	•	Convert calendar time to local time	`time.h`
`mktime()`	•	Convert broken-down time to calendar time	`time.h`
`_os_getime()`		Get system date and time	`time.h`
`_os9_getime()`		Get system date/time	`time.h`
`_os_gregorian()`		Get Gregorian date	`time.h`
`_os_julian()`		Get Julian date	`time.h`
`_os_setime()`		Set system date/time	`time.h`
`_os9_setime()`		Set system date/time	`time.h`
`setime()`		Set system time	`time.h`
`setitimer()`		Set a timer to specified value	`os9time.h`
`strftime()`	•	Place formatted time in buffer	`time.h`
`sys_mktime()`		Convert local time to Greenwich Mean Time	`time.h`
`_sysdate()`		Get current system date/time	`time.h`
`time()`	•	Get calendar time	`time.h`
`utimes()`		Get process times.	`sys/time.h`

Processor-Specific Functions

Functions available only on the 80x86 family of systems are identified in Table 1-28. ANSI prototypes for non-ANSI functions are achieved by defining the macro name `_OPT_PROTOS` during the compile.

Table 1-28. 80x86-Only Functions

Function	Description	Header File
`get_current_tss()`	Get current task segment	`regs.h`
`get_excpt_base()`	Return exception table base address	`regs.h`
`get_gdtr()`	Get global descriptor pointer	`regs.h`
`make_gdesc()`	Make global descriptor table entry	`regs.h`
`make_idesc()`	Make interrupt descriptor table entry	`regs.h`
`set_excpt_base()`	Set exception table base address	`regs.h`
`set_gdtr()`	Set global descriptor pointer	`regs.h`

These functions are available only on the PowerPC processors as identified in Table 1-29. ANSI prototypes for non-ANSI functions are achieved by defining the macro name `_OPT_PROTOS` during the compile.

Table 1-29. Power PC-Only Functions

Function	Description	Header File
`_get_<name>()`	Read the value of SPRs, DCRs, PREGs, and TBs	`getset.h`
`_set_<name>()`	Set the value of SPRs, DCRs, PREGs, and TBs	`getset.h`

Implementation-Defined Behavior

The following are the implementation-defined issues pertaining to the Ultra C library. Each item contains an implementation-defined issue. The number in parentheses included with each item indicates the location in the ANSI specification where you can find more information.

- The null pointer constant to which the macro NULL expands (4.1.5). NULL expands to `(void *) 0`.
- The diagnostic printed by and the termination behavior of `assert()` (4.2). `assert()` prints a line with the following syntax if the assertion fails (if the `NDEBUG` macro is not defined):

  ```
  Assertion failed:<expression>, file <file>, line <line>\n
  ```

`<expression>`	expression being tested
`<file>`	file name of the file containing the `assert`
`<line>`	line number of the file containing `assert`

  `abort()` is called after the assertion failure line is printed. This raises the `SIGABRT` signal that may be handled by the application.

  Refer to `signal()` for more information about `SIGABRT`.

- The sets of characters tested by `isalnum()`, `isalpha()`, `iscntrl()`, `islower()`, `isprint()`, and `isupper()` (4.3.1).

`isalnum()`	return non-zero for characters that `isdigit()` or `isalpha()` return non-zero.
`isalpha()`	return non-zero for characters that `islower()` or `isupper()` returns non-zero.
`iscntrl()`	return non-zero for ASCII characters with values from 0 to 0x1f and 0x7f.
`islower()`	return non-zero for ASCII characters with values from 0x61 to 0x7a.
`isprint()`	return non-zero for ASCII characters with values from 0x20 to 0x7e.
`isupper()`	return non-zero for ASCII characters with values from 0x41 to 0x5a.

- Values returned by mathematics functions on domain errors (4.5.1). The mathematics functions return HUGE_VAL on domain errors.
- If the mathematics functions set the integer expression errno to the value of the macro ERANGE on underflow range errors (4.5.1). errno is not set to ERANGE on underflow errors.
- Whether a domain error occurs or zero is returned when the fmod() function has a second argument of zero (4.5.6.4). fmod() returns zero if it has a second argument of zero.
- The set of signals for the signal() function (4.7.1.1). The set of signals for the signal function varies with the operating system and the processor. A set of signals is also available regardless of operating system.

ANSI “Core” Signals

SIGABRTSIGFPE	SIGILL
SIGINTSIGSEGV	SIGTERM

OS-9 “Core” Signals

SIGKILLSIGWAKESIGQUIT	
SIGHUPSIGALRM	SIGPIPE
SIGUSR1SIGUSR2	

OS-9 68K Family Signals

SIGADDRSIGCHK	SIGTRAPV
SIGPRIVSIGTRACE	SIG1010
SIG1111	

OS-9 80x86 Family Signals

SIGGPROTSIGSTACK	SIGSEGNP
SIGINVTSSSIGDBLFLT	SIGBNDCHK
SIGBRKPTSIGNMISIGDBG	

OS-9 PowerPC™ Family Signals

SIGCHKSIGINST

SIGPRIVSIGALIGN

The semantics for each signal recognized by signal() (4.7.1.1).

The following table lists family signals.

Table 1-30. Signals

Signal	Condition
`SIGABRT`	Abnormal termination such as initiated by the `abort()` function.
`SIGFPE`	An erroneous arithmetic operation such as zero divide or an operation resulting in overflow. This signal is generated on target-specific conditions.
`SIGILL`	Detection of an invalid function image such as illegal instruction. This signal is generated on target-specific conditions.
`SIGINT`	Receipt of an interactive attention signal generated by the keyboard interrupt character on OS-9 for 68K and OS-9.
`SIGSEGV`	An invalid access to storage. This signal is generated on target-specific conditions.
`SIGTERM`	A termination request sent to the program.
`SIGKILL`	A death request sent to the program. This signal cannot be ignored or handled.
`SIGWAKE`	A wakeup request sent to the program. If a process is active when this signal arrives, it is ignored. Otherwise, the process is activated, but the signal handling function is not called.
`SIGQUIT`	Receipt of an interactive abort signal generated by the keyboard quit character on OS-9.
`SIGHUP`	Modem hangup signal. This signal is sent to a process when a modem connection is lost.
`SIGALRM`	Not automatically sent. Programs can use this signal for an alarm call.
`SIGPIPE`	Not automatically sent.
`SIGUSR1`	Condition is user defined.
`SIGUSR2`	Condition is user defined.

Processor-Specific Family Signals

For information related to the exceptions, see the reference manual for your specific processor.

68K Family Processors

The OS-9 68K family signals sent when their associated exception occurs are identified in Table 1-31.

Table 1-31. OS-9 for 68K Signals

Signal	Exception
`SIGADDR`	Address Error
`SIGCHK`	CHK Instruction
`SIGTRAPV`	TRAPV Instruction
`SIGPRIV`	Privilege Violation
`SIGTRACE`	Trace

Table 1-31. OS-9 for 68K Signals (Continued)

Signal	Exception
SIG1010	Line 1010 Emulation
SIG1111	Line 1111 Emulation

80x86 Family Processors

The OS-9 80x86 family signals shown in Table 1-32 are sent when their associated exception occurs.

Table 1-32. OS-9 80x86 Family Exception Signals

Signal	Exception
SIGGPROT	General Protection
SIGSTACK	Stack Exception
SIGSEGNP	Segment Not Present
SIGINVTSS	Invalid TSS
SIGDBLFLT	Double Fault
SIGBNDCHK	Bounds Check
SIGBRKPT	Breakpoint
SIGNMI	Non-Maskable Interrupt
SIGDBG	Debug Exceptions

PowerPC Family Processors

The OS-9 PowerPC family signals shown in Table 1-33 are sent when their associated exception occurs.

Table 1-33. OS-9 PowerPC Family Exception Signals

Signal	Exception
SIGCHECK	Machine Check
SIGINST	Instruction Access
SIGPRIV	Privilege Violation
SIGALIGN	Alignment

ARM Family Processors

The OS-9 ARM family signal shown in Table 1-34 is sent when its associated exception occurs.

Table 1-34. OS-9 ARM Family Exception Signals

Signal	Exception
SIGALIGN	Alignment

SH Family Processors

The OS-9 SH3 family signal shown in Table 1-35 is sent when the associated exception occurs.

Table 1-35. OS-9 SH3 Family Exception Signals

Signal	Exception
`SIGALIGN`	Alignment

SPARC Family Processors

The OS-9 SPARC family signals shown in Table 1-36 are sent when their associated exception occurs.

Table 1-36. OS-9 SPARC Family Exception Signals

Signal	Exception
`SIGALIGN`	Alignment
`SIGWINDOWOV`	Window Overflow
`SIGWINDOWUV`	Window Underflow
`SIGATAGOV`	Tag Overflow
`SIGCPE`	Coprocessor Exception

- The default handling and the handling at program startup for each signal recognized by the `signal()` function (4.7.1.1).

  For each signal recognized by `signal()`, the default handling is program termination and the program start-up condition is `SIG_DFL`. The program terminates with an exit status related to the exception or the signal number for non-exception related signals.

- If the equivalent of `signal` (`sig`, `SIG_DFL`); is not executed prior to the call of the signal handler, the blocking of the signal that is performed (4.7.1.1).

  `signal (sig, SIG_DFL)` is executed before the call to the signal handler. Signals are blocked for the duration of the signal handler, unless the program takes some action that unblocks `signal()`. Refer to your operating system technical manual for more information.

- Whether the default handling is reset if the `SIGILL` signal is received by a handler specified to the signal function (4.7.1.1).

  The default handling is reset on all signals.

- Whether the last line of a text stream requires a terminating newline character (4.9.2).

  A terminating newline is not required as the last character of a text stream.

- Whether space characters that are written out to a text stream immediately before a newline character appear when read in (4.9.2).

  Space characters written to a text stream immediately before a newline character appears when read.

- The number of null characters that may be appended to data written to a binary stream (4.9.2).

  Null characters are not appended to data written to a binary stream.

- Whether the file position indicator of an append mode stream is initially positioned at the beginning or end of the file (4.9.3).

  The file position indicator of an append mode stream is initially positioned at the beginning of the file. Regardless, all writes to a stream in append mode are started at the current end-of-file.

- Whether a write on a text stream causes the associated file to be truncated beyond that point (4.9.3).

  No truncation of this sort occurs.

- The characteristics of file buffering (4.9.3).

  The file buffering decision is made when the first request is made to the stream. If the buffering type and size have not been set explicitly by `setvbuf()`, the determination is made based on the device with which the stream is associated. If the device is interactive, line buffering is used. Otherwise, full buffering is used. If the device is `RBF` (Random Block File Manager), the buffer size is `2 * current_sector_size`.

- Whether a zero-length file actually exists (4.9.3).

  A zero length file actually does exist.

- The rules for composing valid file names (4.9.3).

  The rules vary depending on the operating system:

  OS-9 for 68KFile names can contain 1 to 28 upper or lower case letters, digits, underscores (_), periods (`.`), or dollar signs (`$`).

  OS-9File names can contain 1 to 43 upper or lower case letters, digits, underscores (_), periods (`.`), or dollar signs (`$`).

- Whether the same file can be open multiple times (4.9.3).

  A program can open a file more than once, but fully buffered reading and writing to the same file has undefined results.

- The effect of the `remove()` function on an open file (4.9.4.1).

  `remove()` returns -1 with `errno` set to `EOS_SHARE` if called with the name of an open file.

- The effect if a file with the new name exists prior to a call to the `rename()` function (4.9.4.2).

  Assuming the calling program has write permission, the file with the new name is deleted and recreated with the new information.

- The output for `%p` conversion in the `fprintf()` function (4.9.6.1).

  The pointer to `void` is printed as an unsigned hexadecimal integer.

- The input for `%p` conversion in the `fscanf()` function (4.9.6.2).

  The input for `%p` conversion is an unsigned hexadecimal integer.

- The interpretation of a '-' character that is neither the first nor the last character in the scanlist for %[conversion in the `fscanf()` function (4.9.6.2).

  A hyphen (-) character is interpreted simply as the addition of - to the scanlist.

- The value to which the macro `errno` is set by the `fgetpos()` or `ftell()` function on failure (4.9.9.1, 4.9.9.4).

  `errno` is set to the operating system specific error that is returned by either `_os_gs_size()` (in append mode) or `_os_gs_pos()`.

- The messages generated by the `perror()` function (4.9.10.4).

  The messages generated by the `perror()` function are located in the system `errmsg` file (`/dd/SYS/errmsg`, `/h0/SYS/errmsg`, or `/d0/SYS/errmsg`). Refer to your operating system technical manual for detailed information. Error messages are generally in the form:

  `<message>: #<major>:<minor> <detail>`

`<message>`	is the user-passed message string.
`<major>`	is the family of error.
`<minor>`	is the error number within the family.
`<detail>`	is the information from the system `errmsg` file (if available).

- The behavior of the `calloc()`, `malloc()`, or `realloc()` function if the size requested is zero (4.10.3).

  The `calloc()`, `malloc()`, and `realloc()` functions return `NULL` if the requested size is zero.

- The behavior of the `abort()` function with regard to open and temporary files (4.10.4.1).

  If the `SIGABRT` signal handler returns, the program is terminated abnormally flushing open streams, closing open streams, and removing temporary files.

- The status returned by the `exit()` function if the value of the argument is other than zero, `EXIT_SUCCESS`, or `EXIT_FAILURE` (4.10.4.3).

  The integer value passed to `exit()` is the exit status of the program.

- The set of environment names and the method for altering the environment list used by the `getenv()` function (4.10.4.3).

  The common set of environment names depends on the operating system. Refer to your operating system's user manual for more information.

  The environment list is implemented as a NULL terminated array of pointers to characters. Each string is in the form: `<name>=<value>`

`<name>`	is the name of the environment variable.
`<value>`	is the current value of the environment variable.

  To modify the list, you must either find the existing entry or enlarge the array and add an entry. The base of the array is stored in the external variable `_environ`.

- The contents and mode of execution of the string by the `system()` function (4.10.4.5).

  The contents of an execution string given to `system()` can be any valid shell command line. The shell used to execute the string is either the current value of the `SHELL` environment variable or `shell` if `SHELL` is unavailable.

- The contents of the error message strings returned by the `strerror()` function (4.11.6.2).

  The strings generated by the `strerror()` function are located in the system `errmsg` file (`/dd/SYS/errmsg, /h0/SYS/errmsg, or /d0/SYS/errmsg`). Refer to your operating system technical manual for detailed information. Error messages are generally in the form: `#<major>:<minor> <detail>`

`<major>`	is the family of error.
`<minor>`	is the error number within the family.
`<detail>`	is the information from the system `errmsg` file (if available).

- The local time zone and Daylight Saving Time (4.12.1).

  The local time zone and Daylight Saving Time are determined by the `TZ` environment variable on OS-9 for 68K and the `TZ` variable or the `m_tmzone` field in the `init` module on OS-9. Failing to find user defined values, the defaults are Central Standard Time and Central Daylight Time.

- The era for the `clock()` function (4.12.2.1).

  The `era` for `clock()` is the elapsed ticks since the program was forked.

Equivalents for the sys_clib.l Functions

The functions in the `sys_clib.l` library exist mainly for compatibility with the Microware K & R C compiler, although the calls are accepted in all modes. Whenever possible, you should use the functions in the `os_lib.l` and `clib.l` libraries that have the same functionality. The following is a list of the `sys_clib.l` functions and the corresponding calls in either `os_lib.l` or `clib.l`.

Table 1-37. sys_clib.l Function Equivalents

sys_clib.l Function	Corresponding Function
`access()`	`_os_open()`
`create()`	`_os_create()`
`alm_atdate()`	`_os_alarm_atime()/ _os9_alarm_atdate()`
`detach()`	`_os_detach()`
`alm_atjul()`	`_os_alarm_atime()/ _os9_alarm_atjul()`
`dup()`	`_os_dup()`
`alm_cycle()`	`_os_alarm_cycle()`
`ebrk()`	`malloc()`
`alm_delete()`	`_os_alarm_delete()`
`_errmsg()`	`strerror()`
`alm_set()`	`_os_alarm_set()`
`_ev_creat()`	`_os_ev_creat()`
`attach()`	`_os_attach()`
`_ev_delete()`	`_os_ev_delete()`
`_ev_info()`	`_os_ev_info()`
`chainc(), chain()`	`_os_chain()`
`_ev_link()`	`_os_ev_link()`
`chdir()`	`_os_chdir()`
`_ev_pulse()`	`_os_ev_pulse()`
`chmod()`	`_os_ss_attr()`
`_ev_read()`	`_os_ev_read()`
`chown()`	`_os_ss_fd()`
`_ev_set()`	`_os_ev_set()`
`chxdir()`	`_os_chdir()`
`_ev_setr()`	`_os_ev_setr()`
`_cleareof(), cleareof()`	`clearerr()`
`_ev_signal()`	`_os_ev_signal()`
`_ev_unlink()`	`_os_ev_unlink()`
`close()`	`_os_close()`
`_ev_wait()`	`_os_ev_wait()/ _os9_ev_wait()`
`closedir()`	`_os_close()`
`_ev_waitr()`	`_os_ev_waitr()/ _os9_ev_waitr()`
`_cmpnam()`	`_os_cmpnam()`
`_exit()`	`_os_exit()`
`_cpymem()`	`_os_cpymem()`
`fdopen()`	none

Table 1-37. sys_clib.l Function Equivalents (Continued)

sys_clib.l Function	Corresponding Function
`crc()`	`_os_crc()`
`findnstr()`	`strstr()`
`creat()`	`_os_create()`
`findstr()`	`strstr()`
`_get_module_dir()`	`_os_get_moddir()`
`makdir()`	`_os_makdir()`
`_get_process_desc()`	`_os_gprdsc()`
`make_module()`	`_os_mkmodule()`
`_get_process_table()`	`_os_get_prtbl()`
`_mkdata_module()`	`_os_datmod()`
`mktime()`	`_os_getime()`/ `_os9_getime()`
`mknod()`	`_os_makdir()`
`getpid()`	`_os_id()`
`mktemp()`	`tmpnam()`
`getstat()`	`_os_getstat()`
`modcload()`	`_os_loadp()`
`_getsys()`	`_os_getsys()`
`modlink()`	`_os_link()`
`getuid()`	`_os_id()`
`modload()`	`_os_load()`
`getw()`	`getc()` `getw()` is replaced by performing two calls to `getc()`
`modloadp()`	`_os_loadp()`
`_gregorian()`	`_os_gregorian()`
`munlink()`	`_os_unlink()`
`_gs_devn()`	`_os_gs_devnm()`
`munload()`	`_os_unload()`
`_gs_eof()`	`_os_gs_eof()`
`open()`	`_os_open()`
`_gs_gfd()`	`_os_gs_fd()`
`opendir()`	`_os_open()`
`_gs_opt()`	`_os_gs_popt()`
`os9exec()`	`_os_exec()`
`_gs_pos()`	`_os_gs_pos()`
`os9fork()`, `os9forkc()`	`_os_fork()`
`_gs_rdy()`	`_os_gs_ready()`
`_gs_size()`	`_os_gs_size()`
`os9kexec()`	`_os_exec()`
`hypot()`	none
`pause()`	`_os_prsnam()`
`ibrk()`	`malloc()`
`pause()`	`sleep()`
`index()`	`strchr()`

Table 1-37. sys_clib.l Function Equivalents (Continued)

sys_clib.l Function	Corresponding Function
pffinit()	none
intercept()	_os_intercept()
pflinit()	none
_julian()	_os_julian()
prerr()	strerror()
kill()	_os_send()
_prgname()	argv[0]
lseek()	_os_seek()
_prsnam()	_os_prsnam()
putw()	putc() putc() putw() is replaced by performing two calls to putc()
_ss_enrts()	_os_ss_enrts()
read()	_os_read()
_ss_lock()	_os_ss_lock()
readdir()	_os_read()
_ss_opt()	_os_ss_popt()
readln()	_os_readln()
_ss_pfd()	_os_ss_fd()
rewinddir()	_os_seek()
_ss_rel()	_os_ss_relea()
rindex()	strrchr()
_ss_rest()	_os_ss_reset()
sbrk()	malloc()
_ss_size()	_os_ss_size()
seekdir()	_os_seek()
_ss_ssig()	_os_ss_sendsig()
_setcrc()	_os_setcrc()
_ss_tiks()	_os_ss_ticks()
setime()	_os_setime()/ _os9_setime()
_ss_wtrk()	_os_ss_wtrack()
setpr()	_os_setpr()
_strass()	memcpy() on structure assignment
setstat()	_os_setstat()
strhcpy()	none
_setsys()	_os_setsys()
sys_mktime()	mktime() for user programs
setuid()	_os_setuid()
_sysdate()	_os_setime()/_os9_setime()
sigmask()	_os_sigmask()
_sysdbg()	_os_sysdbg()
sleep()	_os_sleep()/_os9_sleep()
telldir()	_os_gs_pos()
srqcmem()	_os_srqmem()
tsleep()	_os_sleep()

Table 1-37. sys_clib.l Function Equivalents (Continued)

sys_clib.l Function	Corresponding Function
`_srqmem()`	`_os_srqmem()/_os9_srqmem()`
`unlink()`	`_os_delete()`
`_srtmem()`	`_os_srtmem()`
`unlinkx()`	`_os_delete()`
`_ss_attr()`	`_os_ss_attr()`
`wait()`	`_os_wait()`
`_ss_dcoff()`	`_os_ss_dcoff()`
`write()`	`_os_write()`
`_ss_dcon()`	`_os_ss_dcon()`
`writeln()`	`_os_writeln()`
`_ss_dsrts()`	`_os_ss_dsrts()`

The Function Description

Each function description includes a minimum of the following sections:

- Syntax
- OS-9 Attributes
- Description
- Library

In addition, descriptions may also contain sections for the following:

- Examples
- Errors
- References to other calls (See Also)

Syntax

The syntax shows how the function and parameters look if written as a C function definition, even if the actual function is a macro or is written in assembly language.

For example, the syntax for `fopen()` appears as follows:

```
#include <stdio.h>

FILE *fopen(const char *name, const char *action);
```

This indicates that `fopen()` requires the `<stdio.h>` header file, returns a pointer to a structure of type `FILE`, and requires two parameters, both pointers to constant character strings. The parameter names are suggestions only; you can use any name.

OS-9 Attributes

The OS-9 Attributes section lists various attributes of each function in relation to OS-9—including whether the function is compatible with OS-9 and/or OS-9 for 68K; whether the function is in user state and/or system state; whether the function is safe for use in a threaded application; and whether the function is re-entrant. Note that functions which are not re-entrant should not be used in signal handlers unless signals are masked before the functions are used and unmasked after the functions return.

Library

The library field indicates the libraries that contain the function.

Errors

When an error occurs, C functions typically return an error code in the global variable `errno`. You must include the file `<errno.h>` in C programs to declare `errno`.

References to Other Calls

Many functions also have a “See Also” section. Functions listed in the “See Also” section are related functions or are called by the function being described.

C Shared Library

The following two CSL (C Shared Library) files are available when configuring OS-9 systems: `csl` and `mt_csl`.

Both files contain a module named `csl`. Use the file `csl` for systems that execute no threaded `csl`-using applications. Use the file `mt_csl` for systems that execute both threaded and non-threaded `csl`-using applications.

Table 1-38 lists all functions available in `csl.l`. Table 1-39 lists all functions available in `mt_csl.l`.

Table 1-38. CSL Function List

Function	Description
`access()`	Determine file accessibility.
`asctime()`	Convert broken-down time to string format.
`atexit()`	Specify function to call at normal program termination.
`atof()`	Alpha to floating conversion.
`atoi()`	Alpha to interger conversion.
`atol()`	Alpha to long converstion.
`_aton()`	Alpha to numeric translation.
`_atou()`	Alpha to unsigned converstion.

Table 1-38. CSL Function List (Continued)

Function	Description
calloc()	Allocate storage for array.
chmod()	Change file access permissions.
chown()	Change owner of file.
clearerr()	Clear error condition.
close()	Close path.
create()	Create file.
_dtoa()	Double to ASCII conversion.
_errmsg()	Print error message.
_exit()	Task termination.
fclose()	Close file.
fdopen()	Attach path to file pointer.
feof()	Check buffered file for end of file.
ferror()	Check buffered file for error condition.
fflush()	Flush file's buffer.
fgetc()	Get character from file.
fgetpos()	Get current position in file.
fgets()	Get string from file.
fopen()	Open file.
fprintf()	Formatted output.
fputc()	Output character to file.
fputs()	Output string to file.
fread()	Read data from file.
free()	Return memory.
_freemin()	Set memory reclamation bound.
freopen()	Re-open file.
fscanf()	Input string conversion.
fseek()	Reposition file pointer.
fsetpos()	Set current file position.
ftell()	Report file pointer position.
fwrite()	Write data to file.
getc(), getchar()	Get next character from file, stdin.
getenv()	Get value for environment name.
getpid()	Return group ID.
gets()	Get string from file.
_getsys()	Get system global variables.
getuid()	Determine user ID number.
gmtime()	Convert calendar time to Greenwich Mean Time.
kill()	Send Signal to Process
_lcalloc()	Allocate storage for array (low-overhead).

Table 1-38. CSL Function List (Continued)

Function	Description
`_lfree()`	Return memory (low overhead).
`_lmalloc()`	Allocate memory from areana (low-overhead).
`localeconv()`	Numeric formatting convention inquiry.
`localtime()`	Convert Calendar Time to Local Time.
`_lrealloc()`	Resize block of memory (low-overhead).
`lseek()`	Position file pointer.
`malloc()`	Allocate memory from arena.
`_mallocmin()`	Set minimum allocation size.
`mbstowcs()`	Convert sequence of multibyte characters.
`mbtowc()`	Determine number of bytes in multibyte characters.
`memcpy()`	Copy memory.
`memmove()`	Move memory.
`memset()`	File memory.
`mktime()`	Convert Broken-Down Time to Calendar Time.
`open()`	Open file.
`opendir()`	Open directory.
`_os_loadp()`	Load and link to memory module using PATH.
`_parsepath()`	Parse disk file (RBF) pathlist.
`perror()`	Map error number.
`pow()`	Power function.
`printf()`	Formatted output.
`putc()`, `putchar()`	Put next character to file, standard out.
`puts()`	Output string to file.
`read()`	Read bytes from path.
`readdir()`	Return pointer.
`readln()`	Read bytes from path.
`realloc()`	Resize block of memory.
`remove()`	Remove file.
`rename()`	Rename file.
`rewind()`	Return file pointer to zero.
`rewinddir()`	Reset position of directory stream.
`scanf()`	Input strings conversion.
`seekdir()`	Set position of next readdir.
`setlocale()`	Locale control.
`_setsys()`	Set/Examine system global variables.
`setvbuf()`	Set up buffer for I/O stream
`sprintf()`	Formatted output.
`sscanf()`	Input strings conversion.
`strcat()`	String catenation.

Table 1-38. CSL Function List (Continued)

Function	Description
strchr()	Locale string.
strcmp()	String comparison.
strcpy()	String copy.
strerror()	Map error message string.
strftime()	Place formatted time in buffer.
strlen()	Determine string length.
strncat()	String catenation.
strncmp()	String comparison.
strncpy()	String copy.
strrchr()	Locate last occurrence of string.
strtod()	String to double conversion.
strtok()	Break string into tokens.
strtoll()	String to long conversion.
strtoul()	String to long conversion.
system()	Shell command execution.
telldir()	Return current location.
time()	Get Calendar Time.
tmpfile()	Create temporary binary file.
tmpnam()	Generate unique valid filename.
ungetc()	Unget character.
vfprintf()	Print to file.
vprintf()	Print to standard output.
vsprintf()	Print to string.
wcstombs()	Convert sequence of wide chars to multibyte chars
wctomb()	Convert wide character to multibyte character.
write()	Write bytes to path.
writeln()	Write bytes to path.

The following table lists the MT_CSL functions.

Table 1-39. MT_CSL Function List

Function	Description
pthread_attr_destroy()	Free thread attribute object.
pthread_attr_getdetachstate()	Get detach state attrubute.
_pthread_attr_getinitfunction()	Get initialization function attribute.
_pthread_attr_getpriority()	Get priority attribute.
pthread_attr_getstackaddr()	Get stack address attribute.
pthread_attr_getstacksize()	Get stack size attribute.
pthread_attr_init()	Allocate thread creation attribute object.
pthread_attr_setdetachstate()	Set detached state attribute.
_pthread_attr_setinitfunction()	Set initialization function attribute.

Table 1-39. MT_CSL Function List (Continued)

Function	Description
_pthread_attr_setpriority()	Set priority attribute.
pthread_attr_setstackaddr()	Set stack address attribute.
pthread_attr_setstacksize()	Set stack size attribute.
pthread_cancel()	Cancel target thread.
pthread_cleanup_pop()	Pop cleanup routine.
pthread_cleanup_push()	Push cleanup routine.
pthread_cond_broadcast()	Release threads waiting for condition variable.
pthread_cond_init()	Allocate condition variable object.
pthread_cond_signal()	Release thread waiting for condition variable.
pthread_cond_timedwait()	Wait on condition variable for specified interval.
pthread_cond_wait()	Wait on condition variable.
pthread_create()	Create new thread.
pthread_detach()	Orphan target thread.
pthread_exit()	Terminate thread.
pthread_getspecific()	Get thread-specific data pointer.
_pthread_getstatus()	Get thread status information.
_pthread_interrupt()	Interrupt target thread.
_pthread_interrupt_clear()	Clear interrupt request for target thread.
pthread_join()	Wait for target thread to terminate.
pthread_key_create()	Creat thread-specific data key.
pthread_key_delete()	Delete thread-specific data key.
pthread_mutex_destroy()	Free mutex object.
pthread_mutex_getprioceiling()	Get mutex priority ceiling.
pthread_mutex_init()	Allocate mutex object.
pthread_mutex_lock()	Lock mutex object.
pthread_mutex_setprioceiling()	Set mutext priority ceiling.
pthread_mutex_trylock()	Lock mutex object (non-blocking)
pthread_mutex_unlock()	Unlock mutex object.
pthread_once()	Execute routine once per process.
_pthread_resume()	Decrement suspension counter.
pthread_setcancelstate()	Set cancel state.
pthread_setcanceltype()	Set cancel type.
_pthread_setpr()	Set priority for target thread.
_pthread_setsignalrange()	Set range of signal values.
pthread_setspecific()	Set thread-specific data pointer.
_pthread_setsuspendable()	Decrement suspendability counter.
_pthread_setunsuspendable()	Increment suspendability counter.
_pthread_suspend()	Increment suspension counter.

2 Functions

This chapter includes library function definitions in alphabetical order according to some special rules.

- Special characters (not letters, numbers, or underscores) are listed first.
- Function calls are listed in alphabetic order next without regard for numbers and underscores.
- If two function calls are identical using these rules, then they are alphabetized according to the following order:
  1. Symbols
  2. Underscores
  3. Alphabetic characters
  4. Numbers

abort()

Abnormal Program Termination

Syntax

```
#include <stdlib.h>
```

```
void abort(void);
```

Description

`abort()` abnormally terminates a program by raising the signal `SIGABRT`. However, if the signal `SIGABRT` is being caught and the signal handler does not return, the program is not terminated. If `SIGABRT` returns, the program is terminated abnormally. This flushes and closes the open streams and removes temporary files. The process returns the status `EXIT_FAILURE`.

`abort()` does not return to the caller.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

abs()

Integer Absolute Value

Syntax

```
#include <stdlib.h>
int abs(int value);
```

Description

`abs()` returns the absolute value of its integer parameter.

`value`
: is the integer parameter. (Input)

`abs(0x80000000)`
: returns `0x80000000` as the result.

Applying `abs()` to the most negative integer yields a result that is the most negative integer.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

access()

Determine File Accessibility

Syntax

```
#include <modes.h>
int access(
          const char *name,
          int perm);
```

Description

`access()` returns zero if the mode(s) specified in the file permissions are correct for the user to access the specified file.

`name`
: is a pointer to the name of the file. (Input)

`perm`
: may be any legal mode as defined in the `modes.h` header file. (Input)

  Use a mode value of zero to verify that a file exists. Only the lower 16 bits of `perm` are used. If the file cannot be accessed, `-1` is returned and the appropriate error code is placed in `errno`.

  This value may not be compatible with other systems.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`sys_clib.l`

acos()

Arc Cosine Function

Syntax

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

```
double acos(double x);
```

Description

`acos()` returns the arc cosine of `x` (input), in the range of [`0, p`] radians. A domain error, `EDOM` stored in `errno`, occurs for parameters not in the range [`-1, +1`]. On error, `acos()` returns `HUGE_VAL`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

Possible Error

`EDOM`

alarm()

Sends signal SIGALRM

Syntax

```
#include <UNIX/os9def.h>
unsigned int alarm(unsigned int seconds);
```

Description

`alarm()` requests that a signal be sent to the requesting process after a specified number of `seconds`. Unless caught or ignored, the signal terminates the process. `alarm()` sends signal `SIGALRM` when the alarm expires.

`alarm()` requests are not stacked; successive calls reset the alarm clock. If the argument is `0`, any `alarm()` request is canceled.

`alarm()` returns `-1` and sets the global value `errno` if an error occurs.

`seconds`
: is a specified amount of time after which a signal is sent. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`_os9_alarm_atdate()`

`_os_alarm_set()`

alloca()

Allocates Bytes of Space in Stack Frame

Syntax

```
#include <UNIX/os9def.h>
void *alloca(unsigned int size);
```

Description

`alloca()` allocates `size` number of zero bytes from the `malloc()` pool. This space is not automatically freed.

`alloca()` returns a pointer to the allocated bytes. If an error occurs, `NULL` is returned and the global variable `errno` is set.

`size`
: is the number of zero bytes from the `malloc()` pool. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

alm_atdate()

Set Alarm at Gregorian Date/Time

Syntax

```
#include <alarm.h>
int alm_atdate(
            int sigcode,
            int time,
            int date);
```

Description

`alm_atdate()` requests that a signal be sent to the requesting process at a specific Gregorian time and date. The time and date must be in the following format:

Figure 2-1. alm_atdate() Time and Date Format

	Byte 0	Byte 1	Byte 2	Byte 3
Time:	0	Hour (0-23)	Minute	Second
	Year (two bytes)		Month	Day

Because the system time and date may be changed, the alarm signal is sent when the time and date become greater than or equal to the alarm time. If errors occur, `-1` is returned and the appropriate error code is placed in the global variable `errno`. If no errors occur, `alm_atdate()` returns the alarm ID.

Refer to the *OS-9 Technical Manual* for information about alarms.

`sigcode`
: specifies the signal to be sent to the caller. (Input)

`time`
: specifies the time to send the signal. (Input)

`date`
: specifies the Gregorian date for the signal to be sent. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	No

Library

`sys_clib.l`

See Also

`_os9_alarm_atdate()`

`_os_alarm_set()`

alm_atjul()

Set Alarm at Julian Date/Time

Syntax

```
#include <alarm.h>

int alm_atjul(
            int sigcode,
            int time,
            int date);
```

Description

`alm_atjul()` requests that a signal be sent to the requesting process at a specific Julian date and time.

Because the system time and date may be changed, the alarm signal is sent when the system time and date become greater than or equal to the alarm time. If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`. If errors do not occur, `alm_atjul()` returns the alarm ID.

Refer to your operating system technical manual for information about alarms.

`sigcode`
: specifies the signal to be sent to the caller. (Input)

`time`
: should contain the time at which to send the signal, expressed as the number of seconds after midnight. (Input)

`date`
: must contain the Julian date on which to send the signal. (Input)

The Julian date is the number of days since 1 January 4713 B.C., the beginning of the Julian period. A Julian day begins at midnight on OS-9 systems. Standard Julian days begin twelve hours earlier, at noon. For example, 1:00 a.m. January 2, 4713 B.C. is one hour after the beginning of Julian Day 1 for OS-9, but thirteen hours after the beginning in standard Julian time.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`sys_clib.l`

See Also

`_os9_alarm_atjul()`

`_os_alarm_set()`

alm_cycle()

Set Alarm at Specified Time Intervals

Syntax

```
#include <alarm.h>
int alm_cycle(
             int sigcode,
             int time_interval);
```

Description

`alm_cycle()` sends a signal to the requesting process after the specified time has elapsed and then resets the alarm to provide a recurring periodic signal. If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`. If errors do not occur, `alm_cycle()` returns the alarm ID.

`sigcode`
: specifies the signal to be sent to the caller. (Input)

`time_interval`
: specifies the periodic interval at which the signal is to be sent. (Input)

For example, if the request is made at time `X` and `time_interval` is `t`, the signal is sent to the requesting process at times `(X + t)`, `(X + 2t)`, `(X + 3t)`, and so forth until the alarm is deleted.

If the most significant bit of `time_interval` is set, `time_interval` is assumed to be in 256ths of a second. Otherwise, `time_interval` is assumed to be in units of system clock ticks (refer to `CLOCKS_PER_SEC` in the `time.h` header file). The minimum `time_interval` allowed is two system clock ticks.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`alm_delete()`

`alm_set()`

`alm_cycle()`

`alm_delete()`

`_os_alarm_set()`

alm_delete()

Remove Pending Alarm Request

Syntax

```
#include <alarm.h>

int alm_delete(int alarmid);
```

Description

`alm_delete()` cancels the specified alarm request.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

If errors do not occur, `alm_delete()` returns zero.

Refer to the *OS-9 Technical Manual* for information about alarms.

`alarmid`
: is the alarm ID of alarm to cancel. (Input)

  If `alarmid` is zero, all pending alarm requests are cancelled.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_alarm_delete()`

alm_set()

Set Alarm after Specified Time Interval

Syntax

```
#include <alarm.h>

int alm_set(
    int sigcode,
    int time);
```

Description

`alm_set()` requests that a signal be sent to the requesting process after the specified time has elapsed. For example, if the request is made at time `X` and `time` is `t`, the signal is sent at time `(X + t)`, unless the alarm request is cancelled.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

If errors do not occur, `alm_set()` returns the alarm ID.

`sigcode`
: is the signal code to be sent to the requesting process. (Input)

`time`
: specifies the time interval. (Input)

  If the most significant bit of `time` is set, `time` is assumed to be in 256ths of a second. Otherwise, `time` is assumed to be in units of system clock ticks (refer to `CLOCKS_PER_SEC` in the `time.h` header file). The minimum `time` allowed is two system clock ticks.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_alarm_set()`

asctime()

Convert Broken-Down Time to String Format

Syntax

```
#include <time.h>
```

```
char *asctime(struct tm *tp);
```

Description

`asctime()` converts the broken-down time structure into the following 26-byte string format, including the terminating `\0`:

```
xxx mmm dd hh:mm:ss yyyy\n\0
```

`asctime()` returns a pointer to a static area which may be overwritten. To insure data integrity, use the string or save it immediately.

`xxx`
: is one of the following days of the week:
`SunMonTueWedThuFriSat`

`mmm`
: is one of the following months of the year:
`JanFebMarAprMayJun`
`JulAugSepOctNovDec`

`dd`
: specifies the day of the month.

`hh:mm:ss`
: specifies the time in hours, minutes, and seconds.

`yyyy`
: specifies the year.

`tp`
: is a pointer to the broken-down time structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`ctime()`

`localtime()`

`gmtime()`

`sys_mktime()`

`strftime()`

asin()
Arc Sine Function

Syntax

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

```
double asin(double x);
```

Description

`asin()` returns the arc sine of `x` (input), in the range [-`π/2`, `+π/2`] radians. A domain error, `EDOM` stored in `errno`, occurs for parameters not in the range `[-1, +1]`. On error, `asin()` returns `HUGE_VAL`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

Possible Error

`EDOM`

assert()

Place Diagnostics in Programs

Syntax

```
#include <assert.h>
void assert(int expression);
```

Description

`assert()` is a macro that places diagnostics in programs. If `expression` is false, `assert()` writes a message about the failed call to standard error. The following message is printed:

```
Assertion failed: expression, file filename,
     line line#\n
```

After printing the message, `assert()` calls `abort()`. This raises the `SIGABRT` signal that may be handled by the application.

`assert()` never returns a value.

If `NDEBUG` is defined as a macro name when the `assert.h` header file is included, `assert()` is defined as follows:

```
#define assert(ignore) ((void)0)
```

`expression`
: is the text of the parameter. (Input)

`filename`
: is the name of the file containing the `assert` macro.

`line#`
: is the line number of the file containing the `assert` macro.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`assert()` is a macro defined in `assert.h`.

See Also

`abort()` `raise()`
`signal()`

atan()
Arc Tangent Function

Syntax

```
#include <math.h>
double atan(double x);
```

Description

`atan()` returns the arc tangent of `x` (input), in the range [-π/2, +π/2] radians.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

atan2()

Arc Tangent Function

Syntax

```
#include <math.h>
double atan2(
    double y,
    double x);
```

Description

`atan2()` returns the arc tangent of `y` (input) divided by `x` (input)--that is, `atan(y/x)`), in the range [-π, π] radians. `atan2()` uses the signs of both `y` and `x` to determine the quadrant of the returned value. A domain error, `EDOM` placed in `errno`, occurs if both `y` and `x` are zero. On error, `atan2()` returns `HUGE_VAL`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

Possible Error

`EDOM`

atexit()

Specify Function to Call at Normal Program Termination

Syntax

```
#include <stdlib.h>
int atexit(void (*func)(void));
```

Description

`atexit()` specifies a function to be called without parameters at normal program termination. Thirty-two functions may be specified.

`atexit()` returns zero if it succeeds. Otherwise, it returns a non-zero value.

`func`
: is a pointer to the function. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`exit()`

atof()

Alpha to Floating Conversion

Syntax

```
#include <stdlib.h>
double atof(const char *string);
```

Description

`atof()` converts a string into its equivalent representation in type `double`.

Except that no error indication is given, `atof()` is equivalent to the following:

```
strtod(nptr,(char **)NULL)
```

`string`
is a pointer to the string. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`strtod()`

atoi()

Alpha to Integer Conversion

Syntax

```
#include <stdlib.h>
int atoi(const char *string);
```

Description

`atoi()` converts a string into its equivalent representation in type `int`.

Except that no error indication is given, `atoi()` is equivalent to the following:

```
(int) strtol(nptr,(char**)NULL,10)
```

`string`
is a pointer to the string. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`strtol()`

`strtoll()`

atol()

Alpha to Long Conversion

Syntax

```
#include <stdlib.h>
long atol(const char *string);
```

Description

`atol()` converts a string into its equivalent representation in type `long`.

Except that no error indication is given, `atol()` is equivalent to the following:

```
strtol(nptr,(char**)NULL,10)
```

`string`
is a pointer to the string. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`strtoll()`

_aton()

Alpha to Numeric Translation

Syntax

```
#include <aton.h>
_number_type _aton(
   char **buf,
   _number *value);
```

Description

`_aton()` converts a string into its associated numeric value, if possible.

Table 2-1. _aton() Return Values

Value	Description
`_ERROR`	No recognizable number is found, or the value cannot be represented (it would cause overflow or underflow).
`_INTEGER`	The recognized number is an integer.
`_REAL`	The recognized number is not an integer.

`_aton()` updates `buf` to point to the character just after the recognized string. It updates `value` to contain the recognized number, unless an error occurs.

`buf`
: is a pointer to a pointer to a string containing a printable representation of a number expressed in base ten. (Input/Output)

  The number may be an integer or a real number. You may also express the number in the following exponential format:

  `<number>(E|e)(-|+)<exponent>`

`value`
: is a pointer to one of the three possible values that can be returned. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`clib.l`

_atou()

Alpha to Unsigned Conversion

Syntax

```
#include <stdlib.h>
```

```
unsigned _atou(const char *string);
```

Description

`_atou()` converts a string into its appropriate unsigned numeric value, if possible.

`_atou()` treats `long` and `int` values identically.

`string`
: is a pointer to a string containing a printable representation of a number expressed in the format below. (Input)

```
[+/-]<digits>
```

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`clib.l`

attach()

Attach to Device

Syntax

```
#include <modes.h>
#include <io.h>
dev_list *attach(
    const char *name,
    int mode);
```

Description

`attach()` causes a new device to become known to the system or verifies that the device is already attached.

If the device descriptor is found and the device is not already attached, `attach()` links to its file manager and device driver, and places their addresses in a new device table entry. If the attach fails, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`name`
: is a pointer to the name of the device descriptor. (Input)

`mode`
: is the access mode. (Input)

Possible access modes include `FAM_READ`, `FAM_WRITE`, `S_IREAD`, and`S_IWRITE`.

`mode` may be used to verify that subsequent read and/or write operations are permitted. Only the lower 16 bits of `mode` are used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_attach()`

`I$Attach` *OS-9 for 68K Technical Manual*

`I_ATTACH`*OS-9 Technical Manual*

bcmp()

Compares Bytes from Two Memory Areas

Syntax

```
#include <UNIX/os9def.h>
int bcmp(
    void *addr1,
    void *addr2,
    unsigned int len);
```

Description

`bcmp()` compares memory at the first address (`addr1`) against the memory at the second address (`addr2`). The function returns zero if the memory areas are identical, non-zero otherwise. Both memory areas are assumed to be the given length (`len`). If `len` is zero, `bcmp()` returns zero.

`addr1`
: is the first memory address. (Input)

`addr2`
: is the second memory address. (Input)

`len`
: is the length of both addresses. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

See Also

`bcopy()`

`bzero()`

`ffs()`

bcopy()

Copies Bytes from One Memory Area to Another Memory Area

Syntax

```
#include <UNIX/os9def.h>
void  bcopy(
    void *addr1,
    void *addr2,
    unsigned int len);
```

Description

`bcopy()` copies bytes, of length `len`, from one memory area (`addr1`) to another (`addr2`). Overlapping memory areas are handled correctly.

`addr1`
: is the first memory area. (Input)

`addr2`
: is the second memory area. (Output)

`len`
: is the length of `addr1` and `addr2`. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`unix.l`

See Also

`bcmp()`

`bzero()`

`ffs()`

bsearch()

Search Array

Syntax

```
#include <stdlib.h>
void *bsearch(
    const void *key,
    const void *base,
    size_t nmemb,
    size_t size,
    int (*compar)  (const void *,
const void *));
```

Description

`bsearch()` searches an array of `nmemb` objects for an element that matches `key`.

The array consists of all elements that compare less than, equal to, and greater than the `key` object, in that order.

`bsearch()` returns a pointer to a matching array element. If no match is found, it returns a null pointer. If two elements compare as equal, which element is matched is unspecified.

`key`
: is a pointer to the key object. (Input)

`base`
: is a pointer to the initial element of the array. (Input)

`nmemb`
: specifies the number of array elements. (Input)

`size`
: specifies the size of each array element. (Input)

`compar`
: is a pointer to a comparison function. (Input/Output)

`compar`
: is called with two parameters that point to the key object and to an array element, in that order. `compar` returns an integer that is:

- Negative if `key` is considered less than the array element.
- Zero if `key` is equal to the array element.
- Positive if `key` is considered greater than the array element.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

buildpath()

Adds a Filename to the Root Directory Variable

Syntax

```
#include <UNIX/os9def.h>
char  *buildpath(const char *filename);
```

Description

`buildpath()` adds `filename` (input) to the value of the environment variable `XOS9ROOTDIR`. If `XOS9ROOTDIR` is not set, a default value of `/h0` is used.

`buildpath()` returns the final string in a static buffer that should be saved if additional calls are made to `buildpath()`. For example:

- with `XOS9ROOTDIR` set to `/dd/ETC`, `buildpath(xfile);` returns the following string:

  ```
  /dd/ETC/xfile
  ```

- without `XOS9ROOTDIR` set to `/dd/ETC`, `buildpath(xfile);` returns the following string:

  ```
  /h0/xfile
  ```

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

bzero()

Clear Bytes In Memory

Syntax

```
#include <UNIX/os9def.h>
void  bzero(
    void *addr,
    unsigned int len);
```

Description

`bzero()` clears bytes in memory starting from an address (`addr`) for a number of bytes (`len`).

`addr`
: is a memory address. (Input/Output)

`len`
: is the number of bytes. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`unix.l`

See Also

`bcopy()`

`bcmp()`

`ffs()`

calloc()

Allocate Storage for Array

Syntax

```
#include <stdlib.h>
void *calloc(
    size_t nmemb,
    size_t size);
```

Description

`calloc()` allocates space for an array. The allocated memory is cleared to zeroes.

f the allocation is successful, `calloc()` returns a pointer to the area. If the allocation fails or if `size` is zero, `NULL` is returned. The space designated by the returned pointer is suitably aligned to hold an object of any type.

`nmemb`
: is the number of elements in the array. (Input)

`size`
: is the size of each array element. (Input)

lAttributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`ebrk()`

`free()`

`malloc()`

`_os_srqmem()`

`_os9_srqmem()`

`realloc()`

cbrt()
Cube Root

Syntax

```
#include <UNIX/os9def.h>
double cbrt(double x);
```

Description

`cbrt()` returns the cube root of `x` (input).

The declaration `double cbrt()` must be included in any code that uses `cbrt()`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

ceil()
Ceiling Function

Syntax

```
#include <math.h>
double ceil(double x);
```

Description

`ceil()` returns the smallest integer, as a `double`, that is not less than `x` (input).

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`floor()`

chainc(), chain()

Load and Execute New Module

Syntax

```
#include <process.h>
int chainc(
    const char *modname,
    int parmsize,
    const char *parmptr,
    int type,
    int lang,
    int datasize,
    int prior,
    int pathent);
int chain(
    const char *modname,
    int parmsize,
    const char *parmptr,
    int type,
    int lang,
    int datasize,
    int prior);
```

Description

`chainc()` executes a new program without the overhead of creating a new process. It is functionally similar to `os9forkc()` followed by `exit()`, but with less system overhead.

`chainc()` effectively resets the calling process' program and data areas and begins executing a new primary module. Open paths are not closed or otherwise affected.

Regardless of whether the chain is successful, `chainc()` never returns to the caller; you must verify that the program to chain to exists and is executable before chaining. Use `modlink()` to check the module directory for the program or `modload()` to check the execution directory.

`chain()` is the same as `chainc()` without the `pathent` parameter. The number of open paths for the new process to inherit is three.

- `_os_exec()` is the preferred method by which to chain to C programs.
- Be aware of chaining to a system state program. `chain()` is an historical function and is likely to be removed in a future release. `_os_exec()` is the recommended function.
- Threaded programs may only chain from the `main()` thread and may not chain if multiple threads are currently active within the process.

`modname`
: is a pointer to a null-terminated module name. (Input)

`parmsize`
: is generally `strlen(parmptr)`. (Input)

`parmptr`
: is a pointer to a null-terminated string to be passed to the new module. (Input)

`type and lang`
: specify the desired type and language of the module; values of zero indicate any type or language. Only the lower 16 bits of `type` and `lang` are used. (Input)

`datasize`
: allocates extra memory to the new program. If no extra memory is required, `datasize` can be zero. (Input)

`prior`
: is the new priority at which to run the program. Specify zero if no priority change is desired. Only the lower 16 bits of `prior` are used. (Input)

`pathent`
: is the number of open paths for the new process to inherit. Only the lower 16 bits of `pathent` are used. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`modlink()`

`modload()`

`_os_chain()`

`os9fork(), os9forkc()`

`_os_fork()`

`_os_exec()`

`F$Chain, F$Fork` *OS-9 for 68K Technical Manual*

`F_CHAIN, F_FORK` *OS-9 Technical Manual*

change_const()

Change Current Static Storage Pointer

Syntax

```
#include <regs.h>
void *change_const(void *constptr);
void *_change_const(void *constptr);
```

Description

`change_const()` and `_change_const()` change the current constant data pointer and return the previous constant data pointer.

These functions are not present in the libraries for a given processor if a constant data pointer is not applicable.

`constptr`
is the value of the new constant data pointer. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`change_const() - cpu.l, _change_const() - os_lib.l`

change_static()

Change Current Static Storage Pointer

Syntax

```
#include <regs.h>
void *change_static(void *dest_stat);
void *_change_static(void *dest_stat);
```

Description

`change_static()` and `_change_static()` change the current static storage pointer and return the the previous static storage pointer.

`dest_stat`
 is the new static storage pointer. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`change_static() - cpu.l, _change_static() - os_lib.l`

chdir()

Change Current Data Directory

Syntax

```
#include <modes.h>
int chdir(const char *dirname);
```

Description

`chdir()` changes the current data directory for the calling process.

`chdir()` returns zero after a successful call. If `dirname` is not a directory path name or some other error occurs, `-1` is returned; and the appropriate error code is placed in the global variable `errno`.

`chdir()` changes the data directory only for the program containing the function call, not the shell that executes the program. Use the built-in shell command `chd` to change the shell's data directory.

`dirname`
is a pointer to a string containing a path name for the directory. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_chdir()`	
`I$ChgDir`	*OS-9 for 68K Technical Manual*
`I_CHDIR`	*OS-9 Technical Manual*
`chd`	*Using OS-9 for 68K* and *Using OS-9*

chmod()

Change File Access Permissions

Syntax

```
#include <modes.h>
int chmod(
    const char *name,
    int perm);
```

Description

`chmod()` changes the access permission bits associated with a file.

`chmod()` returns zero after a successful call. If the caller is not entitled to change the access permissions or if the file cannot be found, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

Only the super user or the owner of the file may change the access permissions.

`name`
: must be a pointer to a string containing a file name. (Input)

`perm`
: should contain the desired bit pattern for the file permissions. Only the lower 16 bits of `perm` are used. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ss_attr()`

`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT, SS_ATTR`	*OS-9 Technical Manual*
`attr`	*Using OS-9 for 68K* and *Using OS-9*

chown()

Change Owner of File

Syntax

```
#include <modes.h>
int chown(
    const char *name,
    int newowner);
```

Description

`chown()` changes the owner number of a file.

Refer to your operating system technical manual for information about how the owner ID is stored.

`chown()` returns zero after a successful call. If the caller does not have permission to change the owner ID or the file cannot be found, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

Only the super user may change the owner ID.

`name`
: is a pointer to the name of the file. (Input)

`newowner`
: is the new owner ID to assign to the file. The owner ID consists of a group ID and a user ID. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ss_fd()`

`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT, SS_FD`	*OS-9 Technical Manual*

chxdir()

Change Current Execution Directory

Syntax

```
#include <modes.h>
```

```
int chxdir(const char *dirname);
```

Description

`chxdir()` changes the current execution directory for the calling process. `chxdir()` returns `0` after a successful call. If `dirname` is not a directory path name or some other error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`chxdir()` changes the execution directory only for the program containing the function call, not the shell that executes the program. Use the built-in shell command `chx` to change the shell's execution directory.

`dirname`
: is a pointer to a string containing the directory name. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_chdir()`

`I$ChgDir`	*OS-9 for 68K Technical Manual*
`I_CHDIR`	*OS-9 Technical Manual*
`chx`	*Using OS-9 for 68K* and *Using OS-9*

_cleareof(), cleareof()

Clear End of File Condition

Syntax

```
#include <stdio.h>

void _cleareof(FILE *stream);

void cleareof(FILE *stream);
```

Description

`_cleareof()` is a macro that resets the end-of-file condition that causes `feof()` to return a non-zero value.

You can use this to retry an input operation on a terminal after end-of-file is encountered. `getc()` does not read characters until the end-of-file condition is cleared.

If you are executing the compiler in strictly conforming ANSI mode, only `_cleareof()` is available. Otherwise, both calls are available.

These calls are implemented as macros in the `stdio.h` header file.

`stream`
: is a pointer to the stream. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`sys_clib.l`

See Also

`feof()`

`getc(), getchar()`

clearerr()

Clear Error Condition

Syntax

```
#include <stdio.h>

void clearerr(FILE *stream);
```

Description

`clearerr()` clears the end-of-file and error indicators for a stream if compiled in strictly conforming ANSI mode. Otherwise, only the error indicator is cleared.

`stream`
: is a pointer to the stream to clear. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`_cleareof()`, `cleareof()`

`feof()`

`ferror()`

`fopen()`

`getc()`, `getchar()`

clock()

Get Processor Time

Syntax

```
#include <time.h>
clock_t  clock(void);
```

Description

`clock()` returns a value (in tick units) approximating the processor time used by the current process.

The returned value may be divided by `CLOCKS_PER_SEC` to determine the processor time in seconds. `CLOCKS_PER_SEC` is defined in the `time.h` header file to be the number of ticks per second. The era for `clock()` is the elapsed ticks for this process since the program was forked.

If `clock()` cannot determine the processor time, it returns `(clock_t) -1` to indicate an error.

In order to use `clock()` from a system-state module, the global variable `_environ` must be defined. The following C declarations can be used to properly define and initialize `_environ`:

```
void *xenviron;
void **_environ = &xenviron;
```

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`F$SetSys`, `F$Time`	*OS-9 for 68K Technical Manual*
`F_SETSYS`, `F_TIME`	*OS-9 Technical Manual*

close()

Close Path

Syntax

```
#include <modes.h>

int close(int path);
```

Description

`close()` closes an open path. The path number is usually obtained by a previous call to `open()`, `creat()`, `create()`, or `dup()`. The standard paths 0, 1, and 2 (standard input, standard output, and standard error, respectively) are not normally closed by user programs. If an error occurs during the close, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

Use a path number, not a file pointer assigned by `fopen()`.
The thread-enabled version of this function has a cancel point.

`path`
: specifies the open path to close. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`open()`

`creat()`

`create()`

`dup()`

`_os_close()`

closedir()

Close Named Directory Stream

Syntax

```
#include <dir.h>

void closedir(DIR *dirp);
```

Description

`closedir()` closes the named directory stream and frees the structure associated with `dirp`.

`dirp`
: is a pointer to the directory stream. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`sys_clib.l`

See Also

`opendir()`

`readdir()`

`rewinddir()`

`seekdir()`

`telldir()`

_cmpnam()

Compare Two Strings

Syntax

```
#include <strings.h>
error code _cmpnam(
    const uchar *pattern,
    const uchar *string,
    uint32  length);
```

Description

`_cmpnam()` compares the target string to the pattern string to determine if they match. `_cmpnam()` returns zero if the strings match. `-1` is returned if no match occurs.

`target`
: is a pointer to the target string. (Input)

  The target name must be terminated by a null byte. Upper and lower case characters are considered to match.

`pattern`
: is a pointer to the pattern string. (Input)

  Two metacharacters are recognized in the pattern string:

  - A question mark (`?`) matches any single character.
  - An asterisk (`*`) matches any string of characters.

`patlen`
: specifies the length of the pattern string. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_cmpnam()`

`F$CmpNam`	*OS-9 for 68K Technical Manual*
`F_CMPNAM`	*OS-9 Technical Manual*

cos()
Cosine Function

Syntax

```
#include <math.h>
double cos(double x);
```

Description

`cos()` returns the cosine of `x` (input) as a double. The value of `x` is in radians. A domain error, `EDOM` placed in `errno`, occurs if `x` is ∞ or -∞. `cos()` returns `HUGE_VAL` on error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

Possible Error

`EDOM`

cosh()
Hyperbolic Cosine Function

Syntax

```
#include <math.h>
double cosh(double x);
```

Description

`cosh()` returns the hyperbolic cosine of `x` (input). The value of `x` is in radians. If the magnitude of `x` is too large, a range error, `ERANGE` placed in `errno`, occurs and the properly signed `HUGE_VAL` is returned.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

Possible Error

`ERANGE`

_cpymem()
Copy External Memory

Syntax

```
#include <process.h>
int _cpymem(
    int pid,
    int count,
    void *from,
    void *into);
```

Description

`_cpymem()` copies memory owned by another process or the system into a buffer. If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`pid`
: is the process ID number of the external process. (Input)

  If `pid` is zero, the system's address space is assumed. Only the lower 16 bits of `pid` are used.

`count`
: is the number of bytes to copy. (Input)

`from`
: is a pointer to the address in the process' address space from which to copy. (Input)

`into`
: is a pointer to the buffer into which to copy the memory. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_cpymem()`

`F$CpyMem`	*OS-9 for 68K Technical Manual*
`F_CPYMEM`	*OS-9 Technical Manual*

crc()

Calculate Module CRC

Syntax

```
#include <module.h>
int crc(
    void *ptr,
    unsigned int count,
    int *accum);
```

Description

`crc()` generates or checks the CRC (cyclic redundancy check) values of sections of memory. Compilers, assemblers, and other module generators use `crc()` to generate a valid module CRC.

To generate the CRC for a module, complete the following steps:

Step 1. Initialize the accumulator to `-1 (0xffffffff)`.

Step 2. Perform the CRC over the module.

Step 3. Call `crc()` with a NULL value for `ptr`.

Step 4. Complement the CRC accumulator.

Step 5. Write the contents of the accumulator to the module.

`ptr`
: is a pointer to the data. (Input)

`count`
: specifies the byte count for the data. (Input)

`accum`
: points to location at which the CRC accumulator is passed. (Input/Output)

  `crc()` also stores the updated CRC accumulator at the location pointed to by `accum`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

_os_crc()

F$CRC	*OS-9 for 68K Technical Manual*
F_CRC	*OS-9 Technical Manual*

Example

The following code fragment illustrates a technique for generating a CRC for a module:

```
#include <stdio.h>
#include <module.h>

main()
{
  char *ptr;
  int count,accum = -1;
  /* one or more calls to crc */
  crc(ptr,count,&accum);

  /* The final call to crc(). At */
  crc(ptr,count,&accum);

/* this point the entire module less the four crc
/* bytes has been processed */
  crc(NULL,0,&accum);
    /* this is a special case to   */
    /* run a null byte through the */
    /* crc  calculation */
  accum = ~accum; /* complement the accumulator.*/
                  /* Previous calls have left the   */
                  /*  most significant byte as 0xff */
                  /* Complementing changes this byte*/
                  /* to zero */
  fwrite(&accum,1,sizeof accum,fp);
    /* finally write out the four crc bytes  */
}
```

creat()

Create File

Syntax

```
#include <modes.h>
int creat(
    const char *name,
    int mode);
```

Description

`creat()` returns a path number to a newly created file. The file is available for writing.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

You do not need to specify `write` access in `mode` to write to the file. You cannot create directories with this call; instead, use `_os_makdir()`.

The thread enabled version of this function contains a cancel point. For more information, refer to *Using OS-9 Threads*.

`name`

is a pointer to the newly created file. (Input)
If `name` is the name of an existing file, the file is truncated to zero length and the ownership and permissions remain unchanged.

`mode`

specifies the access modes for the file. (Input)

The `modes.h` header file contains the valid `mode` values. Only the lower 16 bits of `mode` are used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`open()`

`_os_create()`

`_os_makdir()`

`_os_ss_size()`

`I$Create` and `I$SetStt`	*OS-9 for 68K Technical Manual*
`I_CREATE` and `I_SETSTAT`	*OS-9 Technical Manual*
`SS_SIZE`	*OS-9 Technical Manual*

create()
Create File

Syntax

```
#include <modes.h>
int create(
    const char *name,
    int mode,
    int perm,
    {int initial_size});
```

Description

`create()` returns a path number to the newly created file. If the file already exists or any other error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

> `create()` is similar to the `creat()` call. However, `create()` allows the caller to specify the exact file attributes desired and does not truncate the file if it is already present. You cannot create directories with this call; instead, use `_os_makdir()`.

`name`
: is a pointer to the newly created file. (Input)

`mode`
: specifies the access modes for the file. (Input)

  The `modes.h` header file contains the valid `mode` values. Only the lower 16 bits of `mode` are used.

`perm`
: specifies the file permission attributes. (Input)

  The `modes.h` header file contains the valid `perm` values. Only the lower 16 bits of `perm` are used.

`initial_size`
: may be used to indicate the file's initial allocation size. (Input)

  For disk files, the allocation is made even though the file size does not change. For pipe files, the pipe buffer is set to this value. This may be used only if the `FAM_SIZE` (or `S_ISIZE`) bit is set in `mode`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_create()`

`_os_makdir()`

`_os_ss_size()`

`I$Create` and `I$SetStat`	*OS-9 for 68K Technical Manual*
`I_CREATE` and `I_SETSTAT`	*OS-9 Technical Manual*
`SS_SIZE`	*OS-9 Technical Manual*

crtolf()

Convert Carriage Return Characters to Linefeed Characters

Syntax

```
#include <UNIX/os9def.h>
void crtolf(
    char *buf,
    unsigned int n);
```

Description

`crtolf()` converts all carriage return characters to linefeed characters in `buf` for a span of `n` characters.

`buf`
: is a pointer to a buffer. (Input/Output).

`n`
: is the number of characters spanned. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

ctime()

Convert Calendar Time to String Format

Syntax

```
#include <time.h>
char *ctime(time_t *t);
```

Description

`ctime()` converts the calendar time `t` into the following 26-byte string format, including the terminating `\0`:

`xxx mmm dd hh:mm:ss yyyy\n\0`

`ctime()` returns a pointer to a static area which may be overwritten. To ensure data integrity, use the string or save it immediately.

`xxx`
is one of the following days of the week:
`SunMonTueWedThuFriSat`

`mmm`
is one of the following months of the year:
`JanFebMarAprMayJun`
`JulAugSepOctNovDec`

`dd`
specifies the day of the month.

`hh:mm:ss`
specifies the time in hours, minutes, and seconds.

`yyyy`
specifies the year.

`ctime(t)`
is the equivalent of `asctime(localtime(t))`. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`asctime()` `gmtime()` `localtime()`

detach()

Detach Device

Syntax

```
#include <io.h>
#include <modes.h>
int detach(dev_list *ptr);
```

Description

`detach()` removes a device from the system device table if no other process is using it.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`ptr`
: is a pointer returned by either `attach()` or `_os_attach()`. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_attach()`

`_os_detach()`

`I$Detach`	*OS-9 for 68K Technical Manual*
`I_DETACH`	*OS-9 Technical Manual*

difftime()

Find Temporal Difference

Syntax

```
#include <time.h>
double difftime(
    time_t time1,
    time_t time0);
```

Description

`difftime()` returns the difference in seconds between `time1` and `time0`. This value is returned as a `double`. If you could subtract the `time_t` values, the return value would be: `time1 - time0`.

`time0`, `time1`
: are the compared values for `difftime()`. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`time()`

div()
Compute Quotient and Remainder

Syntax

```
#include <stdlib.h>
div_t div(
    int numer,
    int denom);
```

Description

`div()` returns the quotient and remainder of the division of the numerator by the denominator. If the division is inexact, the resulting quotient is the integer of lesser magnitude that is the nearest to the algebraic quotient. If the result cannot be represented, the behavior is undefined. Otherwise,
`quot * denom + rem` equals `numer`.

`div()` returns a structure of type `div_t`, comprising both the quotient and the remainder. The `div_t` structure contains the `quot` and `rem` fields.

`numer`
: is the numerator. (Input)

`denom`
: is the denominator. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

_dtoa()

Double to ASCII Conversion

Syntax

```
#include <stdlib.h>

int _dtoa(
    double fnum,
    char *buff,
    int tot_digs,
    int frac_digs,
    int *sign);
```

Description

`_dtoa()` converts a floating point number of type `double` to the ASCII string equivalent. The conversion terminates when either the requested number of digits are converted or the specified number of digits after the decimal point is reached.

If `fnum` represents ±∞ or an IEEE 754 Not a Number and `tot_digs` is greater than or equal to three, `buff` contains, respectively, `Inf` or `NaN`. If `tot_digs` is less than three, `buff` contains, respectively, `I` or `N`. In these cases, `_dtoa()` returns `DBL_MAX_10_EXP`.

`_dtoa()` returns no errors.

`fnum`
: is the floating point number to convert. (Input)

`buff`
: is a pointer to a buffer for the converted ASCII string. (Output)

`_dtoa()`
: returns the signed decimal exponent. The returned string only contains mantissa digits. A null byte is appended to the end of `buff`. `buff` should be one byte larger than the requested number of digits.

`tot_digs`
: is the number of digits requested. (Input)

`frac_digs`
: is the specified number of digits following the decimal point. (Input)

`sign`
: is a pointer to the sign. (Input)

  Set the sign in `sign` as follows:

  - `1` for a negative sign.
  - `0` for a positive sign.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`clib.l`

dup()

Duplicate Path

Syntax

```
#include <modes.h>

int dup(int path);
```

Description

`dup()` returns a synonymous path number for an existing file or device. The lowest available path number is used.

`path`
: specifies the path number. (Input)

`dup()` increments the link count of a path descriptor and returns a different synonymous path number. The path descriptor is not cloned.

It is ill advised for more than one process to perform I/O on the same path concurrently.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_dup()`

`I$Dup`	*OS-9 for 68K Technical Manual*
`I_DUP`	*OS-9 Technical Manual*

Syntax

```
#include <UNIX/os9def.h>

int dup2(int fd1, int fd2);
```

Description

`dup2()` returns a synonymous path number for an existing file or device and specifies the value of the new duplicated path.

`fd1`
: specifies the original path number. (Input)

`fd2`
: specifies the value of the duplicated path. (Input/Output)

If path `fd2` is already in use, it is first closed.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

ebrk()

Get External Memory

Syntax

```
#include <stdlib.h>

extern int _memmins;

void *ebrk(unsigned int size);
```

Description

`ebrk()` returns the amount of memory specified by `size`. The memory is obtained from the system using the `F$SRqMem` (for OS-9 for 68K) or `_os_srqmem()` (for OS-9) system request. It is intended for general purpose memory allocation.

To reduce the overhead involved in requesting small quantities of memory, `ebrk()` requests memory from the system in a minimum size determined by the global variable `_memmins` and satisfies the user requests from this memory space. `_memmins` is initially set to 8192. `ebrk()` grants memory requests from this memory space provided the requests are no larger than the amount of space.

If the request is larger than the available space, `ebrk()` wastes the rest of the space and tries to get enough memory from the system to satisfy the request. This method works well for programs that need to get large amounts of not necessarily contiguous memory in little bits and cannot afford the overhead of `malloc()`.

Changing the `_memmins` variable causes `ebrk()` to use that value as the `F$SRqMem` (for OS-9 for 68K) or `F_SRQMEM` (for OS-9) memory request size.

If the memory request is granted, a pointer (even-byte aligned) to the block is returned. If the request is not granted, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

The memory obtained from `ebrk()` is not returned until the process terminates.

`size`
: specifies the amount of memory. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`sys_clib.l`

See Also

`sbrk()`

`ibrk()`

`malloc()`

`_os_srqmem()`

`F$SRqMem`	*OS-9 for 68K Technical Manual*
`F_SRQMEM`	*OS-9 Technical Manual*

endpwent()

Closes Password File

Syntax

```
#include <UNIX/pwd.h>
void endpwent();
```

Description

`endpwent()` can be used to close a password file after processing is complete.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`fgetpwent()`

`getpw()`

`fgetpwent()`

`getpwnam()`

`getpwuid()`

`setpwent()`

err(), errx()

Display Error Message

Syntax

```
#include <UNIX/err.h>
void err(int eval, const char *fmt, ...);
void errx(int eval, const char *fmt, ...);
```

Description

The `err()` family of functions displays a formatted error message on the standard error output. In all cases, the last component of the program name, a colon character, and a space are output. If the `fmt` argument is not NULL, the formatted error message is output. In the case of the `err()` function, the error message string affiliated with the current value of the global variable errno is output next, preceded by a colon character and a space if fmt is not NULL. In all cases, the output is followed by a newline character.

These functions do not return, rather they exit with the value of the argument `eval`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`verr(), verrx()`

_errmsg()

Print Error Message

Syntax

```
#include <stdio.h>
int _errmsg(
    int nerr,
    const char *msg,
    [u_int32 arg1,
    u_int32 arg2,
    u_int32 arg3]);
```

For C++ Programmers:
The parameters for this function are *not* optional in C++. You must specify each; if you do not, a compliation error will occur.

Description

`_errmsg()` displays an error message and the program name on the standard error path. For added flexibility in message printing, `msg` can be a conversion string suitable for `fprintf()` with up to three additional parameters of any integral type. `nerr` is returned as the value of the function so `_errmsg()` can be used as a parameter to a function such as `exit()` or `prerr()`.

`nerr`
: specifies the error number returned by `_errmsg()`. (Input)

`msg`
: is a pointer to the error message. (Input)

The message string is displayed in the following format:

```
prog: <message text>
```

`prog`
: is the module name of the program, and `<message text>` is the string pointed to by `msg`.

`[arg1-arg3]`
: Input

Example

Assume the program calling the function is named `foobar`:

Call:	`errmsg(1,"programmed message\n");`
Prints:	`toobar: programmed message`
Call:	`exit(_errmsg(errno, "unknown option '%c'\n",'q'));`
Prints:	`foobar: unknown option 'q'`

Then exits with `errno` as its termination status.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`sys_clib.l`

See Also

`fprintf()`

`_prgname()`

_ev_creat()
Create Event

Syntax

```
#include <events.h>
int _ev_creat(
    int ev_value,
    int wait_inc,
    int signal_inc,
    const char *ev_name);
```

Description

`_ev_creat()` creates an event.

An event ID number is returned if the event is successfully created.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

Refer to the *OS-9 Technical Manual* for more information about events.

`ev_value`
: is the initial value for the event. (Input)

`wait_inc`
: is the wait increment. (Input)

  It is added to the value of the event when a successful `_ev_wait()`, `_ev_waitr()`, `_os_ev_wait()`, or `_os_ev_waitr()` is performed.

`signal_inc`
: is the signal increment. (Input)

  It is added to the value of the event when an `_ev_signal()` or `_os_ev_signal()` is performed.

`ev_name`
: is a pointer to the name for the event. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_ev_signal()`
`_ev_wait()`
`_ev_waitr()`
`_os_ev_creat()`
`_os_ev_signal()`
`_os9_ev_wait()`
`_os_ev_waitr()`

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`	*OS-9 Technical Manual*
`EV_CREAT`	*OS-9 Technical Manual*
`EV_SIGNL`	*OS-9 Technical Manual*
`EV_WAIT`	*OS-9 Technical Manual*
`EV_WAITR`	*OS-9 Technical Manual*

_ev_delete()
Delete Event

Syntax

```
#include <events.h>
int _ev_delete(const char *ev_name);
```

Description

`_ev_delete()` deletes an event. The use count for the event must be zero before the event can be deleted.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`ev_name`
: is a pointer to the name of the event. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ev_delete()`

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`, `EV_DELET`	*OS-9 Technical Manual*

_ev_info()

Get Event Information

Syntax

```
#include <events.h>
```

OS-9:

```
int _ev_info(
            int     ev_index,
            void     *ev_buffer);
```

OS-9 for 68K:

```
int _ev_info(
            int     ev_index,
            ev_infostr *ev_buffer);
```

Description

`_ev_info()` returns information about an event. The event table is indexed from zero to one less than the maximum number of events allowed on the system.

If `ev_index` is greater than all active events in the table, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

The format of the information written to `ev_buffer` is the same regardless of the OS, it matches the OS-9 for 68K `ev_infostr` structure. For OS-9, use `_os_ev_info()` instead of this call.

`ev_index`
: corresponds to the starting point in the event table to search for an event. (Input)

`ev_buffer`
: is a pointer to the event structure buffer where `_ev_info()` will write the event information, if found. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ev_info()`

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`, `EV_INFO`	*OS-9 Technical Manual*

_ev_link()

Link to Existing Event

Syntax

```
#include <events.h>
int _ev_link(const char *ev_name);
```

Description

`_ev_link()` links to an existing event. An event ID number is returned if the event is successfully linked.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`ev_name`
: is a pointer to the name of the event. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ev_link()`	
`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`, `EV_LINK`	*OS-9 Technical Manual*

_ev_pulse()

Signal Event Occurrence

Syntax

```
#include <events.h>
int _ev_pulse(
    int ev_id,
    int ev_value,
    int allflag);
```

Description

`_ev_pulse()` indicates that an event has occurred. The current event value is saved. The event variable is set to the value given by `ev_value`, and the normal signal increment is not applied. The saved event value is restored after activating processes, if any.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`. Refer to your operating system technical manual for more information about events.

`ev_id`
: is the event ID returned from a call to `_ev_creat()`, `_ev_link()`, `_os_ev_creat()`, or `_os_ev_link()`. (Input)

`ev_value`
: sets the value of the event variable. (Input)

`allflag`
: indicates which process(es) to activate. (Input)

  Only the lower 16 bits of `allflag` are used.

  - If `allflag` is zero, the first process waiting for the event is activated.
  - If `allflag` is `0x8000`, all processes waiting for the event that have a value in range are activated.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_ev_creat()`
`_ev_link()`
`_os_ev_creat()`
`_os_ev_link()`
`_os_ev_pulse()`

`F$Event`	*OS-9 Technical Manual*
`F_EVENT`	*OS-9 Technical Manual*
`V_CREAT`	*OS-9 Technical Manual*
`EV_LINK`	*OS-9 Technical Manual*
`EV_PULSE`	*OS-9 Technical Manual*

_ev_read()

Read Event Without Waiting

Syntax

```
#include <events.h>
```

```
int _ev_read(int ev_id);
```

Description

`_ev_read()` reads the value of an event, without waiting for or affecting the event variable, and returns the current value of the event.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`. Clear the global variable `errno` prior to calling `_ev_read()` to distinguish between return of an event value of `-1` and an error.

`ev_id`
identifies the event. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

Example

```
errno = 0;
if ((ev_val = _ev_read(ev_id)) == -1 && errno)
    exit(_errmsg(errno,
     "can't read event value - "));
```

See Also

`_os_ev_read()`

`F$Event`	*OS-9 for 68k Technical Manual*
`F_EVENT`	*OS-9 Technical Manual*
`EV_READ`	*OS-9 Technical Manual*

_ev_set()

Set Event Variable and Signal Event Occurrence

Syntax

```
#include <events.h>
int _ev_set(
    int ev_id,
    int ev_value,
    int allflag);
```

Description

`_ev_set()` indicates that an event has occurred. The event variable is set to the value given by `ev_value`, and the normal signal increment is not applied. Processes waiting for the event are then activated.

OS-9 for 68K Users: `_ev_set()` returns the value of the event before changing to `ev_value`. If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`. Clear the global variable `errno` prior to calling `_ev_set()` to distinguish between return of a prior event value of `-1` and an error.

OS-9 Users: `_ev_set()` returns zero. If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`ev_id`
: is the event ID returned from a call to `_ev_creat()`, `_ev_link()`, `_os_ev_creat()`, or `_os_ev_link()`. (Input)

`ev_value`
: sets the value of the event variable. (Input)

`allflag`
: specifies the process(es) to activate. (Input)

Only the lower 16 bits of `allflag` are used.

- If `allflag` is zero, the first process waiting for the event is activated.
- If `allflag` is `0x8000`, all processes waiting for the event that have a value in range are activated.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_ev_creat()`
`_ev_link()`
`_os_ev_creat()`
`_os_ev_link()`
`_os_ev_set()`

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`	*OS-9 Technical Manual*
`EV_CREAT`	*OS-9 Technical Manual*
`EV_LINK`	*OS-9 Technical Manual*
`EV_SET`	*OS-9 Technical Manual*

_ev_setr()

Set Relative Event Variable and Signal Event Occurrence

Syntax

```
#include <events.h>
int _ev_setr(
    int ev_id,
    int ev_value,
    int allflag);
```

Description

`_ev_setr()` indicates that an event has occurred. The event variable is incremented by the value given by `ev_value`. Processes waiting for the event are then activated.

OS-9 for 68K Users: `_ev_setr()` returns the value of the event before changing by `ev_value`. If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`. Clear the global variable `errno` prior to calling `_ev_setr()` to distinguish between return of a prior event value of `-1` and an error.

OS-9 Users: `_ev_setr()` returns `0`. If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`ev_id`
: is the event ID returned from a call to `_ev_creat()`, `_ev_link()`, `_os_ev_creat()`, or `_os_ev_link()`. (Input)

`ev_value`
: specifies the amount to increment the event variable. (Input)

`allflag`
: specifies the process(es) to activate. (Input)

  Only the lower 16 bits of `allflag` are used.

  - If `allflag` is zero, the first process waiting for the event is activated.
  - If `allflag` is `0x8000`, all processes waiting for the event that have a value in range are activated.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

_ev_creat()
_ev_link()
_os_ev_creat()
_os_ev_link()
_os_ev_setr()

F$Event	*OS-9 for 68K Technical Manual*
F_EVENT	*OS-9 Technical Manual*
EV_CREAT	*OS-9 Technical Manual*
EV_LINK	*OS-9 Technical Manual*
EV_SETR	*OS-9 Technical Manual*

_ev_signal()

Signal Event Occurrence

Syntax

```
#include <events.h>
int _ev_signal(
    int ev_id,
    int allflag);
```

Description

`_ev_signal()` indicates that an event has occurred. The current event variable is updated by the signal increment which was given when the event was created.

OS-9 for 68K Users: `_ev_signal()` returns the value of the event before incremented by the signal increment. If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`. Clear the global variable `errno` prior to calling `_ev_signal()` to distinguish between return of a prior event value of `-1` and an error.

OS-9 Users: `_ev_signal()` returns zero. If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`ev_id`
: is the event ID returned from a call to `_ev_creat()`, `_ev_link()`, `_os_ev_creat()`, or `_os_ev_link()`. (Input)

`allflag`
: specifies the process(es) to activate. (Input)

  Only the lower 16 bits of `allflag` are used.

  - If `allflag` is zero, the first process waiting for the event is activated.
  - If `allflag` is `0x8000`, all processes waiting for the event that have a value in range are activated.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_ev_creat()`
`_ev_link()`
`_os_ev_creat()`
`_os_ev_link()`
`_os_ev_signal()`

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`	*OS-9 Technical Manual*
`EV_CREAT`	*OS-9 Technical Manual*
`EV_LINK`	*OS-9 Technical Manual*
`EV_SIGNL`	*OS-9 Technical Manual*

_ev_unlink()

Unlink Event

Syntax

```
#include <events.h>

int _ev_unlink(int ev_id);
```

Description

`_ev_unlink()` decrements the link count of an event. When the link count becomes zero, you can delete the event using `_ev_delete()` or `_os_ev_delete()`.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`ev_id`
: specifies the event ID.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_ev_delete()`

`_os_delete()`

`_os_ev_unlink()`

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`	*OS-9 Technical Manual*
`EV_DELET`	*OS-9 Technical Manual*
`EV_UNLNK`	*OS-9 Technical Manual*

_ev_wait()

Wait for Event

Syntax

```
#include <events.h>

int _ev_wait(
    int ev_id,
    int ev_min,
    int ev_max);
```

Description

`_ev_wait()` waits for an event to occur. The event value is compared to the range values specified by `ev_min` and `ev_max`. If the event value is not in the specified range, the process waits until some other process places the value within the range. Once in range, the wait increment is applied to the event value. The actual event value is returned as the value of the function.

`_ev_wait()` returns the value of the event after completion of wait. If an error occurs, `-1` is returned and the appropriate error code is placed in `errno`. Clear the global variable `errno` prior to calling `_ev_wait()` to distinguish between return of a current event value of `-1` and an error. Further, if a signal was received by the process, the event value returned is outside of the range `ev_min` to `ev_max`.

```
errno = 0;
if ((ev_val = _ev_wait(ev_id, -5, 0)) == -1 && errno)
     exit(_errmsg(errno,
          "error waiting on event - "));
if (ev_val < -5 || ev_val > 0)
    _errmsg(1,
    "received signal while waiting for event\n");
```

`ev_id`
: specifies the event ID. (Input)

`ev_min`
: specifies the minimum range value for the event. (Input)

`ev_max`
: specifies the maximum range value for the event. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ev_wait()`
`_os9_ev_wait()`

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`	*OS-9 Technical Manual*
`EV_WAIT`	*OS-9 Technical Manual*

_ev_waitr()

Wait for Relative Event

Syntax

```
#include <events.h>
int _ev_waitr(
    int ev_id,
    int ev_min,
    int ev_max);
```

Description

`_ev_waitr()` waits for the specified event to occur. The event value is compared to the relative values specified by `ev_min` and `ev_max`. The current event value is added to the range values before the comparison. If the event value is not in the specified range, the process waits until some other process places the value within the range. Once in range, the wait increment is applied to the event value. The actual event value is returned as the value of the function.

`_ev_waitr()` returns the value of the event after completion of the wait. If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`. Clear the global variable `errno` prior to calling `_ev_waitr()` to distinguish between return of a current event value of `-1` and an error. Further, if a signal was received by the process, the event value returned is outside of the relative range `ev_min` to `ev_max`.

`ev_id`
: specifies the event ID for the event. (Input)

`ev_min`
: specifies the minimum range value for the event. (Input)

`ev_max`
: specifies the maximum range value for the event. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ev_waitr()`

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`, `EV_WAITR`	*OS-9 Technical Manual*

execl()

Calls a File With Variable Arguments

Syntax

```
#include <UNIX/os9def.h>
int execl(
    const char *path,
    const char *arg0,
    ...);
```

Description

`execl()` is the UNIX-like exec interface to the `_os_chain()` system call.

`arg0` (input), and any additional variable arguments, are the arguments to pass to the chained process. `arg0` is conventionally the name of the chained program. The list of variable arguments is terminated by a NULL entry.

The global variable `_environ` is used for the environment for the call to `_os_chain()`.

`execl()` returns `-1` and sets the global variable `errno` to indicate an error. `execl()` only returns an error if setting up for the `_os_chain()` call fails. Once an attempt to chain occurs, the process exits if any error occurs.

- To use `execl()` link with `unix.l`.
- A threaded process may only chain from the `main()` thread and may not chain if multiple threads are active in the process.
- `_os_chain()` does not do the normal PATH searching that the `shell` does.

`path`
: is the pathlist to the program on which to chain. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`execle()`
`execv()`
`execvp()`

execle()

Calls a File With Variable Arguments

Syntax

```
#include <UNIX/os9def.h>
int execle(
    const char *path,
    const char *arg0,
    ...,
    const char *envp[]);
```

Description

`execle()` is the UNIX-like exec interface to the `_os_chain()` system call.

The list of variable arguments is terminated by a `NULL` entry. The `NULL` entry is followed by an environment pointer to use for the call to `_os_chain()`. `envp` is a pointer to an array of strings that constitute the environment of the process.

`execle()` returns `-1` and sets the global variable `errno` to indicate an error. `execle()` only returns an error if setting up for the `_os_chain()` call fails. Once an attempt to chain occurs, the process exits if any error occurs.

- To use `execl()`, link with `unix.l`.
- A threaded process may only chain from the `main()` thread and may not chain if multiple threads are active in the process.
- `_os_chain()` does not do the normal PATH searching that the `shell` does.

`path`

is the pathlist to the program on which to chain. (Input)

`arg0`

is conventionally the name of the chained program. (Input)

`arg0`, and any additional variable arguments, are the arguments to pass to the chained process.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`execl()`   `execv()execvp()`

execv()

Calls a File With an Argument Vector

Syntax

```
#include <UNIX/os9def.h>
int execv(
    const char *path,
    char *const argv[]);
```

Description

`execv()` is a UNIX-like interface to the `_os_chain()` system call. The argument to `execv()` is an argument vector to pass to the chained process and the path to the program on which to chain. The last argument should be a `NULL` entry.

- To use `execv()`, link with `unix.l`.
- `_os_chain()` does not do the normal PATH searching that the `shell` does.
- A threaded process may only chain from the `main()` thread and may not chain if multiple threads are active in the process.

`argv[0]`
: is the name of the program being chained to. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

See Also

`execl()`

`execle()`

`execvp()`

execve()

Calls a File With an Argument Vector

Syntax

```
#include <UNIX/os9def.h>
int execv(
    const char *path,
    char *const argv[],
    char *const envp[]);
```

Description

`execve()` is a UNIX-like interface to the `_os_chain()` system call. The argument to `execve()` is an argument vector to pass to the chained process and the path to the program on which to chain. The last argument should be a `NULL` entry.

- To use `execve()`, link with `unix.l`.
- `_os_chain()` does not do the normal PATH searching that the `shell` does.
- A threaded process may only chain from the `main()` thread and may not chain if multiple threads are active in the process.

`path`
: is the pathlist to the program on which to chain. (Input)

`argv[0]`
: is the name of the program being chained to. (Input)

  `envp` is a pointer to a null-terminated array of character pointers to null-terminated strings. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

See Also

`execl()`

`execle()`

`execvp()`

execvp()

Calls a File With an Argument Vector

Syntax

```
#include <UNIX/os9def.h>
int execvp(
    const char *file,
    char *const argv[]);
```

Description

`execvp()` is a UNIX-like interface to the `_os_chain()` system call. The argument to `execvp()` is an argument vector to pass to the chained process and the path to the program to chain to. The last argument should be a `NULL` entry.

- To use `execve()`, link with `unix.l`.
- `_os_chain()` does not do the normal PATH searching that the `shell` does.
- A threaded process may only chain from the `main()` thread and may not chain if multiple threads are active in the process.

`fileInput`

`argv[0]`
: is the name of the program being chained to. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

See Also

`execl()`

`execle()`

`execv()`

_exit()
Task Termination

Syntax

```
#include <stdlib.h>
void _exit(int status);
```

Description

`_exit()` immediately terminates a program.

An exit `status` of zero is considered normal termination. Most programs (especially the `shell`) interpret a non-zero value as an error code.

`_exit()` cannot return to its caller, and it does not flush and close standard I/O buffers.

`status`
: is the exit status. (Input)

  The parent process can use `status` to determine the program's success or failure.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_exit()`	
`F$Exit`	*OS-9 for 68K Technical Manual*
`F_EXIT`	*OS-9 Technical Manual*

exit()

Task Termination

Syntax

```
#include <stdlib.h>
```

```
void exit(int status);
```

Description

`exit()` is the normal means of terminating a task. All functions specified by `atexit()` are called in the reverse order of the order in which they were specified.

All open streams with unwritten buffered data are flushed, all open streams are closed, and all files created by `tmpfile()` are removed. Control is returned to the host environment.

`exit()` cannot return to its caller.

`status`
: is the exit status. (Input)

- If `status` is zero or `EXIT_SUCCESS`, zero is communicated to the parent process executing the `_os_wait()`.
- If `status` is `EXIT_FAILURE`, one is communicated.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`atexit()`
`_os_exit()`
`_os_wait()`
`tmpfile()`

`F$Exit`	*OS-9 for 68K Technical Manual*
`F_EXIT`	*OS-9 Technical Manual*

exp()

Exponential Function

Syntax

```
#include <math.h>

double exp(double x);
```

Description

`exp()` returns the exponential function of `x` (input), `e` (2.71828..) raised to the `x` power. A range error, `ERANGE` stored in `errno`, occurs if the magnitude of `x` is too large. In this case, `exp()` returns `HUGE_VAL`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

Possible Error

`ERANGE`

fabs()
Floating Absolute Value

Syntax

```
#include <math.h>
double fabs(double x);
```

Description

`fabs()` returns the absolute value of `x` (input).

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

fclose()
Close File

Syntax

```
#include <stdio.h>
int fclose(FILE *stream);
```

Description

`fclose()` flushes the file pointed to by `stream` and closes the associated file. Any unwritten buffered data for the stream are written to the file; any unread buffered data are discarded. The stream is disassociated from the file. If the associated buffer was automatically allocated, it is deallocated. If `stream` was returned from `tmpfile()`, it is deleted.

`fclose()` returns zero if the stream was successfully closed. Otherwise, `EOF` is returned.

The `sclib.l` and `sclib.il` libraries contain a smaller version of the `fclose()` function. Refer to the *Using Ultra C/C++* manual for more information about the small library functions.

`stream`
: is a pointer to the C I/O `FILE` structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fflush()`

`fopen()`

`getc()`, `getchar()`

`putc()`, `putchar()`

`tmpfile()`

fdopen()

Attach Path to File Pointer

Syntax

```
#include <stdio.h>
FILE *fdopen(
    int path,
    const char *action);
```

Description

`fdopen()` returns a file pointer to the file specified by a currently open path.

Use `fdopen()` when you require some special processing not provided by `fopen()` for opening files.

`path`
: is the path to attach. (Input)

`action`
: is a pointer to the file action string. (Input)

The `action` must be compatible with the access mode of the given path. The valid actions are listed in Table 2-3.

Action	Description
`r`	Open for reading
`w`	Open for writing
`a`	Append (write) at the end of the file or create file for writing if path does not exist
`r+`	Open for update
`w+`	Create for update
`a+`	Create or open for update at end of file
`d`	Directory read

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`sys_clib.l`

See Also

`fopen()` `freopen()`

feof()

Check Buffered File for End of File

Syntax

```
#include <stdio.h>
int feof(FILE *stream);
```

Description

`feof()` tests the end-of-file indicator for the specified stream. `feof()` returns a non-zero value only if the end-of-file indicator is set for `stream`.

`stream`
is a pointer to the C I/O `FILE` structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`clearerr()`

`fopen()`

ferror()

Check Buffered File for Error Condition

Syntax

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

```
int ferror(FILE *stream);
```

Description

`ferror()` tests the error indicator for the specified stream. `ferror()` returns a non-zero value only if the error indicator is set for `stream`.

`stream`
: is a pointer to the C I/O `FILE` structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`clearerr()`

`fopen()`

fflush()

Flush File's Buffer

Syntax

```
#include <stdio.h>
int fflush(FILE *stream);
```

Description

`fflush()` writes any unwritten data for the specified stream to the file. Unwritten data is written if the stream was opened in either `write` or `update` mode.

`fflush()` returns `EOF` if a write error occurs or if the stream is read-only. Otherwise, it returns zero.

`stream`
: is a pointer to the C I/O `FILE structure`. (Input)

  If `stream` is a null pointer, `fflush()` performs this flushing action on all streams opened in either `write` or `update` mode and containing unwritten data.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fopen()`

`getc(), getchar()`

`putc(), putchar()`

ffs()

Find First Set Bit

Syntax

```
#include <UNIX/os9def.h>

int ffs(unsigned int i);
```

Description

`ffs()` finds the first bit set in the argument passed to it and returns the index of that bit. Bits are numbered starting at one (1) from the least significant. A return value of zero indicates that the value passed to the function was zero.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

fgetc()

Get Character from File

Syntax

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

```
int fgetc(FILE *stream);
```

Description

`fgetc()` returns a character, as an unsigned converted to an `int`, from the file and advances the associated file position indicator for the stream, if defined.

`stream`

is a pointer to the C I/O `FILE` structure. (Input)

If the stream is at end-of-file, the end-of-file indicator for the stream is set and `fgetc()` returns `EOF`. If a read error occurs, the error indicator for the stream is set and `fgetc()` returns `EOF`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`getc()`, `getchar()`

fgetpos()

Get Current Position in File

Syntax

```
#include <stdio.h>
int fgetpos(
    FILE *stream,
    fpos_t *pos);
```

Description

`fgetpos()` stores the current value of the file position indicator. The stored value contains information usable by `fsetpos()` for repositioning the stream to its position at the time of the `fgetpos()` call. If successful, `fgetpos()` returns zero. Otherwise, it returns a non-zero value and the appropriate error code is placed in the global variable `errno`.

`stream`
: is a pointer to the C I/O `FILE` structure. (Input)

`pos`
: is a pointer to the file position indicator. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fsetpos()`

fgetpwent()

Get Password File Entry

Syntax

```
#include <UNIX/pwd.h>
struct passwd *fgetpwent(FILE *f);
```

Description

`fgetpwent()` returns a pointer to the next password structure in the stream (`f`), which matches the format of the password file `/dd/SYS/password`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`endpwent()`
`getpw()`
`getpwent()`
`getpwnam()`
`getpwuid()`
`setpwent()`

fgets()
Get String from File

Syntax

```
#include <stdio.h>
char *fgets(
    char *ptr,
    int cnt,
    FILE *stream);
```

Description

`fgets()` reads at most one less than the specified number of characters from the stream into an array. No additional characters are read after a newline character (which is returned) or after end-of-file. A null character is added to the end of the string.

`fgets()` returns `ptr` if successful. If the end-of-file is encountered and no characters have been read into the array, the contents of the array remain unchanged and a null pointer is returned. If a read error occurs during the operation, the array contents are indeterminate and a null pointer is returned.

`ptr`
: is a pointer to the array into which to read the characters. (Output)

`cnt`
: is the number of characters to read. (Input)

`stream`
: is a pointer to the C I/O `FILE` structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`clib.l`

See Also

`fgetc()`

_fileno(), fileno()

Determine Path Number from File

Syntax

```
#include <stdio.h>
int _fileno(FILE *stream);
int fileno(FILE *stream);
```

Description

`_fileno()` returns the path number associated with the specified file pointer. The path number is not valid unless `(stream->_flag & _INIT)` is non-zero. This call is only available as a macro.

If you are executing the compiler in strictly conforming ANSI mode, only `_fileno()` is available. Otherwise, both calls are available.

`stream`
: is a pointer to the C I/O `FILE` structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

These macros are defined in the `stdio.h` header file.

See Also

`fopen()`

`freopen()`

findnstr()

Search String for Pattern

Syntax

```
#include <strings.h>
int findnstr(
    int pos,
    const char *string,
    const char *pattern,
    int len);
```

Description

`findnstr()` searches the string for the first occurrence of the pattern. It starts at position `pos` (where the first position is one, not zero). The returned value is the position of the first matched character of the pattern in the string, or zero if a match is not found. `findnstr()` stops searching at `len`; it may continue past null bytes.

The current implementation does not use the most efficient pattern matching algorithm. `strstr()` is preferred for very long strings.

`pos`
: specifies the starting position. (Input)

`string`
: is a pointer to the string to search. (Input)

`pattern`
: is a pointer to the pattern to use for the search. (Input)

`len`
: specifies the final position to be searched. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`findstr()`

`strstr()`

findstr()

Search String for Pattern

Syntax

```
#include <strings.h>
int findstr(
    int pos,
    const char *string,
    const char *pattern);
```

Description

`findstr()` searches the string for the first instance of the pattern. It starts at position `pos` (where the first position is one, not zero). The returned value is the position of the first matched character of the pattern in the string, or zero if a match is not found. `findstr()` stops searching when a null byte is found in `string`.

The current implementation does not use the most efficient pattern matching algorithm. `strstr()` is preferred for very long strings.

`pos`
: specifies the starting position. (Input)

`string`
: is a pointer to the string to search. (Input)

`pattern`
: is a pointer to the pattern to use for the search. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`findnstr()`

`strstr()`

floor()
Floor Function

Syntax

```
#include <math.h>
double floor(double x);
```

Description

`floor()` returns the largest integer, as a `double`, that is not greater than `x` (input).

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`ceil()`

fmod()

Compute Floating Point Remainder

Syntax

```
#include <math.h>
double fmod(
    double x,
    double y);
```

Description

`fmod()` computes the floating-point remainder of `x` (input) divided by `y` (input). If `y` is non-zero, `fmod()` returns the value with the same sign as `x` and a magnitude less than the magnitude of `y`. If `y` is zero, zero is returned.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

Possible Error

`EDOM`

fopen()
Open File

Syntax

```
#include <stdio.h>
FILE *fopen(
    const char *name,
    const char *mode);
```

Description

`fopen()` opens a file and associates a stream with it. If an error occurs, `fopen()` returns NULL.

When opened, a stream is fully buffered only if it does not refer to an interactive device. The error and end-of-file indicators for the stream are cleared.

Three file pointers are available and are considered open the moment the program runs:

`stdin`	standard inputI/O is to path 0
`stdout`	standard outputI/O is to path 1
`stderr`	standard errorI/O is to path 2

These macros are defined in the `stdio.h` header file.

You cannot open a directory for writing with `fopen()`.

`name`
: is a pointer to the name of the file. (Input)

`mode`
: is a pointer to the access mode. (Input)

`mode` may be one of the following:

Table 2-2. Mode Options

Mode	Description
`r`	Open text file for reading
`w`	Truncate to zero length or create text file for writing
`a`	Append; open or create text file for writing at end-of-file
`rb`	Open binary file for reading
`wb`	Truncate to zero length or create binary file for writing
`ab`	Append; open or create binary file for writing at end-of-file
`r+`	Open text file for update (reading and writing)
`w+`	Truncate to zero length or create text file for update

Table 2-2. Mode Options (Continued)

Mode	Description
`a+`	Append; open or create text file for update, writing at end-of-file
`r+b, rb+`	Open binary file for update (reading and writing)
`w+b, wb+`	Truncate to zero length or create binary file for update (reading and writing).
`a+b, ab+`	Append; open or create binary file for update, writing at end-of-file
`d`	Directory read (OS-9 extension); this is only available in K & R source mode.

Appending an `x` to any action(s) indicates that names are relative to the current execution directory. The `x` also implies that the file should have the execute permission bit set. This option is only available for OS-9 in non-ANSI mode.

In modes other than compatibility mode, appending a `d` to any action(s) indicates that the file is a directory.

`mode` must point to a string and not a character; `fopen("fun","r")` is correct, `fopen("fun",'r')` is not correct. If the file does not exist or cannot be read, opening a file with read mode fails.

On OS-9 for 68K systems, when you open a file with append mode, the file position indicator is initially positioned at the beginning of the file. However, all subsequent writes to the file are forced to the then current end-of-file, regardless of intervening calls to `fseek()`. On OS-9 systems, if the append mode bit is set and the target file already exists, the file is opened and the associated file pointer points to the end of the file. If an error occurs when opening a file with append mode, refer to `fopen` Append Bit subsection in the appropriate processor-specific chapter of the *Ultra C/C++ Processor Guide*.

When a file is opened with update mode, both input and output may be performed on the associated stream. However, output may not be directly followed by input without an intervening call to `fflush()` or to a file positioning function (`fseek()`, `fsetpos()`, or `rewind()`). Likewise, input may not be directly followed by output without an intervening call to a file positioning function, unless the input operation encounters end-of-file.

Example

Examples using `fopen()` are found in Table 2-3.

Table 2-3. fopen() Examples

`fp = fopen(fred,wx);`	Creates a file for writing in the execution directory
`fp = fopen(moe,r);`	Opens an existing file for reading
`fp = fopen(stooge/curly,w+);`	Creates a file for reading and writing

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`creat()`

`fflush()`

`fseek()`

`getc(), getchar()`

`open()`

`_os_create()`

`_os9_create()`

`_os_open()`

`putc(), putchar()`

fparseln()

Return Next Logical Line from a Stream

Syntax

```
#include <UNIX/util.h>

char *fparseln(FILE *stream, size_t *len, size_t *lineno, const char
delim[3],
     int flags);
```

Description

The `fparseln()` function returns a pointer to the next logical line from the stream referenced by `stream`. This string is NUL terminated and it is dynamicaly allocated on each invocation. It is the responsibility of the caller to free the pointer.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`util.l`

fprintf()

Formatted Output

Syntax

```
#include <stdio.h>
int fprintf(
   FILE *stream,
   const char *format, ...);
```

Description

`printf()`, `fprintf()`, and `sprintf()` are standard C library functions that perform formatted output. Each of these functions converts, formats, and prints any parameters as indicated by the control string.

`fprintf()` writes output to a stream.

`fprintf()` returns when the end of the format string is encountered.

A format specification consists of a percent (`%`) character followed by (in this order):

1. Zero or more flags that modify the meaning of the conversion specification. You may use the following flags in any order:

Table 2-4. fprintf() Flags

Flag	Description
`-`	The result of the conversion is left-justified within the field. If this flag is not specified, the result is right-justified.
`+`	The result of a signed conversion always begins with a plus or minus sign. If this flag is not specified, the result begins with a sign only when a negative value is converted.
`space`	If the first character of a signed conversion is not a sign or if a signed conversion results in no characters, a space is prefixed to the result. If the space and + flags both appear, the space flag is ignored.
`#`	The result is to be converted to an alternate form. For `o` conversion, it increases the precision to force the first digit of the result to zero. For `x` (or `X`) conversion, a non-zero result has a `0x` (or `0X`) prefix. For `e`, `E`, `f`, `g`, and `G` conversions, the result always contains a decimal point character, even if no digits follow. Normally, a decimal point character appears in the result of these conversions only if a digit follows it. For `g` and `G` conversions, trailing zeros are not removed from the result. For other conversions, the behavior is undefined.
`0`	For `d`, `i`, `o`, `u`, `x`, `X`, `e`, `E`, `f`, `g`, and `G` conversions, leading zeros, following any indication of sign or base, pad the field width; no space padding is performed. If the `0` and - flags both appear, the `0` flag is ignored. For `d`, `i`, `o`, `u`, `x`, and `X` conversions, the `0` flag is ignored if a precision is specified. For other conversions, the behavior is undefined.

2. An optional minimum field width. If the converted value has fewer characters than the field width, it is padded with spaces (by default) on the left (or right, if the left adjustment flag has been given) to the field width. The field width takes the form of an asterisk `(*)` or a decimal integer.

3. An optional precision that gives:

   - The minimum number of digits to appear for the `d`, `i`, `o`, `u`, `x`, and `X` conversions.
   - The number of digits to appear after the decimal point character for `e`, `E`, and `f` conversions.
   - The maximum number of significant digits for the `g` and `G` conversions.
   - The maximum number of characters to be written from a string in `s` conversion.

   The precision takes the form of a period `(.)` followed either by an asterisk `(*)` or by an optional decimal integer. If only the period is specified, the precision is taken as zero. If a precision appears with any other conversion specifier, the behavior is undefined.

4. An optional `h`, `l`, or `L` that specifies:

   Table 2-5. Optional Flags for fprintf()

Flag	Description
`h`	The following `d`, `i`, `o`, `u`, `x`, or `X` conversion specifier applies to a `short int` or an `unsigned short int` parameter, or the following `n` conversion specifier applies to a pointer to a `short int` parameter.
`l`	The following `d`, `i`, `o`, `u`, `x`, or `X` conversion specifier applies to a `long int` or an `unsigned long int` parameter, or the following `n` conversion specifier applies to a pointer to a `long int` parameter.
`L`	The following `e`, `E`, `f`, `g`, or `G` conversion specifier applies to a `long double` parameter. The following `d`, `i`, `o`, `u`, `x` or `X` conversion specifier applies to a `long long int` parameter.

   If an `h`, `l`, or `L` appears with any other conversion specifier, the behavior is undefined.

5. A character that specifies the type of conversion to apply.

   An asterisk `(*)` may indicate the field width, precision, or both. In this case, an `int` parameter supplies the field width or precision. The parameters specifying field width, precision, or both appear in that order before the parameter, if any, to convert.

   A negative field width parameter is taken as a `-` flag followed by a positive field width.

   A negative precision parameter is taken as if the precision was omitted.

The conversion specifiers and their meanings are:

Table 2-6. fprint() Conversion Specifiers

Flag	Description
`c`	The `int` parameter is converted to an `unsigned char`, and the resulting character is written.
`d, i`	The `int` parameter is converted to a signed decimal in the style `[-]dddd`. The precision specifies the minimum number of digits to appear. If the value being converted can be represented in fewer digits, it is expanded with leading zeros. The default precision is `1`. The result of converting a zero value with a precision of zero is no characters.
`e, E`	The `double` parameter is converted in the style `[-]d.ddde±dd`, where there is one digit before the decimal point character (which is non-zero if the parameter is non-zero) and the number of digits after the decimal point character is equal to the precision. The default precision is `6`. If the precision is zero and the `#` flag is not specified, no decimal point character appears. The value is rounded to the appropriate number of digits. The `E` conversion specifier produces a number with `E` instead of `e` introducing the exponent. The exponent always contains at least two digits. If the value is zero, the exponent is zero.
`f`	The `double` parameter is converted to decimal notation in the style `[-]ddd.ddd`. The number of digits after the decimal point character is equal to the precision specification. The default precision is `6`. If the precision is zero and the `#` flag is not specified, no decimal point character appears. If a decimal point character appears, at least one digit appears before it. The value is rounded to the appropriate number of digits.
`g, G`	The `double` parameter is converted in the style `f` or `e` (or in style `E` in the case of a `G` conversion specifier), with the precision specifying the number of significant digits. If the precision is zero, it is taken as one. The style used depends on the value converted; style `e` (or `E`) is used only if the exponent resulting from the conversion is less than `-4` or greater than or equal to the precision. Trailing zeros are removed from the fractional portion of the result. A decimal point character appears only if it is followed by a digit.
`n`	The parameter is a pointer to an integer into which is written the number of characters written to the output stream so far by this call to `fprintf()`. No parameter is converted.
`o, u, x, X`	The `unsigned int` parameter is converted to unsigned octal (`o`), unsigned decimal (`u`), or unsigned hexadecimal notation (`x` or `X`) in the style `dddd`. The letters `abcdef` are used for `x` conversion and letters `ABCDEF` for `X` conversion. The precision specifies the minimum number of digits to appear. If the value being converted can be represented in fewer digits, it is expanded with leading zeros. The default precision is one. The result of converting a zero value with a precision of zero is no characters.
`p`	The parameter is a pointer to a `void`. The pointer value is converted to a sequence of printable characters as an unsigned hexadecimal integer.

Table 2-6. fprint() Conversion Specifiers (Continued)

Flag	Description
`s`	The parameter is a pointer to an array of character type. Characters from the array are written up to, but not including, a terminating null character. If the precision is specified, no more than that many characters are written. If the precision is not specified or is greater than the size of the array, the array contains a null character.
`%`	A `%` is written. No parameter is converted. The complete conversion specification is `%%`.

If a conversion specification is invalid, the behavior is undefined.

If any parameter is, or points to, a union or an aggregate (except for an array of character type using `%s` conversion or a pointer using `%p` conversion), the behavior is undefined.

A non-existent or small field width never truncates a field. If the result of a conversion is wider than the field width, the field expands to contain the conversion result.

`fprintf()` returns the number of characters transmitted, or a negative value if an output error occurred.

The `sclib.l` and `sclib.il` libraries contain a smaller version of the `fprintf()` function. Refer to the *Using Ultra C/C++* manual for more information about the small library functions.

`stream`
: is a pointer to the C I/O `FILE` structure. (Output)

`format`
: is a pointer to a control string. (Input)

`format` determines the format, type, and number of parameters that the function expects. If the control string does not correctly match the parameters, the results are not predictable.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`printf()` `sprintf()`

fputc()

Output Character to File

Syntax

```
#include <stdio.h>
int fputc(
    int chr,
    FILE *stream);
```

Description

`fputc()` converts a character to an `unsigned char`. It writes the character to the output stream at the position indicated by the associated file position indicator for the stream, if defined, and advances the indicator appropriately. If the file cannot support positioning requests or the stream is opened in append mode, the character is appended to the output stream. `fputc()` returns the character written. If a write error occurs, the error indicator for the stream is set and `fputc()` returns `EOF`.

`chr`	is the character to convert. (Input)
`stream`	is a pointer to the C I/O `FILE` structure. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fgetc()`

fputs()
Output String to File

Syntax

```
#include <stdio.h>
int fputs(
    const char *str,
    FILE *stream);
```

Description

`fputs()` writes a string to a stream. The terminating null character is not written.

`fputs()` returns `EOF` if a write error occurs. Otherwise, it returns a non-negative value.

`str`
: is a pointer to the string. (Input)

`stream`
: is a pointer to the stream to write. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fgets()`

fread()

Read Data from File

Syntax

```
#include <stdio.h>
int fread(
void *ptr,
size_t size,
size_t nmemb,
FILE   *stream);
```

Description

`fread()` reads up to `nmemb` elements into an array. The file position indicator for the stream, if defined, is advanced by the number of characters successfully read. If an error occurs, the resulting value of the file position indicator for the stream is indeterminate. If a partial element is read, its value is indeterminate.

`fread()` returns the number of elements successfully read, which may be less than `nmemb` if a read error or end-of-file is encountered. If `size` or `nmemb` is zero, `fread()` returns zero and the array contents and stream state remain unchanged.

The `sclib.l` and `sclib.il` libraries contain a smaller version of the `fread()` function. Refer to the *Using Ultra C/C++* manual for more information.

`ptr`
: is a pointer into the array. (Output)

`size`
: specifies the size of each array element. (Input)

`nmemb`
: specifies the number of array elements to read. (Input)

`stream`
: is a pointer to the C I/O `FILE` structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fwrite()`

free()

Return Memory

Syntax

```
#include <stdlib.h>
void free(void *ptr);
```

Description

`free()` deallocates the space pointed to by `ptr`. If `ptr` (input) is a null pointer, no action occurs. Otherwise, if the parameter does not match a pointer previously returned by `calloc()`, `malloc()`, or `realloc()`, or if the space has been deallocated by a call to `free()` or `realloc()`, the behavior is undefined.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	no
Standards:	ANSI

Library

`clib.l`

See Also

`calloc()`

`malloc()`

`realloc()`

_freemem(), freemem()

Determine Size of Unused Stack Area

Syntax

```
#include <stdlib.h>
```

```
int freemem(void);
```

```
int _freemem(void);
```

Description

`freemem()` returns the number of bytes allocated for the stack that have not been used. If compiler stack checking is enabled, the stack is checked for possible overflow before entering a function. The lowest address the stack pointer has reached is retained so `freemem()` can report the number of bytes between the stack limit and the lowest stack value as the unused stack memory.

The program must be compiled with stack checking code in effect for `freemem()` to return a correct result. `freemem()` is historical; avoid using it in new code as it is likely to be removed in a future release. These calls are not available when compiled in strictly conforming ANSI mode.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`cstart.r`

See Also

`stacksiz(), _stacksiz()`

_freemin()

Set Memory Reclamation Bound

Syntax

```
#include <stdlib.h>
void _freemin(int size);
```

Description

`_freemin()` allows you to set the minimum size for a free block of memory or concatenation of free blocks for `free()` to return to the operating system. If a program is known to use a lot of memory, you can instruct `free()` never to return memory to the operating system.

You do not need to use `_freemin()` to return memory to the system. The default minimum size to return is 4K. `_freemin()` ignores any specified non-negative `size` smaller than 4K.

`size`
: is the minimum size for a free block of memory or the concatenation of free blocks. (Input)

- If `size` is positive, it is used as the minimum number of bytes for a free block of memory to be a candidate for return to the operating system.
- If `size` is negative, `free()` never tries to return memory allocated by the ANSI memory allocation functions (`calloc()`, `malloc()`, or `realloc()`) to the system.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`calloc()`

`free()`

`malloc()`

`realloc()`

freopen()

Re-Open File

Syntax

```
#include <stdio.h>
FILE *freopen(
    const char *name,
    const char *action,
    FILE *stream);
```

Description

`freopen()` substitutes a file name for the file currently open, if any. The original file is closed, even if the opening of the new file does not succeed.

`freopen()` is usually used to associate the `stdin`, `stdout`, or `stderr` file pointers with a file instead of a terminal device. It returns the `stream` passed or a null pointer if the open fails.

`name`
: is a pointer to the file name to use for a substitute. (Input)

`action`
: specifies the action to take. (Input)

  Refer to `fopen()` for details on the action values.

`stream`
: is a pointer to the C I/O `FILE` structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fopen()`

frexp()

Return Portions of Floating Point Number

Syntax

```
#include <math.h>

double frexp(
    double value,
    int *exp);
```

Description

`frexp()` breaks a floating point value into a normalized fraction and an integral exponent of two. `frexp()` returns the fraction `x`, such that `1/2 <= x < 1` and `value = x * 2^exp`.

`value`
: is the floating point value. (Input)

`exp`
: is a pointer to the integral exponent of two. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

fscanf()

Input String Conversion

Syntax

```
#include <stdio.h>
int fscanf(
    FILE *stream,
    const char *format, ...);
```

Description

`fscanf()` reads input from a stream.

The format is a multibyte character sequence, beginning and ending in its initial shift state. The format is composed of zero or more directives:

- One or more white space characters.
- An ordinary multibyte character (neither `%` nor a white space character).
- A conversion specification.

A percent (`%`) character introduces each conversion specification. After the `%`, the following appear in sequence:

- An optional assignment-suppressing asterisk (`*`) character.
- An optional non-zero decimal integer that specifies the maximum field width.
- An optional `h`, `l`, or `L` indicating the size of the receiving object.

  The conversion specifiers `d`, `i`, and `n` are preceded by `h` if the corresponding parameter is a pointer to a `short int` rather than pointing to `int`, by `l` if it is a pointer to a `long int` or by `L` if it is a pointer to `long long int`.

  The conversion specifiers `o`, `u`, and `x` are preceded by `h` if the corresponding parameter is a pointer to an `unsigned short int` rather than pointing to an `unsigned int`, by `l` if it is a pointer to an `unsigned long int` or by `L` if it is a pointer to an `unsigned long long int`.

  The conversion specifiers `e`, `f`, and `g` are preceded by `l` if the corresponding parameter is a pointer to a `double` rather than pointing to a `float`, or by `L` if it is a pointer to a `long double`.

  If an `h`, `l`, or `L` appears with any other conversion specifier, the behavior is undefined.

- A character that specifies the type of conversion to apply. The following conversion specifiers are valid:

Table 2-7. Conversion Specifiers for fscanf()

Flag	Description
`c`	Matches a character sequence of the number specified by the field width. By default, the field width is one. The corresponding parameter is a pointer to the initial character of an array large enough to accept the sequence. No null character is added.
`d`	Matches an optionally signed decimal integer, whose format is the same as expected for the subject sequence of `strtol()`. The base parameter is 10. The corresponding parameter is a pointer to an integer.
`e, f, g`	Matches an optionally signed floating point number, whose format is the same as expected for the subject string of `strtod()`. The corresponding parameter is a pointer to a float.
`i`	Matches an optionally signed integer, whose format is the same as expected for the subject sequence of `strtol()`. The base parameter is `0.` The corresponding parameter is a pointer to an integer.
`n`	No input is consumed. The corresponding parameter is a pointer to an integer into which to write the number of characters read from the input stream so far by this call to `fscanf()`. Executing a `%n` directive does not increment the assignment count returned when `fscanf()` finishes execution.
`o`	Matches an optionally signed octal integer, whose format is the same as expected for the subject sequence of `strtoul()`. The base parameter is 8. The corresponding parameter is a pointer to an unsigned integer.
`p`	Matches the set of sequences that may be produced by the `%p` conversion of `fprintf()`. The corresponding parameter is a pointer to a void. The input item is interpreted the same as `%x`. If the input item is a value converted earlier during the same program execution, the resulting pointer compares equal to that value. Otherwise, the behavior of the `%p` conversion is undefined.
`s`	Matches a sequence of non-white space characters. The corresponding parameter is a pointer to the initial character of an array large enough to accept the sequence and a terminating null character. The terminating null character is added automatically.
`u`	Matches an optionally signed decimal integer, whose format is the same as expected for the subject sequence of `strtoul()`. The base parameter is 10. The corresponding parameter is a pointer to an unsigned integer.

Table 2-7. Conversion Specifiers for fscanf() (Continued)

Flag	Description
x	Matches an optionally signed hexadecimal integer, whose format is the same as expected for the subject sequence of `strtoul()`. The base parameter is 16. The corresponding parameter is a pointer to an unsigned integer.
[	Matches a non-empty character sequence from a set of expected characters called the `scanset`. The corresponding parameter is a pointer to the initial character of an array large enough to accept the sequence and a terminating null character. The terminating null character is added automatically. The conversion specifier includes all subsequent characters in the format string, up to and including the matching right bracket (`]`). The characters between the brackets are the `scanlist`. The `scanlist` is the `scanset`, unless the character after the left bracket is a caret (`^`). In this case, the `scanset` contains all characters not appearing in the `scanlist` between the `^` and the `]`. If the conversion specifier begins with `[]` or `[^]`, the `]` is in the `scanlist` and the next right bracket character ends the specification. Otherwise, the first right bracket character ends the specification. A hyphen `(-)` has no special meaning; it is matched like any other character.
%	Matches a single `%`. No conversion or assignment occurs. The complete conversion specification is `%%`.

The conversion specifiers `E`, `G`, and `X` are also valid and behave the same as, respectively, `e`, `g`, and `x`.

If a conversion specification is invalid, the behavior is undefined.

`fscanf()` executes each directive of the format in turn. If a directive fails, `fscanf()` returns. Failures are described as “input failures or matching failures.”

- An input failure is caused by the unavailability of input characters.
- A matching failure is caused by inappropriate input.

A directive composed of white space character(s) is executed by reading input up to the first non-white space character or until no more characters can be read. The first non-white space character remains unread.

A directive containing an ordinary multibyte character is executed by reading the next characters of the stream. If one character differs from one in the directive, the directive fails, and the differing and subsequent characters remain unread.

A directive containing a conversion specification defines a set of matching input sequences for each specifier. A conversion specification is executed in the following steps:

- Input white space characters (as specified by `isspace()`) are skipped, unless the specification includes a `[`, `c`, or `n` specifier.
- An input item is read from the stream, unless the specification includes an `n` specifier. An input item is defined as the longest matching sequence of input characters, unless it exceeds a specified field width. If it exceeds the field width, it is the initial subsequence of that length in the sequence. The first character, if any, after the input item remains unread. If the length of the input item is zero, the execution of the directive fails. This condition is a matching failure, unless an error prevented input from the stream. If an error prevented input from the stream, it is an input failure.
- Except in the case of a `%` specifier, the input item (or, in the case of a `%n` directive, the count of input characters) is converted to a type appropriate to the conversion specifier. If the input item is not a matching sequence, the execution of the directive fails. This condition is a matching failure. Unless assignment suppression was indicated by an asterisk `(*)`, the conversion result is placed in the object pointed to by the first parameter following the format parameter that has not already received a conversion result. If this object does not have an appropriate type or if the conversion result cannot be represented in the space provided, the behavior is undefined.

If the end-of-file is reached during input, conversion terminates. If end-of-file occurs before any characters matching the current directive have been read, other than leading white space where permitted, execution of the current directive terminates with an input failure. Otherwise, unless execution of the current directive is terminated with a matching failure, execution of the following directive, if any, is terminated with an input failure.

If conversion terminates on a conflicting input character, the offending input character is left unread in the input stream. Trailing white space, including newline characters, is left unread unless matched by a directive. You must use the `%n` directive to determine the success of literal matches and suppressed assignments.

`fscanf()` returns `EOF` if an input failure occurs before any conversion. Otherwise, `fscanf()` returns the number of input items assigned which can be fewer than provided for, or zero in the event of an early matching failure.

The `sclib.l` and `sclib.il` libraries contain a smaller version of the `fscanf()` function. Refer to the *Using Ultra C/C++* manual for more information about the small library functions.

`stream`
is a pointer to the C I/O `FILE` structure. (Input)

`format`
is a pointer to a character sequence. (Input)

`format` specifies the allowable input sequences and specifies how to convert these sequences for assignments. If the format is exhausted while parameters remain, the excess parameters are evaluated, but are otherwise ignored.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`scanf()`

`sscanf()`

`strtod()`

`strtoll()`

`strtoul()`

fseek()

Reposition File Pointer

Syntax

```
#include <stdio.h>
int fseek(
    FILE *stream,
    long int offset,
    int place);
```

Description

`fseek()` sets the file position indicator for a stream.

`fseek()` returns non-zero only for a request that cannot be satisfied.

The `sclib.l` and `sclib.il` libraries contain a smaller version of the `fseek()` function. Refer to the *Using Ultra C/C++* manual for more information about the small library functions.

`stream`
: is a pointer to the C I/O `FILE` structure. (Input)

`offset`
: specifies an amount to offset the file position indicator. (Input)

`place`
: specifies where to place the file position indicator. (Input)

`place`
: has three possible values:

Table 2-8. fseek() place Values

Value	Description
SEEK_SET	The new file position is offset.
SEEK_CUR	The new file position is the current file position + `offset`. `offset` can be negative.
SEEK_END	The new file position is the current file size + `offset` (usually `offset` is negative or zero in this case). A successful call to `fseek()` clears the end-of-file indicator for the stream and undoes the effects of the `ungetc()` function on the same stream. After an `fseek()` call, the next operation may be either input or output.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`ftell()`

`getc(), getchar()`

`putc(), putchar()`

`ungetc()`

fsetpos()

Set Current File Position

Syntax

```
#include <stdio.h>
int fsetpos(
    FILE *stream,
    const fpos_t *pos);
```

Description

`fsetpos()` sets the file position indicator for a stream.

A successful call to `fsetpos()` clears the end-of-file indicator for the stream and undoes any effects of `ungetc()` on the same stream. After an `fsetpos()` call, the next operation on an update stream may be either input or output.

If successful, `fsetpos()` returns zero. Otherwise, it returns a non-zero value and places the appropriate error code in the global variable `errno`.

`stream`
: is a pointer to the C I/O `FILE` structure. (Input)

`pos`
: is a pointer to the value of the file position indicator. (Input)

`pos`
: is returned from `fgetpos()`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fgetpos()`

fstat()

Get File Status

Syntax

```
#include <UNIX/stat.h>
int fstat(
    unsigned int fd,
    struct stat *buf);
```

Description

`fstat()` obtains the same information about an open file referenced by the argument descriptor, as would be obtained by a `stat` call.

`fstat()` returns zero on success. It returns `-1` on failure and sets `errno` to indicate the error.

`buf`
: is a pointer to a `stat` structure into which information about the file is placed. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`stat()`

ftell()

Report File Pointer Position

Syntax

```
#include <stdio.h>
long ftell(FILE *stream);
```

Description

`ftell()` returns the current value of the file position indicator as the number of bytes from the beginning of the file for a stream. This is not necessarily a meaningful measure of the number of characters written or read.

If successful, `ftell()` returns the current value of the file position indicator for the stream. On failure, `ftell()` returns `-1L` and the appropriate error code is placed in the global variable `errno`.

`stream`
: is a pointer to the C I/O `FILE` structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fseek()`

`getc()`, `getchar()`

`putc()`, `putchar()`

fwrite()

Write Data to File

Syntax

```
#include <stdio.h>
size_t fwrite(
    const void *ptr,
    size_t size,
    size_t nmemb,
    FILE *stream);
```

Description

`fwrite()` writes up to `nmemb` elements from an array to the stream. The file position indicator for the stream, if defined, is advanced by the number of characters successfully written. If an error occurs, the resulting value of the file position indicator for the stream is indeterminate.

`fwrite()` returns the number of elements successfully written. This is less than `nmemb` only if a write error is encountered.

A write to a text stream does not cause the associated file to truncate beyond that point.

The `sclib.l` and `sclib.il` libraries contain a smaller version of the `fwrite()` function. Refer to the *Using Ultra C/C++* manual for more information about the small library functions.

`ptr`
: is a pointer to the array. (Input)

`size`
: specifies the size of each array element. (Input)

`nmemb`
: specifies the number of array elements to write. (Input)

`stream`
: is a pointer to the C I/O `FILE` structure. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fread()`

get<name>()

Read Value of SPR, DCR, PREG, and TB

Syntax

```
#include <getset.h>

#include <types.h>

u_int32 _get_<name>(void);
```

Description

The _get_<name>() class of functions can be used to read the value of Special Purpose Registers (SPRs), Device Control Registers (DCRs), Processor Registers (PREGs), and Time-Based Registers (TBs).

All functions are provided. It is the programmer's responsibility to avoid using system-state only registers from user-state and accessing registers that do not exist on the target processor. All registers are accessible from system-state. Only those noted are available from user-state. Attempting to use system state registers from user state causes unpredictable results.

For information on which _get<name>() functions are available for your processor, refer to the getset.h header file in the following location: MWOS\OS9000\<PROCESSOR>\DEFS\getset.h

name

is any of the names listed in the following table. There is one exception to the following table, the dec SPR on the 601 can be read from user-state with the function _get_user_dec().

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

cpu.l

See Also

set<name>()

getc(), getchar()

Get Next Character from File, Stdin

Syntax

```
#include <stdio.h>
int getc(FILE *stream);
int getchar(void);
```

Description

`getc()` returns a character, as an unsigned converted to an `int`, from the file and advances the associated file position indicator for the stream, if defined. If `getc()` is implemented as a macro, it may evaluate `stream` more than once. Therefore, the parameter should never be an expression with side effects. `getchar()` is a macro that is equivalent to `getc(stdin)`.

`getc()` returns the next character from the input stream pointed to by `stream`. If the stream is at end-of-file, the end-of-file indicator for the stream is set and `getc()` returns `EOF`. If a read error occurs, the error indicator for the stream is set and `getc()` returns `EOF`.

`getchar()` returns the next character from the input stream pointed to by `stdin`. If the stream is at end-of-file, the end-of-file indicator for the stream is set and `getchar()` returns `EOF`. If a read error occurs, the error indicator for the stream is set and `getchar()` returns `EOF`.

`stream`
    is a pointer to the C I/O `FILE` structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fgetc()`

`fopen()`

`putc(), putchar()`

get_const()

Get Current Constant Data

Syntax

```
#include <regs.h>
void *get_const(void);
void *_get_const(void);
```

Description

`get_const()` and `_get_const()` return the current constant data pointer. These functions are not present in the libraries for a given processor if a constant data pointer is not applicable.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`get_const() - cpu.l, _get_const() - os_lib.l`

get_current_tss()

Get Current Task Segment

Syntax

```
#include <types.h>
#include <regs.h>
u_int32 *get_current_tss(void);
```

Description

`get_current_tss()` returns the current task segment.

`get_current_tss()` is only supported on the 80x86 family of processors version of the compiler.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

getcwd()

Copy Pathname of Current Directory

Syntax

```
#include <unistd.h>
char *
getcwd(char *buf,
    size_t size);
```

Description

The `getcwd()` function copies the absolute pathname of the current working directory into the memory referenced by `buf` and returns a pointer to `buf`. The size argument is the size, in bytes, of the array referenced by `buf`. If buf is NULL, space is allocated as necessary to store the pathname.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

See Also

`chdir()`

`malloc()`

getenv()

Get Value for Environment Name

Syntax

```
#include <stdlib.h>

char *getenv(const char *name);
```

Description

`getenv()` searches the environment list for a string that matches the specified name.

`getenv()` returns a pointer to a string associated with the matched list member. The string pointed to cannot be modified by the program. If the specified name cannot be found, a null pointer is returned.

The common set of environment names depends on the operating system. Refer to your operating system's user manual for more information.

The environment list is implemented as a NULL terminated array of pointers to characters. Each string is in the form:

```
<name>=<value>
```

`name`
: is a pointer to the name. (Input)

```
<name>
```
: is the name of the environment variable.

```
<value>
```
: is the current value of the environment variable.

  To modify the list, you must either find the existing entry or enlarge the array and add an entry. The base of the array is stored in the external variable `_environ`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`_os_chain()`

`_os_chainm()`

`_os_dfork()`

`_os9_dfork()`

`_os_dforkm()`

`_os_exec()`

`_os_fork()`

`os9fork(), os9forkc()`

`_os_forkm()`

getgid()

Return Group ID

Syntax

```
#include <UNIX/os9def.h>
unsigned int getgid();
```

Description

`getgid()` returns the group identification of the current process.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

get_excpt_base()

Return Exception Table Base Address

Syntax

```
#include <types.h>
#include <regs.h>
u_int32 *get_excpt_base(void);
```

Description

`get_excpt_base()` returns the exception table base address.

`get_excpt_base()` is only supported on the 80x86 family of processors version of the compiler.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

get_gdtr()

Get Global Descriptor Pointer

Syntax

```
#include <types.h>
#include <regs.h>
void *get_gdtr(void);
```

Description

`get_gdtr()` returns a pointer to the global descriptor.

`get_gdtr()` is only supported on the 80x86 family of processors version of the compiler.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

getime()

Get System Time

Syntax

```
#include <time.h>
```

```
int getime(struct sgtbuf *timebuf);
```

Description

`getime()` returns the system time in a time buffer. The time units are defined in the `time.h` header file.

`timebuf`
    is a pointer to the time buffer. (Output)

If successful, `getime()` returns the buffer pointer.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_getime()`

`F$Time`	*OS-9 for 68K Technical Manual*
`F_TIME`	*OS-9 Technical Manual*

_get_module_dir()

Get Module Directory Entry

Syntax

```
#include <module.h>
int _get_module_dir(
    void *buffer,
    int count);
```

Description

`_get_module_dir()` copies the system's module directory into the buffer for inspection. A maximum of `count` bytes are copied. `_get_module_dir()` returns the number of bytes actually copied.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`buffer`
: is a pointer to the buffer. (Output)

`count`
: specifies the maximum number of bytes to copy. (Input)

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_get_moddir()`	
`F$GModDr`	*OS-9 for 68K Technical Manual*

getnextpwnam()

Get Next Password File Entry for Name

Syntax

```
#include <UNIX/pwd.h>
struct passwd *getnextpwnam(const char *name);
```

Description

`getnextpwnam()` returns NULL if no more password file entries are found for the `name`.

This function is useful for OS-9 systems where users have more than one password file entry.

`namegetnextpwnam()`
returns the next password file entry associated with `name`. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`endpwent()`

`fgetpwent()`

`getpwent()`

`getpwuid()`

`getpwnam()`

`setpwent()`

getopt()

Return Next Option Letter in String

Syntax

```
#include <UNIX/os9def.h>
extern char *optarg;
extern int optind, opterr;
int getopt(
    int argc,
    char *const *argv,
    const char *optstring);
```

Description

`getopt()` returns the next option letter in `argv` that matches a letter in `optstring`. `optstring` must contain the option letters the command using `getopt()` recognizes. If a letter is followed by a colon, the option is expected to have an argument, or a group of arguments, which must be separated from it by white space.

`optarg` is set to point to the start of the option argument on return from `getopt()`.

`getopt()` places in `optind` the `argv` index of the next argument to be processed. `optind` is external and is initialized to `1` before the first call to `getopt()`.

When all options have been processed (up to the first non-option argument), `getopt()` returns `-1`. The special option `--` may be used to delimit the end of the options. When it is encountered, `-1` is returned and `--` is skipped.

`getopt()` prints an error message on the standard error and returns a question mark (`?`) when it encounters an option letter not included in `optstring` or no option-argument after an option that expects one. This error message may be disabled by setting `opterr` to `0`.

For example, this code fragment shows how one might process the arguments for a command that can take the mutually exclusive options `a` and `b`, and the option `o`, which requires an option argument:

```
main(argc, argv);
int argc;
char **argv;
{
int c;
extern char *optarg;
extern int optind;
.
.
.
```

```
while ((c = getopt(argc, argv, “abo:”)) != -1)
   switch (c) {
     case ‘a’:
         if (bflg)
            errflg++;
         else
            aflag++;
         break;
     case ‘b’:
         if (aflg)
            errflg++;
         else
            bproc ();
         break;
     case ‘o’:
         ofile = optarg;
         break;
     case ‘?’:
         errflg++;
   }
if (errflg) {
   (void)fprintf(stderr, “usage: . . .”);
   exit (2);
}
for (; optind < argc; optind++) {
    if (access(argv[optind], 4)) {
       .
       .
       .
     }
  }
```

Changing the value of the variable `optind`, or calling `getopt()` with different values of `argv`, may lead to unexpected results.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Unsafe
Re-entrant:	No

Library

`unix.l`

getpid()

Return Process ID Number

Syntax

```
#include <process.h>
int getpid(void);
```

Description

`getpid()` returns the system process ID number for the calling process. You can use this number for tasks such as creating unique file names.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_id()`

`_os9_id()`

`F$ID`	*OS-9 for 68K Technical Manual*
`F_ID`	*OS-9 Technical Manual*

getppid()

Return Parent Process ID Number

Syntax

```
#include <UNIX/os9def.h>
unsigned int getppid(void);
```

Description

`getppid()` returns the system process ID number for the parent of the calling process. You can use this number for tasks such as creating unique file names.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

See Also

`getpid()`

_get_process_desc()

Get Process Descriptor Copy

Syntax

```
#include <process.h>
int _get_process_desc(
    int pid,
    int count,
    pr_desc *buffer);
```

Description

`_get_process_desc()` copies a process descriptor into the buffer for inspection.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

The following is an example call:

```
procid pbuf;
_get_process_desc(pid,sizeof(pbuf),&pbuf);
```

`pid`
: is the process ID number of the desired process. (Input)

  Only the lower 16 bits of `pid` are used.

`count`
: specifies the maximum number of bytes to copy. (Input)

`buffer`
: is a pointer to the buffer. (Output)

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_gprdsc()`

`F$GPrDsc` *OS-9 for 68K Technical Manual*

_get_process_table()

Get Process Table Entry

Syntax

```
#include <process.h>

int _get_process_table(
    void *buffer,
    int count);
```

Description

`_get_process_table()` copies the system's process descriptor table into the buffer for inspection. A maximum of `count` bytes are copied. The number of bytes actually copied is returned.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`buffer`
: is a pointer to the buffer. (Output)

`count`
: specifies the maximum number of bytes to copy. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_get_prtbl()`

`F$GPrDBT` *OS-9 for 68K Technical Manual*

getpw()

Get Name from Password File

Syntax

```
#include <UNIX/pwd.h>
int getpw(
    int uid,
    char *buf);
```

Description

`getpw()` searches the password file for the (numerical) user identification number and fills in the buffer with the corresponding name. It returns non-zero if the `uid` could not be found. The name is null-terminated.

`uid`
: is the user identification number. (Input)

`buf`
: is the buffer. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`endpwent()`

`fgetpwent()`

`getpwent()`

`getpwuid()`

`getpwnam()`

`setpwent()`

getpwent()

Get Password File Entry

Syntax

```
#include <UNIX/pwd.h>

struct passwd *getpwent(void);
```

Description

`getpwent()`, `getpwuid()` and `getpwnam()` each return a pointer to an object with the following structure containing the fields of a line in the password file. Each line in the file contains a `passwd` structure, declared in the `<UNIX/pwd.h>` header file:

```
struct    passwd {
   char *pw_name;     * login name
   char *pw_passwd;   * password
   int pw_uid;        * user ID
   int pw_gid;        * group ID
   int  pw_prio;      * priority
   char *pw_age;      * unsupported -zero length string
   char *pw_comment;  * unsupported -zero length string
   char *pw_gecos;    * unsupported -zero length string
   char *pw_dir;      * initial data directory
   char *pw_xdir;     * initial execution directory
   char *pw_shell;    * initial command executed
   char *pw_junk;     * undefined
};
```

The fields `pw_age`, `pw_comment`, `pw_gecos`, and `pw_junk` are unused. When first called, `getpwent()` returns a pointer to the first `passwd` structure in the file; thereafter, it returns a pointer to the next `passwd` structure in the file; so successive calls can be used to search the entire file. `getpwuid()` searches from the beginning of the file until a numerical user ID matching `uid` is found and returns a pointer to the particular structure in which it was found. `getpwnam()` searches from the beginning of the file until a `login` name matching `name` is found, and returns a pointer to the particular structure in which it was found. If an end-of-file or an error is encountered on reading, these functions return a NULL pointer.

A call to `setpwent()` has the effect of rewinding the password file to allow repeated searches. `endpwent()` may be called to close the password file when processing is complete.

`fgetpwent()` returns a pointer to the next `passwd` structure in the stream `f`, which matches the format of the password file `/dd/SYS/password`.

`getpwent()`, `getpwuid()`, and `getpwnam()` return a pointer to `struct passwd` on success. On EOF or error, or if the requested entry is not found, they return NULL.

- The above routines use the standard I/O library, which increases the size of programs not otherwise using standard I/O more than might be expected.
- All information is contained in a static area that is overwritten by subsequent calls to these functions, so it must be copied if it is to be saved.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`endpwent()`

`getpwent()`

`getpw()`

`getpwuid()`

`getpwnam()`

`setpwent()`

getpwnam()

Get Password File Name

Syntax

```
#include <UNIX/pwd.h>
struct passwd *getpwnam(const char *nam);
```

Description

`getpwnam()` returns a pointer to an object with the structure shown in `getpwent()` containing the fields of a line in the password file that matches the name `nam`. Each line in the file contains a `passwd` structure, declared in the `<UNIX/pwd.h>` header file.

The above routines use the standard I/O library, which increases the size of programs not otherwise using standard I/O more than might be expected.

All information is contained in a static area which is overwritten by subsequent calls to these functions, so it must be copied if it is to be saved.

`nam`

is the name matching the fields in the password file. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`endpwent()`

`fgetpwent()`

`getpw()`

`getpwent()`

`getpwuid()`

`setpwent()`

getpwuid()

Get Password File User ID

Syntax

```
#include <UNIX/pwd.h>
```

```
struct passwd *getpwuid(unsigned int uid);
```

Description

`getpwuid()` returns a pointer to an object with the structure shown in `getpwent()`containing the fields of a line in the password file that matches the specified user identification. Each line in the file contains a `passwd` structure, declared in the `<UNIX/pwd.h>` header file.

The above routines use the standard I/O library, which increases the size of programs not otherwise using standard I/O more than might be expected.

All information is contained in a static area that is overwritten by subsequent calls to these functions, so it must be copied if it is to be saved.

`uid`

is the specified user identification. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`endpwent()`

`fgetpwent()`

`getpw()`

`getpwent()`

`getpwnam()`

`setpwent()`

gets()
Get String from File

Syntax

```
#include <stdio.h>
char *gets(char *str);
```

Description

`gets()` reads characters from the standard input file into an array until end-of-file is encountered or a newline character is read. Any newline character is discarded, and a null character is written immediately after the last character read into the array.

`gets()` returns `str` if successful. If end-of-file is encountered and no characters have been read into the array, the contents of the array remain unchanged and a null pointer is returned. If a read error occurs during the operation, the array contents are indeterminate and a null pointer is returned.

`str`
: is a pointer to the array. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fgets()`

getstat()

Get File Status

Syntax

```
#include <sgstat.h>
#include <sg_codes.h>

int getstat(
    int code,
    int path,
    struct sgbuf *buffer); * code = 0

    int getstat(
    int code,
    int path); * code = 1 or 6

    int getstat(
    int code,
    int path,
    long *size); * code = 2

    int getstat(
    int code,
    int path,
    long *pos);   * code = 5
```

Description

`getstat()` is historical from the 6809 C Compiler. It accesses a few `I$GetStt` system functions.

When `getstat()` returns with the value `-1`, the appropriate error code is placed in the global variable `errno`.

`getstat()` is supported for the convenience of programs ported from the 6809.

`code`
: is defined as shown in Table 2-9. (Input)

Table 2-9. getstat() Code Values

Code	Description
`0`	`buffer` is the address of the 128 byte buffer into which the path option bytes are copied. The `sgstat.h` header file contains a `struct` defined for use by the program.
`1`	This applies only to SCF devices and is used to test for data ready. The return value is the number of bytes available or `-1` if an error occurred.
`2`	`size` is the address of the long integer into which the current file size is placed. The function returns `-1` on error and zero on success.
`5`	`pos` is the address of the long integer into which the current file position is placed. The function returns `-1` on error and zero on success.
6	The function returns `-1` on either `EOF` or error, and `0` if not at EOF.

Only the lower 16 bits of `code` are used.

`path`
: must be the path number of an open file. (Input)

`buffer`
: is the address of the 128 byte buffer into which the path option bytes are copied. (Output)

`sizeis`
: the address of the long integer into which the current file size is placed. (Output)

`posis`
: the address of the long integer into which the current file position is placed. (Output)

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_gs_devnm()`
`_os_gs_eof()`
`_os_gs_fd()`
`_os_gs_fdinf()`
`_os_gs_popt()`
`_os_gs_pos()`
`_os_gs_ready()`
`_os_gs_size()`
`I$GetStt` *OS-9 for 68K Technical Manual*

get_static()

Return Current Static Storage Pointer

Syntax

```
#include <regs.h>
void *get_static(void);
void *_get_static(void);
```

Description

`get_static()` and `_get_static()` return a pointer to the current static storage.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`get_static() - cpu.l, _get_static - os_lib.l`

See Also

`change_static()`

get_sysglobs()

Return a Pointer to the System Global Variables

Syntax

```
#include <types.h>
#include <regs.h>
#include <const.h>
#include <stdef.h>
#include <sysglob.h>

void   *get_sysglobs(void);
```

Description

`get_sysblobs()` returns a pointer to the system global variables defined in `sysglob.h`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

See Also

`sysglob.h`

`_os_getsys()`

`_os_setsys()`

_getsys()

Get System Global Variables

Syntax

```
#include <sysglob.h>
int _getsys(
    int glob,
    int size);
```

OS-9 for 68K users need to include `setsys.h` also.

Description

`_getsys()` examines a system global variable. These variables are defined in `setsys.h` for C programs. Each of these variables begin with a `D_` prefix.

`_getsys()` returns the value of the variable if the examine request succeeds. If the request fails, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`glob`
    is the system global variable to examine. (Input)

Only the lower 16 bits of `glob` are used.

`size`
    is the size of the variable. (Input)

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_getsys()`
`_os_setsys()`

`F$GetSys`	*OS-9 for 68K Technical Manual*
`F_GetSys`	*OS-9 Technical Manual*

gettimeofday()

Get Current Time

Syntax

```
#include <UNIX/os9time.h>
int gettimeofday(
    struct timeval *tp,
    struct timezone *tzp);
```

Description

The system's notion of the current time is obtained with the `gettimeofday()` call. The current time is expressed in elapsed seconds and microseconds since January 1, 1970 (zero hour). The resolution of the system clock is hardware dependent. The time may be updated continuously, or in `"ticks."` `gettimeofday()` returns zero (`0`) on success and `-1` on failure and sets `errno` to indicate the error.

`tp`

points to a `timeval` structure, which includes the following members:

```
long tv_sec;      * seconds since Jan. 1, 1970
long tv_usec;     * and microseconds
```

If `tp` is a NULL pointer, the current time information is not returned.

`tzp`

is not supported by `unix.l`. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

getuid()

Determine User ID Number

Syntax

```
#include <process.h>
int getuid(void);
```

Description

`getuid()` returns the group/user ID of the current process. The upper word (two bytes) of the value is the group number; the lower word is the user number.

If unsuccessful, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_id()`

`_os9_id()`

`F$ID`	*OS-9 for 68K Technical Manual*
`F_ID`	*OS-9 Technical Manual*

getw()

Read Word from File

Syntax

```
#include <stdio.h>
int getw(FILE *stream);
```

Description

`getw()` returns a word from a file converted to an integer. It returns `-1` on error. Therefore, use the macros `feof()` and `ferror()` to check the success of `getw()`.

`getw()` is a machine-dependent function because the size of a word varies from machine to machine. `getw()` assumes no particular alignment in the file. `getw()` reads two bytes from the file and sign-extends them to four bytes.

`stream`
: is a pointer to the C I/O `FILE` structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`sys_clib.l`

See Also

`feof()`

`ferror()`

getwd()

Get Working Directory Path Name

Syntax

```
#include <UNIX/os9def.h>
char *getwd(char pathname[MAXPATHLEN]);
```

Description

`getwd()` copies the absolute pathname of the current working directory to `pathname` (output) and returns a pointer to the result.

`getwd()` returns NULL and global variable `errno` if an error occurs.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

glob(), globfree()

Implement Rules for File Name Pattern Matching

Syntax

```
#include <UNIX/glob.h>
int glob(
      const char *pattern,
      int flags,
      const int (*errfunc)(const char *, int),
      glob_t *pglob);
void globfree(
           glob_t *pglob);
```

Description

The `glob()` function is a pathname generator that implements the rules for file name pattern matching used by the shell. The include file `glob.h` defines the structure type `glob_t`, which contains at least the following fields:

```
typedef struct {
 int gl_pathc;  /* count of total paths so far */
 int gl_matchc; /* count of paths matching pattern */
 int gl_offs;   /* reserved at beginning of gl_pathv */
 int gl_flags;  /* returned flags */
 char **gl_pathv; /* list of paths matching pattern */
} glob_t;
```

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

gmtime()

Convert Calendar Time to Greenwich Mean Time

Syntax

```
#include <time.h>
```

```
struct tm *gmtime(time_t *tp);
```

Description

`gmtime()` converts the calendar time contained in a time structure to Coordinated Universal Time (UTC). `gmtime()` returns a pointer to that object or a null pointer if UTC is not available.

`gmtime()` returns a pointer to a static area which may be overwritten. To ensure data integrity, use the structure or save it immediately.

`tp`
: is a pointer to the time structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`mktime()` (for more information on the time structure `tp`)

`time()`

_gregorian()

Convert Date/Time to Gregorian Value

Syntax

```
#include <time.h>
int _gregorian(int *time, int *date);
```

Description

`_gregorian()` converts the time and date from Julian format to the Gregorian equivalents.

`_gregorian()` modifies the values to the Gregorian format:

Figure 2-2. _gregorian() Output Date and Time Format

	Byte 0	Byte 1	Byte 2	Byte 3
Time:	0	Hour (0-23)	Minute	Second
Date:	Year (two bytes)		Month	Day

If successful, `_gregorian()` returns zero. Otherwise, `-1` is returned.

Be careful when passing pointers for the `date` and `time` values.

`time` and `date`
: are pointers to the Julian time and date values. (Input/Output)

The values must be in the following format:

Figure 2-3. _gregorian() Input Date and Time Format

Time:	Seconds Since Midnight (0-86399)
Date:	Julian Day Number

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_julian()`	(OS-9 for 68K)
`_os_gregorian()`	(OS-9 for 68K)

_gs_devn()
Get Device Name

Syntax

```
#include <sg_codes.h>
int _gs_devn(int path, char *buffer);
```

Description

`_gs_devn()` allows you to determine the name of the device open on a path. If the path number is invalid, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

You must reserve a buffer of at least 32 bytes to receive the device name. Some networked devices using NFM should have a buffer size of 128 or 256 bytes for the `_gs_devn()`.

`path`
: is the path number of an open path. (Input)

`buffer`
: is a pointer to a character array into which the null-terminated device name is placed. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_gs_devnm()`

`I$GetStt`	*OS-9 for 68K Technical Manual*
`I_GETSTAT`, `SS_DEVNAME`	*OS-9 Technical Manual*

_gs_eof()

Check for End of File

Syntax

```
#include <sg_codes.h>
int _gs_eof(int path);
```

Description

`_gs_eof()` determines if the file open on `path` is at the end of file. If it is at the end of file, `1` is returned. Otherwise, `0` is returned.

`_gs_eof()` cannot determine end-of-file on SCF devices. SCF devices return an `EOS_EOF` error when the EOF character is read. Do not use this call if you are using the buffered I/O facility on the path. Instead, use `feof()`.

`path`

specifies the path number of the open file. (Input)

If `path` is invalid, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`feof()`

`_os_gs_eof()`

`I$GetStt`	*OS-9 for 68K Technical Manual*
`I_GETSTAT`	*OS-9 Technical Manual*
`SS_EOF`	*OS-9 Technical Manual*

_gs_gfd()

Get File Descriptor Sector

Syntax

```
#include <rbf.h>
int _gs_gfd(
    int path,
    struct fd *buffer,
    int count);
```

Description

`_gs_gfd()` places a copy of the RBF file descriptor sector of the file open on `path` into a buffer. The structure `fd`, declared in the `rbf.h` header file, provides a convenient means to access the file descriptor information.

Be sure the buffer is large enough to hold `count` bytes. A file descriptor is one sector in length and a sector may be between 256 bytes and 32K in size. If an entire descriptor is desired, you must first find the sector size on the device and allocate a buffer. The sector size can be found in the path descriptor's option section. See `_os_gs_popt()` and your operating system technical manual for more information. Generally, the `struct fd` in `rbf.h` is only large enough to hold a 256-byte file descriptor.

This call is effective only on RBF devices.

`path`
: specifies the path number of the open file. (Input)

`buffer`
: is a pointer to the buffer in which to place the file descriptor information. (Output)

`count`
: specifies the maximum number of bytes to copy. (Input)

If an error occurs, `-1` is returned and the appropriate error value is placed in the global variable `errno`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_gs_fd()`

`_os_gs_popt()`

`_os_ss_fd()`

`I$GetStt`	*OS-9 for 68K Technical Manual*
`I_GETSTAT`, `SS_FD`	*OS-9 Technical Manual*

_gs_opt()

Get Path Options

Syntax

```
#include <sg_codes.h>
#include <sgstat.h>
int _gs_opt(
    int path,
    struct sgbuf *buffer);
```

Description

`_gs_opt()` copies the options section of the path descriptor open on `path` into a buffer. `sgbuf` provides a convenient means to access the individual option values. `sgbuf` is declared in the `sgstat.h` header file.

If the path is invalid, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

Be sure the buffer is large enough to hold the options. Declaring the buffer as type `struct sgbuf` is safe because this structure is predefined to be large enough for the options.

If you use `_gs_opt()` on OS-9, you must use the OS-9 for 68K header file. `_gs_opt()` is provided on OS-9 solely for compatibility with OS-9 for 68K. If the OS-9 for 68K header file is unavailable, change the source code to use `_os_gs_popt()` or `_os_gs_luopt()`.

`path`
: is the path number of the open path descriptor. (Input)

`buffer`
: is a pointer to the buffer. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_gs_popt()`

`_os_ss_popt()`

`I$GetStt`	*OS-9 for 68K Technical Manual*
`I_GETSTAT`	*OS-9 Technical Manual*
`SS_PATHOPT`	*OS-9 Technical Manual*
`tmode`	*Using OS-9 for 68K* or *Using OS-9*

_gs_pos()

Get Current File Position

Syntax

```
#include <sg_codes.h>
int _gs_pos(int path);
```

Description

`_gs_pos()` returns the value of the file pointer for the file open on `path`.

This call is effective only on RBF devices. Do not use this call if buffered I/O is being performed on the path; instead use `ftell()`.

`path`
: is the path number of the open file. (Input)

  If the path is invalid or the device is not an RBF device, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`ftell()`
`_os_gs_pos()`

`I$GetStt`	*OS-9 for 68K Technical Manual*
`I_GETSTAT`, `SS_POS`	*OS-9 Technical Manual*

_gs_rdy()

Test for Data Available

Syntax

```
#include <sg_codes.h>
int _gs_rdy(int path);
```

Description

`_gs_rdy()` checks the device open on `path` to see if data is waiting to be read. Read requests to the operating system wait until enough bytes have been read to satisfy the specified byte count, thereby suspending the program until the read is satisfied.

`_gs_rdy()` can determine the number of bytes, if any, waiting to be read, and then issue a read request for only the number of bytes actually available.

This call is effective only on RBF, SCF, or pipe devices. `_gs_rdy()` is not intended for use with the buffered I/O calls such as `getc()`; unpredictable results may occur. Use low-level functions when using `_gs_rdy()`.

`path`
: is the path number of the open file. (Input)

If the path is invalid or no data is available to be read, `-1` is returned, and the appropriate error code is placed in the global variable `errno`. Otherwise, the number of bytes available to be read is returned.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_gs_ready()`
`_os_read()`
`_os_readln()`

`I$GetStt`	*OS-9 for 68K Technical Manual*
`I_GETSTAT`	*OS-9 Technical Manual*
`SS_READY`	*OS-9 Technical Manual*

_gs_size()

Get Current File Size

Syntax

```
#include <sg_codes.h>
int _gs_size(int path);
```

Description

`_gs_size()` determines the current size of the file open on `path`.

This call is effective only on RBF and PIPEMAN devices.

`path`
: is the path number of the open file. (Input)

  If the path is invalid or the device is not an RBF device, `-1` is returned and the appropriate error code is placed in the global variable `errno`. Otherwise, the file size is returned.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_gs_size()`

`I$GetStt`	*OS-9 for 68K Technical Manual*
`I_GETSTAT`	*OS-9 Technical Manual*
`SS_SIZE`	*OS-9 Technical Manual*

Syntax

```
#include <math.h>
double hypot(double x, double y);
```

Description

`hypot()` returns the Euclidean distance function:

```
sqrt(x * x + y * y)
```

`hypot()` ignores overflows.

`x` and `y` are inputs.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

ibrk()

Request Internal Memory

Syntax

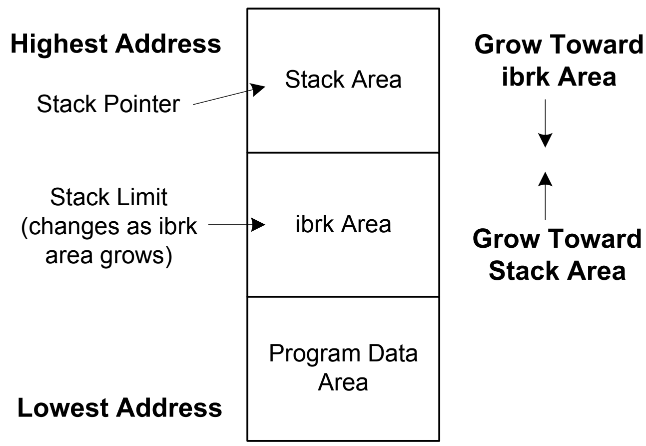
```
#include <stdlib.h>

char *ibrk(unsigned size);
```

Description

`ibrk()` returns a pointer to a memory block. The returned pointer is aligned to a word boundary. The memory from which `ibrk()` grants requests is the area between the end of the data allocation and the stack:

Figure 2-4. ibrk() Memory Stack Diagram



If the requested size would cause the `ibrk` area to cross the stack pointer, the request fails. You can use `freemem()` to determine the amount of stack remaining which is also the remaining `ibrk` area.

`ibrk()` is useful to request memory from a fixed-size area of memory, unlike `ebrk()` whose available memory is that of the entire system. The C I/O library functions request the first 2K of I/O buffers from this area, the remainder from `ebrk()`.

If successful, `ibrk()` returns zero. Otherwise, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

Be very careful not to crowd out the stack with `ibrk()` calls. When stack checking is in effect, the program aborts with a `***Stack Overflow***` message if insufficient stack area exists to call a function.

`size`

specifies the size, in bytes, of the memory block. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`ebrk()`

`_freemem(), freemem()`

`sbrk()`

`stacksiz(), _stacksiz()`

inc()

Get Character From I/O Address

Syntax

```
#include <regs.h>
#include <types.h>
u_char inc(void *address);
```

Description

`inc()` returns the character indicated by the specified I/O address on the 80x86 processors or the memory address on all other processors.

`address`
is the specified I/O address. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

See Also

`inl()`

`inw()`

`outc()`

`outl()`

`outw()`

index()

Search for Character in String

Syntax

```
#include <strings.h>
char *index(
    const char *ptr,
    int ch);
```

Description

`index()` returns a pointer to the first occurrence of a character in a string. If the character is not found, `index()` returns NULL.

`ptr`
: is a pointer to the string. (Input)

`ch`
: is the character for which to search. (Input)

Only the lower 8 bits of `ch` are used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

Example

This example looks for a period (`.`) in `string` and sets the pointer `ptr`. Note that `ch` is a character, not a pointer to a character:

```
func()
{
    char *ptr,*string;
    if((ptr = index(string,'.'))
        process(ptr);
    else printf("No '.' found!\n");
}
```

See Also

`rindex()` `strchr()` `strrchr()`

inl()

Get Integer from I/O Address

Syntax

```
#include <regs.h>

#include <types.h>

u_int32 inl(void *address);
```

Description

`inl()` returns the integer indicated by the specified I/O address on the 80x86 processors or the memory address on all other processors.

`address`
is the specified I/O address. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

See Also

`inc()`

`inw()`

`outc()`

`outl()`

`outw()`

intercept()

Set Up Process Signal Handler

Syntax

```
#include <signal.h>

int intercept(void (*icpthand)(int));
```

Description

`intercept()` instructs the operating system to pass control to a signal handler function when the process receives a signal.

A program does not receive an abort or quit signal from the keyboard (usually `^C` and `^E`) unless the program performs output to the terminal. This is because the operating system sends the abort/quit signals to the last process to perform I/O to the terminal. If you run the program from the shell and type `^E` before the program performs I/O to the terminal, the shell receives the signal and kills the running program. If a program requires immediate control of the terminal, perform some I/O to one of the standard paths such as printing a program banner or getting the terminal options with `_gs_opt()`.

Signal handlers dealing with asynchronous signals should be careful about the following:

- Any I/O using the C library (for example, `printf()`) cannot be performed inside both the intercept handler function and the main program. Consequently, avoid I/O within intercept functions.
- Calling any function that may be working with static storage structures.
- Calling any function that is not re-entrant.
- Modifying any static storage structure other than a variable of type `volatile sig_atomic_t`.

Generally, `intercept()` should not be used with `signal()`. Only signals that are under `SIG_DFL` handling reach a handler installed with this function.

You cannot use floating point math within the intercept handler function.

`icpthand`
: is a pointer to the function.

  If the signal handler function declares an `int` parameter, the function has access to the value of the received signal. On return from the signal handler function, the process resumes at the point in the program where it was interrupted by the signal.

  If `icpthand` is zero, the signal handler is removed.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_intercept()`

`_os_send()`

`_os_sigmask()`

`signal()`

`F$Icpt`	*OS-9 for 68K Technical Manual*
`F$Send`	*OS-9 for 68K Technical Manual*
`F$SigMask`	*OS-9 for 68K Technical Manual*
`F_ICPT`	*OS-9 Technical Manual*
`F_SEND`	*OS-9 Technical Manual*
`F_SIGMASK`	*OS-9 Technical Manual*

Example

As an example, this program is designed to clean up work files and exit when it receives a keyboard quit signal (signal 2 which, normally, is caused by typing `^E` on the terminal):

```
#include <stdio.h>


char *tempname = "tempfile";
FILE *tempfp;
int quittime = 0;


/* the signal handler */
gotsignl(signum)
int signum;
{
   switch(signum) {
      case 2:                * the quit signal
         quittime = 1;
         break;
      default:               * ignore all others
         break;
   }
}
main()
{
   if((tempfp = fopen(tempname,"w") == NULL)
      exit(_errmsg(errno,
            "can’t open file - %s\n",tempname));
   intercept(gotsignl);
   do {
      do_work();
   } while(!quittime);
   fclose(tempfp);
   unlink(tempname);
   exit(_errmsg(1,"quittin’ time!!!\n"));
}
```

ioctl()

Control Device

Syntax

```
#include <UNIX/ioctl.h>
#include <UNIX/os9def.h>
int ioctl(
    unsigned int fd,
    unsigned int request,
    caddr_t arg);
```

Description

`ioctl()` performs some of the UNIX-like I/O control functions.

The two functions that are supported are:

- `FIONREAD` — Return the number of bytes available for reading from the path. The number of bytes is returned at the `unsigned long` pointed to by `arg`. `FIONREAD` works with `RBF, SCF, Pipe`, and `Sockman`.
- `FIONBIO` — Set the I/O blocking status on the path. `arg` is a pointer to `0` (blocking I/O) or `1` (non-blocking I/O). `FIONBIO` works with `Sockman` (only `path_opts` block type it gets and checks for).

`ioctl()` returns zero on success for most requests. Some specialized requests may return non-zero values on success. See the specific description for the request. On failure, `ioctl()` returns `-1` and sets `errno` to indicate an error.

`fd`
: is the path to the device that is affected by the function. (Input)

`request`
: is the function to perform. (Input)

`arg` has various meanings depending on the function to be performed. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

inw()
Get Word from I/O Address

Syntax

```
#include <regs.h>
#include <types.h>
u_int16 inw(void *address);
```

Description

`inw()` returns the word indicated by the specified I/O address on the 80x86 processors or the memory address on all other processors.

`address`
is the specified address. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

See Also

`inc()`
`inl()`
`outc()`
`outl()`
`outw()`

irq_change()
Set IRQ Level

Syntax

```
#include <regs.h>
#include <types.h>
status_code irq_change(status_code newval);
```

Description

`irq_change()` sets the interrupt level to `newval` (input). The next time `irq_change()` is called, it returns the previous interrupt level.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

See Also

`irq_disable()`
`irq_enable()`
`irq_maskget()`
`irq_restore()`
`irq_save()`

irq_disable()

Mask Interrupts

Syntax

```
#include <regs.h>
void irq_disable(void);
```

Description

`irq_disable()` masks interrupts to the highest interrupt level available on the CPU. It is a system-state-only system call.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

See Also

`irq_change()`

`irq_enable()`

`irq_maskget()`

`irq_restore()`

`irq_save()`

irq_enable()

Unmask Interrupts

Syntax

```
#include <regs.h>
void irq_enable(void);
```

Description

`irq_enable()` unmasks all interrupts to the lowest interrupt level available on the CPU.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

See Also

`irq_change()`

`irq_disable()`

`irq_maskget()`

`irq_restore()`

`irq_save()`

irq_maskget()

Mask Interrupts; Return Previous Level

Syntax

```
#include <regs.h>
status_code irq_maskget (void);
```

Description

`irq_maskget()` masks all interrupts to the highest level available on the CPU. `irq_maskget()` returns the interrupt level before masking.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

See Also

`irq_change()`

`irq_disable()`

`irq_enable()`

`irq_restore()`

`irq_save()`

irq_restore()

Restore Interrupt Level

Syntax

```
#include <regs.h>
```

```
void irq_restore(status_code stat_reg);
```

Description

`irq_restore()` sets the interrupt level.

`stat_code`
: specifies the value to put in the processor status register. (Input)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

See Also

`irq_change()`

`irq_disable()`

`irq_enable()`

`irq_maskget()`

`irq_save()`

irq_save()

Return Current Interrupt Level

Syntax

```
#include <regs.h>
status_code irq_save(void);
```

Description

`irq_save()` returns the current value of the status register.

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

See Also

`irq_change()`
`irq_disable()`
`irq_enable()`
`irq_maskget()`
`irq_restore()`

isalnum()

See If Parameter Is Alphanumeric

Syntax

```
#include <ctype.h>
```

```
int isalnum(int c);
```

Description

`isalnum()` returns a non-zero value for any character for which `isalpha()` or `isdigit()` is true.

This routine, available as a function or a macro in `ctype.h`, does not operate well with values outside the range of an `unsigned char`.

The function checks for invalid input (values that are not representable as an `unsigned char` and not equal to the value of the macro `EOF`) and returns 0 for such input. The macro does not check for invalid input, which makes it faster than the function. The macro is the default. To use the function you must explicitly use the `undef` preprocessor directive or ensure that the macro expansion does not occur by placing the function name within parentheses.

For example: `b = (isalnum)(c);`

`c`

is the character to test. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`isalpha()`
`isdigit()`
`islower()`
`ispunct()`
`isupper()`
`iscntrl()`
`isgraph()`
`isprint()`
`isspace()`
`isxdigit()`

isalpha()

See If Parameter Is Alphabetic

Syntax

```
#include <ctype.h>
int isalpha(int c);
```

Description

`isalpha()` returns a non-zero value for any character for which `isupper()` or `islower()` is non-zero. `isalpha()` returns non-zero only for the characters for which `isupper()` or `islower()` is non-zero.

This routine, available as a function or a macro in `ctype.h`, does not operate well with values outside the range of an `unsigned char`.

The function checks for invalid input (values that are not representable as an `unsigned char` and not equal to the value of the macro `EOF`) and returns 0 for such input. The macro does not check for invalid input, which makes it faster than the function. The macro is the default. To use the function you must explicitly use the `undef` preprocessor directive or ensure that the macro expansion does not occur by placing the function name within parentheses.

For example: `b = (isalpha)(c);`

`c`
: is the character to test. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`isalnum()`
`isdigit()`
`islower()`
`ispunct()`
`isupper()`
`iscntrl()`
`isgraph()`
`isprint()`
`isspace()`
`isxdigit()`

_isascii(), isascii()

See If Parameter Is ASCII

Syntax

```
#include <ctype.h>
int _isascii(int c);
int isascii(int c);
```

Description

`_isascii()` returns a non-zero value if `c` is an ASCII character (the value is in the range `0x00` through `0x7f`). Otherwise, it returns zero. Only `_isascii()` is available in strictly conforming ANSI mode. Otherwise, both are available. `_isascii()` and `isascii()` are macro definitions.

This routine, available as a function or a macro in `ctype.h`, does not operate well with values outside the range of an `unsigned char`.

The function checks for invalid input (values that are not representable as an `unsigned char` and not equal to the value of the macro `EOF`) and returns 0 for such input. The macro does not check for invalid input, which makes it faster than the function. The macro is the default. To use the function you must explicitly use the `undef` preprocessor directive or ensure that the macro expansion does not occur by placing the function name within parentheses.

For example: `b = (isascii)(c);`

`c`

is the character to test. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`ctype.h`

See Also

`isalnum()` `isalpha()`
`iscntrl()` `isdigit()`
`isgraph()` `islower()`
`isprint()` `ispunct()`
`isspace()` `isupper()`
`isxdigit()`

isatty()

Determine if a Path is Sequential Character

Syntax

```
#include <UNIX/os9def.h>
int isatty(int fd);
```

Description

`isatty()` returns `1` if the path `fd` is associated with a SCF device. Otherwise, it returns zero.

`fd`
: is the path to test. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

iscntrl()

See If Parameter Is Control Code

Syntax

```
#include <ctype.h>
```

```
int iscntrl(int c);
```

Description

`iscntrl()` is a C macro that returns a non-zero value for ASCII characters with values from `0` to `0x1f` and `0x7f`.

This routine, available as a function or a macro in `ctype.h`, does not operate well with values outside the range of an `unsigned char`.

The function checks for invalid input (values that are not representable as an `unsigned char` and not equal to the value of the macro `EOF`) and returns 0 for such input. The macro does not check for invalid input, which makes it faster than the function. The macro is the default. To use the function you must explicitly use the `undef` preprocessor directive or ensure that the macro expansion does not occur by placing the function name within parentheses.

For example: `b = (iscntrl)(c);`

`c`
: is the character to test. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`ctype.h`

See Also

`isalnum()`	`isalpha()`
`isdigit()`	`isgraph()`
`islower()`	`isprint()`
`ispunct()`	`isspace()`
`isupper()`	`isxdigit()`

isdigit()

See If Parameter Is Digit

Syntax

```
#include <ctype.h>
int isdigit(int c);
```

Description

`isdigit()` is a C macro that returns a non-zero value for any decimal-digit character.

This routine, available as a function or a macro in `ctype.h`, does not operate well with values outside the range of an `unsigned char`.

The function checks for invalid input (values that are not representable as an `unsigned char` and not equal to the value of the macro `EOF`) and returns 0 for such input. The macro does not check for invalid input, which makes it faster than the function. The macro is the default. To use the function you must explicitly use the `undef` preprocessor directive or ensure that the macro expansion does not occur by placing the function name within parentheses.

For example: `b = (isdigit)(c);`

`c`
: is the character to test. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`ctype.h`

See Also

`isalnum()` `isalpha()`
`iscntrl()` `isgraph()`
`islower()` `isprint()`
`ispunct()` `isspace()`
`isupper()` `isxdigit()`

_iseuc_kana()

Check Parameter for Kaka-Kana Character

Syntax

```
#include <ctype.h>
int _iseuc_kana(int c);
```

Description

This function checks to see if the parameter is the first byte of a half- width kaka-kana character. `_iseuc_kana()` is a C macro that returns a non-zero value if `c` is the first byte of a half-width Kata-Kana character. Otherwise, it returns zero. The first byte of a half-width Kata-Kana character is `0X8E`.

This routine, available as a function or a macro in `ctype.h`, does not operate well with values outside the range of an `unsigned char`.

The function checks for invalid input (values that are not representable as an `unsigned char` and not equal to the value of the macro `EOF`) and returns 0 for such input. The macro does not check for invalid input, which makes it faster than the function. The macro is the default. To use the function you must explicitly use the `undef` preprocessor directive or ensure that the macro expansion does not occur by placing the function name within parentheses.

For example: `b = (iseuc_kana)(c);`

`c`

is the character to test. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`ctype.h`

See Also

`isalnum()`
`isalpha()`
`iscntrl()`
`isdigit()`
`isgraph()`
`islower()`
`isprint()`
`ispunct()`
`isspace()`
`isupper()`
`isxdigit()`

_iseuc1(), _iseuc2()

See If Parameter Is EUC Character

Syntax

```
#include <ctype.h>
int _iseuc1();
```

Description

`_iseuc1()` is a C macro that returns a non-zero value if `c` is the first byte of an `EUC` packed format `JIS x 0208-1990` character. Otherwise, it returns zero. The valid range is between `0xa1` and `0xfe`.

`_iseuc2()` is the same thing for the second byte of the character and has the same valid range.

This routine, available as a function or a macro in `ctype.h`, does not operate well with values outside the range of an `unsigned char`.

The function checks for invalid input (values that are not representable as an `unsigned char` and not equal to the value of the macro `EOF`) and returns 0 for such input. The macro does not check for invalid input, which makes it faster than the function. The macro is the default. To use the function you must explicitly use the `undef` preprocessor directive or ensure that the macro expansion does not occur by placing the function name within parentheses.

For example: `b = (_iseuc1)(c);`

`c`
: is the character to test. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`ctype.h`

See Also

`isalnum()`	`isalpha()`
`iscntrl()`	`isdigit()`
`isgraph()`	`islower()`
`isprint()`	`ispunct()`
`isspace()`	`isupper()`
`isxdigit()`	

isgraph()

See If Parameter Is Printing Character

Syntax

```
#include <ctype.h>
```

```
int isgraph(int c);
```

Description

`isgraph()` is a C macro that returns a non-zero value if `c` is any printing character except a space. Otherwise, it returns zero.

This routine, available as a function or a macro in `ctype.h`, does not operate well with values outside the range of an `unsigned char`.

The function checks for invalid input (values that are not representable as an `unsigned char` and not equal to the value of the macro `EOF`) and returns 0 for such input. The macro does not check for invalid input, which makes it faster than the function. The macro is the default. To use the function you must explicitly use the `undef` preprocessor directive or ensure that the macro expansion does not occur by placing the function name within parentheses.

For example: `b = (isgraph)(c);`

`c`

is the character to test. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`ctype.h`

See Also

`isalnum()`	`isalpha()`
`iscntrl()`	`isdigit()`
`islower()`	`isprint()`
`ispunct()`	`isspace()`
`isupper()`	`isxdigit()`

_isjis_kana()

See If Parameter Is Hankaku-kana

Syntax

```
#include <ctype.h>
int _isjis_kana(int c);
```

Description

`_isjis_kana()` is a C macro that returns a non-zero value if `c` is a Hankaku-Kana. Otherwise, it returns zero. The valid range is between `0xa1` and `0xdf`.

This routine, available as a function or a macro in `ctype.h`, does not operate well with values outside the range of an `unsigned char`.

The function checks for invalid input (values that are not representable as an `unsigned char` and not equal to the value of the macro `EOF`) and returns 0 for such input. The macro does not check for invalid input, which makes it faster than the function. The macro is the default. To use the function you must explicitly use the `undef` preprocessor directive or ensure that the macro expansion does not occur by placing the function name within parentheses.

For example: `b = (isjis_kana)(c);`

`c`
: is the character to test. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`ctype.h`

See Also

`isalnum()`	`isalpha()`
`iscntrl()`	`isdigit()`
`isgraph()`	`islower()`
`isprint()`	`ispunct()`
`isspace()`	`isupper()`
`isxdigit()`	

islower()

See If Parameter Is Lowercase

Syntax

```
#include <ctype.h>
int islower(int c);
```

Description

`islower()` is a C macro that tests for lowercase letters. `islower()` returns a non-zero value for ASCII characters from `0x61 (a)` to `0x7a (z)`.

This routine, available as a function or a macro in `ctype.h`, does not operate well with values outside the range of an `unsigned char`. The function checks for invalid input (values that are not representable as an `unsigned char` and not equal to the value of the macro `EOF`) and returns 0 for such input. The macro does not check for invalid input, which makes it faster than the function. The macro is the default. To use the function you must explicitly use the `undef` preprocessor directive or ensure that the macro expansion does not occur by placing the function name within parentheses.

For example: `b = (islower)(c);`

`c`
: is the character to test. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`ctype.h`

See Also

`isalnum()`	`isalpha()`
`iscntrl()`	`isdigit()`
`isgraph()`	`isprint()`
`ispunct()`	`isspace()`
`isupper()`	`isxdigit()`

isprint()

See If Parameter Is Printable Character

Syntax

```
#include <ctype.h>
```

```
int isprint(int c);
```

Description

`isprint()` is a C macro that tests for printing characters. It returns a non-zero value for ASCII characters with values from `0x20` to `0x7e`.

This routine, available as a function or a macro in `ctype.h`, does not operate well with values outside the range of an `unsigned char`.

The function checks for invalid input (values that are not representable as an `unsigned char` and not equal to the value of the macro `EOF`) and returns 0 for such input. The macro does not check for invalid input, which makes it faster than the function. The macro is the default. To use the function you must explicitly use the `undef` preprocessor directive or ensure that the macro expansion does not occur by placing the function name within parentheses.

For example: `b = (isprint)(c);`

`c`

is the character to test. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`ctype.h`

See Also

`isalnum()`	`isalpha()`
`iscntrl()`	`isdigit()`
`isgraph()`	`islower()`
`ispunct()`	`isspace()`
`isupper()`	`isxdigit()`

ispunct()

See If Parameter Is Punctuation Character

Syntax

```
#include <ctype.h>
int ispunct(int c);
```

Description

`ispunct()` is a C macro that returns a non-zero value for any printing character that is neither a space nor a character for which `isalnum()` is non-zero.

This routine, available as a function or a macro in `ctype.h`, does not operate well with values outside the range of an `unsigned char`. The function checks for invalid input (values that are not representable as an `unsigned char` and not equal to the value of the macro `EOF`) and returns 0 for such input. The macro does not check for invalid input, which makes it faster than the function. The macro is the default. To use the function you must explicitly use the `undef` preprocessor directive or ensure that the macro expansion does not occur by placing the function name within parentheses.

For example: `b = (ispunct)(c);`

`c`
: is the character to test. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`ctype.h`

See Also

`isalnum()`	`isalpha()`
`iscntrl()`	`isdigit()`
`isgraph()`	`islower()`
`isprint()`	`isspace()`
`isupper()`	`isxdigit()`

_issjis1()

See If Parameter Is First Byte of SJIS Kanji

Syntax

```
#include <ctype.h>
```

```
int _issjis1(int c);
```

Description

`_issjis1()`is a C macro that returns a non-zero value if `c` is the first byte of a Shift-JIS (Japanese Industrial Standard) Kanji character. Otherwise, it returns zero. The valid ranges for Shift-JIS first bytes are between `0x81` and `0x9f` or between `0xe0` and `0xfc`.

This routine, available as a function or a macro in `ctype.h`, does not operate well with values outside the range of an `unsigned char`.

The function checks for invalid input (values that are not representable as an `unsigned char` and not equal to the value of the macro `EOF`) and returns 0 for such input. The macro does not check for invalid input, which makes it faster than the function. The macro is the default. To use the function you must explicitly use the `undef` preprocessor directive or ensure that the macro expansion does not occur by placing the function name within parentheses.

For example: `b = (issjis1)(c);`

`c`

is the character to test. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`ctype.h`

See Also

`isalnum()`	`isalpha()`
`iscntrl()`	`isdigit()`
`isgraph()`	`islower()`
`isprint()`	`ispunct()`
`_issjis2()`	`isspace()`
`isupper()`	`isxdigit()`

_issjis2()

See If Parameter Is Second Byte of SJIS Kanji

Syntax

```
#include <ctype.h>
int _issjis2(int c);
```

Description

`_issjis2()` is a C macro that returns a non-zero value if `c` is the second byte of a Shift-JIS (Japanese Industrial Standard) Kanji character. Otherwise, it returns zero. The valid range for Shift-JIS second bytes are between `0x40` and `0xfc`.

This routine, available as a function or a macro in `ctype.h`, does not operate well with values outside the range of an `unsigned char`. The function checks for invalid input (values that are not representable as an `unsigned char` and not equal to the value of the macro `EOF`) and returns 0 for such input. The macro does not check for invalid input, which makes it faster than the function. The macro is the default. To use the function you must explicitly use the `undef` preprocessor directive or ensure that the macro expansion does not occur by placing the function name within parentheses.

For example: `b = (issjis2)(c);`

`c`

is the character to test. (Input)

`c` cannot equal `0x7f`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`ctype.h`

See Also

`isalnum()`	`isalpha()`
`iscntrl()`	`isdigit()`
`isgraph()`	`islower()`
`isprint()`	`ispunct()`
`_issjis1()`	`isspace()`
`isupper()`	`isxdigit()`

isspace()
See If Parameter Is White Space

Syntax

```
#include <ctype.h>
int isspace(int c);
```

Description

`isspace()` is a C macro that returns a non-zero value for standard white space characters.

The standard white space characters are:

Table 2-10. isspace() White Space Characters

Description	Character
Space	
Form feed	`\f`
Newline	`\n`
Carriage return	`\r`
Horizontal tab	`\t`
Vertical tab	`\v`

This routine, available as a function or a macro in `ctype.h`, does not operate well with values outside the range of an `unsigned char`.

The function checks for invalid input (values that are not representable as an `unsigned char` and not equal to the value of the macro `EOF`) and returns 0 for such input. The macro does not check for invalid input, which makes it faster than the function. The macro is the default. To use the function you must explicitly use the `undef` preprocessor directive or ensure that the macro expansion does not occur by placing the function name within parentheses.

For example: `b = (isspace)(c);`

`c`
: is the character to test. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`ctype.h`

See Also

isalnum()	isalpha()
iscntrl()	isdigit()
isgraph()	islower()
isprint()	ispunct()
isupper()	isxdigit()

isupper()

See If Parameter Is Uppercase

Syntax

```
#include <ctype.h>
int isupper(int c);
```

Description

`isupper()` is a C macro that returns a non-zero value for uppercase letters. `isupper()` returns a non-zero value for ASCII characters with values in the range from `0x41 (A)` to `0x5a (Z)`.

This routine, available as a function or a macro in `ctype.h`, does not operate well with values outside the range of an `unsigned char`. The function checks for invalid input (values that are not representable as an `unsigned char` and not equal to the value of the macro `EOF`) and returns 0 for such input. The macro does not check for invalid input, which makes it faster than the function. The macro is the default. To use the function you must explicitly use the `undef` preprocessor directive or ensure that the macro expansion does not occur by placing the function name within parentheses.

For example: `b = (isupper)(c);`

`c`
: is the character to test. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`ctype.h`

See Also

`isalnum()`	`isalpha()`
`iscntrl()`	`isdigit()`
`isgraph()`	`islower()`
`isprint()`	`ispunct()`
`isspace()`	`isxdigit()`

isxdigit()

See If Parameter Is Hexadecimal

Syntax

```
#include <ctype.h>
```

```
int isxdigit(int c);
```

Description

`isxdigit()` is a C macro that returns a non-zero value for any hexadecimal-digit character.

This routine, available as a function or a macro in `ctype.h`, does not operate well with values outside the range of an `unsigned char`.

The function checks for invalid input (values that are not representable as an `unsigned char` and not equal to the value of the macro `EOF`) and returns 0 for such input. The macro does not check for invalid input, which makes it faster than the function. The macro is the default. To use the function you must explicitly use the `undef` preprocessor directive or ensure that the macro expansion does not occur by placing the function name within parentheses.

For example: `b = (isxdigit)(c);`

`c`

is the character to test. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`ctype.h`

See Also

`isalnum()`	`isalpha()`
`iscntrl()`	`isdigit()`
`isgraph()`	`islower()`
`isprint()`	`ispunct()`
`isspace()`	`isupper()`

_julian()

Convert Date/Time to Julian Value

Syntax

```
#include <time.h>
int _julian(
    int *time,
    int *date);
```

Description

`_julian()` converts the time and date from Gregorian format to the Julian equivalents.

`_julian()` modifies the objects to which its parameters point as follows:

Figure 2-5. _julian() Output Date and Time Formats

Time:	Seconds Since Midnight (0-86399)
Date:	Julian Day Number

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

Be certain to pass pointers for `date` and `time` values.

`time and date`
are pointers to the Gregorian format time and date values. (Input/Output)

The following format is assumed:

Figure 2-6. _julian() Input Date and Time Formats

	Byte 0	Byte 1	Byte 2	Byte 3
Time:	0	Hour (0-23)	Minute	Second
Date:	Year (two bytes)		Month	Day

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

Example

```
main()
{
   int date,time,tick;
   short day;
   _sysdate(0,&time,&date,&day,&tick);
   _julian(&time,&date);
   printf("The Julian date is %d. \
      Cinderella needs to be home in %d seconds!\n",date,86400-time);
}
```

See Also

`_sysdate()`	(OS-9 for 68K)
`_os_gregorian()`	(OS-9 for 68K)
`_os_julian()`	(OS-9 for 68K)
`F$Time`	*OS-9 for 68K Technical Manual*
`F$Julian`	*OS-9 for 68K Technical Manual*
`F_TIME`	*OS-9 Technical Manual*

kill()

Send Signal to Process

Syntax

```
#include <signal.h>
int kill(
    int pid,
    int sigcode);
```

Description

`kill()` sends a signal to a process. Both the sending and receiving process must have the same user number unless the sending process' user number is that of the super user (`0`).

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

The super user can send a signal to all processes running on the system if the `pid` is zero.

`pid`
: is the process ID of the process to kill. (Input)

`sigcode`
: is the signal code to send. Only the lower 16 bits of `sigcode` are used. (Input)

  The value in `sigcode` is sent as a signal to the process specified by `pid`. You can pass any value in `sigcode`. The conventional code numbers are defined in the `signal.h` header file.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_send()`

`F$Send`	*OS-9 for 68K Technical Manual*
`F_SEND`	*OS-9 Technical Manual*
`kill` command	*Using OS-9 for 68K* or *Using OS-9*

labs()

Compute Absolute Value

Syntax

```
#include <stdlib.h>

long int labs(long int num);
```

Description

`labs()` returns the absolute value of `num`. `num` and the returned value each have type `long int`.

`num`
: is the value to use. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`abs()`

_lcalloc()

Allocate Storage for Array (Low-Overhead)

Syntax

```
#include <stdlib.h>
void *_lcalloc(
    unsigned long nel,
    unsigned long elsize);
```

Description

`_lcalloc()` allocates space for an array. The allocated memory is cleared to zeroes.

`_lcalloc()` calls `_lmalloc()` to allocate memory.

- If the allocation is successful, `_lcalloc()` returns a pointer to the area.
- If the allocation fails, `_lcalloc()` returns NULL.

Use of the low-overhead allocation functions (`_lcalloc()`, `_lmalloc()`, and `_lrealloc()`) instead of the general allocation functions (`calloc()`, `malloc()`, and `realloc()`) saves 8 bytes per allocation because the low-overhead functions do not save the allocation size or the 4-byte check value.

Use extreme care to ensure that you only access the assigned memory. Modifying addresses immediately above or below the assigned memory causes unpredictable program results.

The low-overhead functions require that you keep track of the sizes of allocated spaces in memory. Note the `_lfree()` and `_lrealloc()` parameters.

`nel`
: specifies the number of elements in the array. (Input)

`elsize`
: specifies the size of each element. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`clib.l`

See Also

`calloc()` `free()_lfree()`
`_lmalloc()` `_lrealloc()` `malloc()_mallocmin()`
`_os9_srqmem()` `realloc()`

ldexp()

Multiply Float by Exponent of 2

Syntax

```
#include <math.h>
double ldexp(
    double fp,
    int exp);
```

Description

`ldexp()` multiplies a floating point value by an integral power of two. `ldexp()` returns the value equal to `fp * 2^exp`.

`fp`
: is the floating point value. (Input)

`exp`
: is the integral power of two. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

ldiv()

Compute Quotient and Remainder

Syntax

```
#include <stdlib.h>
ldiv_t ldiv(
    long int numer,
    long int denom);
```

Description

`ldiv()` returns the quotient and remainder of the division of the numerator by the denominator. The parameters and member of the returned structure are all of type `long int`.

`numer`
: is the numerator. (Input)

`denom`
: is the denominator. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`div()`

_lfree()

Return Memory (Low-Overhead)

Syntax

```
#include <stdlib.h>
void _lfree(
    void *ptr,
    unsigned long size);
```

Description

`_lfree()` returns a block of memory granted by `_lcalloc()` or `_lmalloc()`. The memory is returned to a pool of memory for later re-use by `calloc()`, `_lcalloc()`, `_lmalloc()`, or `malloc()`.

Use of the low-overhead allocation functions (`_lcalloc()`, `_lmalloc()`, and `_lrealloc()`) instead of the general allocation functions (`calloc()`, `malloc()`, and `realloc()`) saves 8 bytes per allocation because the low-overhead functions do not save the allocation size or the 4-byte check value.

- If `_lfree()` is used with something other than a pointer returned by `_lcalloc()` or `_lmalloc()`, the memory lists maintained by `_lmalloc()` and `malloc()` are corrupted and programs behave unpredictably.
- `_lfree()` never returns an error.

The low-overhead functions require that you keep track of the sizes of allocated spaces in memory.

`ptr`
: is a pointer to the memory block. (Input)

`size`
: specifies the size of the memory block. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`clib.l`

See Also

`calloc()`	`free()`	`_freemin()`
`_lcalloc()`	`_lmalloc()`	`_lrealloc()`
`malloc()`	`_os_srtmem()`	`realloc()`

lftocr()

Convert Linefeed to Carriage Return

Syntax

```
#include <UNIX/os9def.h>
void lftocr(
    char *buf,
    int n);
```

Description

`lftocr()` converts all linefeed characters to carriage-return characters in `buf` for a span of `n` characters.

`buf`
: is a pointer to a buffer. (Input/Output).

`n`
: is the number of characters spanned. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

_lmalloc()

Allocate Memory from Arena (Low-Overhead)

Syntax

```
#include <stdlib.h>

void *_lmalloc(unsigned long size);
```

Description

`_lmalloc()` returns a pointer to a memory block. The pointer is suitably aligned for storing data of any type.

`_lmalloc()` maintains an amount of memory, called an arena, from which it grants memory requests. `_lmalloc()` searches its arena for a block of free memory large enough for the request and, in the process, joins adjacent blocks of free space returned by either `_lfree()` or `free()`. If sufficient memory is not available in the arena, `_lmalloc()` calls `_srqmem()` to get more memory from the system.

`_lmalloc()` returns NULL if no memory is available or if the arena is detected to be corrupted.

Use of the low-overhead allocation functions (`_lcalloc()`, `_lmalloc()`, and `_lrealloc()`) instead of the general allocation functions (`calloc()`, `malloc()`, and `realloc()`) saves 8 bytes per allocation because the low-overhead functions do not save the allocation size or the 4-byte check value.

Use extreme care to ensure that you only access the memory assigned by `_lmalloc()`. Modifying addresses immediately above or below the assigned memory or passing `_lfree()` a value not assigned by `_lmalloc()` causes unpredictable program results.

The low-overhead functions require that you keep track of the sizes of allocated spaces in memory. Note the `_lfree()` and `_lrealloc()` parameters.

`size`
: specifies the size of the memory block in bytes. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`clib.l`

See Also

`_lcalloc()`
`_lrealloc()`
`_mallocmin()`
`free()`
`realloc()`
`_lfree()`
`malloc()`
`calloc()`
`_os_srqmem()`

localeconv()

Numeric Formatting Convention Inquiry

Syntax

```
#include <locale.h>

struct lconv *localeconv(void);
```

Description

`localeconv()` sets the components of an object with type `struct lconv` with values appropriate for formatting numeric quantities according to the rules of the current locale.

The members of the structure with type `char *` are pointers to strings, any of which (except `decimal_point`) can point to a NULL value to indicate that the value is not available in the current locale or is of zero length. The members with type `char` are non-negative numbers, any of which can be `CHAR_MAX` to indicate that the value is not available in the current locale. The members include the following:

`char *decimal_point`
: The decimal point character used to format non-monetary quantities.

`char *thousands_sep`
: The character used to separate groups of digits before the decimal point character in formatted non-monetary quantities.

`char *grouping`
: A string whose elements indicate the size of each group of digits in formatted, non-monetary quantities. The string may contain the following:

`CHAR_MAX`	No further grouping is to be performed.
`0`	The previous element is to be repeatedly used for the remaining digits.
`other`	The integer value is the number of digits that comprise the current group. The next element is examined to determine the size of the next group of digits before the current group.

`char *int_curr_symbol`
: The international currency symbol that applies to the current locale. The first three characters contain the alphabetic international currency symbol. The fourth character (immediately preceding the null character) is the character used to separate the international currency symbol from the monetary quantity.

`char *currency_symbol`
: The local currency symbol applicable to the current locale.

`char *mon_decimal_point`
: The decimal point used to format monetary quantities.

`char *mon_thousands_sep`
The separator for groups of digits before the decimal point in formatted monetary quantities.

`char *mon_grouping`
A string whose elements indicate the size of each group of digits in formatted monetary quantities. The string may contain the following:

`CHAR_MAX`	No further grouping is to be performed.
`0`	The previous element is to be repeatedly used for the remaining digits.
`other`	The integer value is the number of digits that comprise the current group. The next element is examined to determine the size of the next group of digits before the current group.

`char *positive_sign`
The string used to indicate a non-negative-valued formatted monetary quantity.

`char *negative_sign`
The string used to indicate a negative-valued formatted monetary quantity.

`char int_frac_digits`
The number of fractional digits (those after the decimal point) to display in an internationally formatted monetary quantity.

`char p_cs_precedes`
Set to one or zero if the `currency_symbol` respectively precedes or succeeds the value for a non-negative formatted monetary quantity.

`char p_sep_by_space`
Set to one or zero if the `currency_symbol` respectively is or is not separated by a space from the value for a non-negative formatted monetary quantity.

`char n_cs_precedes`
Set to one or zero if the `currency_symbol` respectively precedes or succeeds the value for a negative formatted monetary quantity.

`char n_sep_by_space`
Set to one or zero if the `currency_symbol` respectively is or is not separated by a space from the value for a negative formatted monetary quantity.

`char p_sign_posn`
Set to a value indicating the positioning of the `positive_sign` for a non-negative formatted monetary quantity. The value may be:

Table 2-11. Values for char _p_sign_posn

`0`	Parentheses surround the quantity and currency symbol.
`1`	The sign string precedes the quantity and currency symbol.
`2`	The sign string succeeds the quantity and currency symbol.

Table 2-11. Values for char _p_sign_posn (Continued)

3	The sign string immediately precedes the currency symbol.
4	The sign string immediately succeeds the currency symbol.

`char n_sign_posn`
Set to a value indicating the positioning of the `negative_sign` for a negative formatted monetary quantity. The values are the same as for `p_sign_posn`.

`localeconv()` returns a pointer to the filled in object. You cannot modify the structure pointed to by the return value, but a subsequent call to `localeconv()` can overwrite the structure. In addition, calls to `setlocale()` with categories `LC_ALL`, `LC_MONETARY`, or `LC_NUMERIC` may overwrite the contents of the structure.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

localtime()

Convert Calendar Time to Local Time

Syntax

```
#include <time.h>
struct tm *localtime(time_t *timer);
```

Description

`localtime()` converts a calendar time into a broken down time, expressed as local time.

`localtime()` returns a pointer to a static area which may be overwritten. To ensure data integrity, use the value or save it immediately.

`timer`
: is a pointer to the calendar time. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`mktime()`

`time()`

log()

Natural Logarithm

Syntax

```
#include <math.h>
double log(double x);
```

Description

`log()` returns the natural logarithm of `x` (input). A domain error occurs, `EDOM` stored in `errno`, if `x` is negative. A range error, `ERANGE` stored in `errno`, occurs if `x` is zero. `log()` returns `HUGE_VAL` for both errors.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

Possible Errors

`EDOM`

`ERANGE`

log10()
Base-Ten Logarithm

Syntax

```
#include <math.h>
double log10(double x);
```

Description

`log10()` returns the base-ten logarithm of `x` (input). A domain error, `EDOM` stored in `errno`, occurs if `x` is negative. A range error, `ERANGE` stored in `errno`, occurs if `x` is zero. `log10()` returns `HUGE_VAL` for both errors.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

Possible Errors

`EDOM`

`ERANGE`

longjmp()

Non-Local Goto

Syntax

```
#include <setjmp.h>
void longjmp(
    jmp_buf env,
    int val);
```

Description

`longjmp()` and `setjmp()` allow program control to return directly to a higher level function. They are most useful when dealing with errors and signals encountered in a low-level routine.

`longjmp()` restores the environment saved by the most recent call to `setjmp()` in the same execution of the program, with the corresponding `jmp_buf` parameter. If there has been no such call or if the function containing the `setjmp()` call has returned in the interim, the behavior is undefined.

All accessible objects have values as of the time `longjmp()` was called, except that the value of objects of automatic storage duration that are local to the function containing the call to the corresponding `setjmp()` call and `longjmp()` call are indeterminate.

Because it bypasses the usual function call and return mechanisms, `longjmp()` executes correctly in contexts of interrupts, signals, and any of their associated functions. However, if `longjmp()` is called from a nested signal handler (that is, from a function called as a result of a signal raised during the handling of another signal), the behavior is undefined.

After `longjmp()` is completed, program execution continues as if the corresponding call to `setjmp()` had just returned the value specified by `val`. `longjmp()` cannot cause `setjmp()` to return the value zero. If `val` is zero, `setjmp()` returns the value `1`.

Do not call `longjmp()` before env is initialized by `setjmp()` or if the function calling `setjmp()` has already returned.

`env`
: is the program environment buffer. (Input)

`val`
: is the error status value. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`setjmp()`

_lrealloc()

Resize Block of Memory (Low-Overhead)

Syntax

```
#include <stdlib.h>
void *_lrealloc(
    void *oldptr,
    unsigned long newsize,
    unsigned long oldsize);
```

Description

`_lrealloc()` resizes a block of memory.

`_lrealloc()` returns a pointer to a new memory block of size `newsize`. The pointer is aligned to store data of any type.

If `newsize` is smaller than `oldsize`, the contents of the old block are truncated and placed in the new block. Otherwise, all of the old block's contents begin the new block. The results of `_lrealloc(NULL,10,0)` and `_lmalloc(10)` are the same. `_lrealloc()` returns NULL if the requested memory is not available or if `newsize` is specified as zero.

Use of the low-overhead allocation functions (`_lcalloc()`, `_lmalloc()`, and `_lrealloc()`) instead of the general allocation functions (`calloc()`, `malloc()`, and `realloc()`) saves 8 bytes per allocation because the low-overhead functions do not save the allocation size or the 4-byte check value. The low-overhead functions require that you keep track of the sizes of allocated spaces in memory.

`oldptr`
: is a pointer to the memory block. (Input)

  `oldptr` should be a value returned by a previous call to `_lmalloc()`, `_lcalloc()`, or `_lrealloc()`.

`newsize`
: specifies the size to use for the memory block. (Input)

`oldsize`
: is the size of the old memory block. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`clib.l`

See Also

`calloc()`	`free()`
`_freemin()`	`_lcalloc()`
`_lfree()`	`_lmalloc()`
`malloc()`	`_mallocmin()`
`_os_srqmem()`	`_os_srtmem()`
`realloc()`	

lseek()

Position File Pointer

Syntax

```
#include <modes.h>
long lseek(
    int path,
    long position,
    int place);
```

Description

`lseek()` repositions the file pointer for the file open on `path` to the byte offset given in `position`.

The returned value is the resulting position in the file. If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

On OS-9, the file pointer is a full unsigned 32-bits.

Do not use `lseek()` on a buffered file because the buffering routines use `fseek()` to keep track of the file pointer.

`path`
: is the path number of the open file. (Input)

`position`
: is the new file position offset. (Input)

`place`
: determines from which file position the offset is based. (Input)

`0` — From the beginning of the file.

`1` — From the current position.

`2` — From the end of the file.

Seeking to a location beyond end-of-file for a file open for writing and then writing to it creates a hole in the file. The hole contains data with no particular value, usually garbage remaining on the disk.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`fseek()`

`_os_seek()`

`I$Seek`	*OS-9 for 68K Technical Manual*
`I_SEEK`	*OS-9 Technical Manual*

lstat()

Obtain Information about a File

Syntax

```
#include <UNIX/stat.h>

int lstat(
            const char *path,
            struct stat *sb);
```

Description

The `lstat()` function obtains information about the file pointed to by `path`. Read, write or execute permission of the named file is not required, but all directories listed in the path name leading to the file must be searchable.

Upon successful completion a value of 0 is returned. Otherwise, a value of -1 is returned and errno is set to indicate the error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

See Also

`close()`	`closedir()`
`open()`	`opendir()`
`localtime()`	`mktime()`

makdir()
Create Directory

Syntax

```
#include <modes.h>
int makdir(
    const char *name,
    int mode,
    int perm[,
    int size]);
```

For C++ Programmers:
The parameters for this function are *not* optional in C++. You must specify each; if you do not, a compliation error will occur.

Description

`makdir()` creates a directory file.

If successful, `makdir()` returns zero. Otherwise, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`name`
: is a pointer to the name of the directory. (Input)

`mode`
: specifies the file access mode. (Input)

  Only the lower 16 bits of `mode` are used. (Input)

`perm`
: specifies the file attribute permissions. (Input)

  Only the lower 16 bits of `perm` are used. If the `FAM_SIZE` (or `S_ISIZE`) bit is set in `mode`, the initial size of the directory is set to `size`.

`size`
: is the size of the directory. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_makdir()`

`I$MakDir`	*OS-9 for 68K Technical Manual*
`I_MAKDIR`	*OS-9 Technical Manual*

make_gdesc()

Make Global Descriptor Table Entry

Syntax

```
#include <regs.h>
#include <types.h>
void *make_gdesc(
    void *tbl_entry_addr,
    u_int32 offset,
    u_int16 segment_attr);
```

Description

`make_gdesc()` makes an entry in the global descriptor table. It returns a pointer to the next entry.

`make_gdesc()` is only supported by the 80x86 family of processors version of the compiler.

`tbl_entry_addr`
: is a pointer to the address of the local descriptor table or the global descriptor table. (Input)

`offset`
: is the offset into the global descriptor table. (Input)

`segment_attr`
: is the segment attributes. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

make_idesc()

Make Interrupt Descriptor Table Entry

Syntax

```
#include <regs.h>
#include <types.h>

void *make_idesc(
    void *tbl_entry_addr,
    u_int32 offset,
    u_int16 segment_attr,
    u_int16 selector);
```

Description

`make_idesc()` makes an entry in the interrupt descriptor table. It returns a pointer to the next entry.

`make_idesc()` is only supported by the 80x86 family of processors version of the compiler.

`tbl_entry_addr`
: is a pointer to the interrupt descriptor table. (Input)

`offset`
: is an offset into the table. (Input)

`segment_attr`
: specifies the segment attributes. (Input)

`selector`
: specifies the selector entry value. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

make_module()
Create Module

Syntax

```
#include <memory.h>
#include <module.h>
mh_com *make_module(
    const char *name,
    int size,
    int attr,
    int perm,
    int typelang,
    int color);
```

Description

`make_module()` creates a memory module with the specified name and attributes in the specified memory. `make_module()` is similar to `_mkdata_module()`. However, `make_module()` allows you to specify the type/language of the module and color of memory in which to make the module.

`make_module()` returns a pointer to the beginning of the module header. If the module cannot be created, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

The name of the module created by `make_module()` always begins at offset `$34` within the module. This implies that program modules, trap handlers, file managers, device drivers, and device descriptors cannot be made conveniently by this call.

`mod_exec`
: is defined in the `module.h` header file.

`name`
: is a pointer to the name of the module. (Input)

`size`
: specifies the desired memory size of the module in bytes. (Input)

  The size value does not include the module header and CRC bytes.

`size`
: is the amount of memory available for actual use. (Input)

  The memory in the module is initially cleared to zeroes.

`attr`
: specifies the module's attribute and revision level. (Input)

  Only the lower 16 bits of `attr` are used.

`perm`
: specifies the module permissions. (Input)

Only the lower 16 bits of `perm` are used.

`typelang`
: specifies the type and language of the module. (Input)

Only the lower 16 bits of `typelang` are used.

`color`
: indicates the specific memory type in which to load the module. (Input)

The `memory.h` header file contains definitions of the memory types that you can specify:

Memory Type	Description
`SYSRAM or MEM_SYS`	System RAM memory
`VIDEO1`	Video memory for plane A
`VIDEO2`	Video memory for plane B
`MEM_ANY`	No specific memory type

If `color` is `MEM_ANY`, the module is made in whatever memory the system allocates.

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_datmod()`

`F$DatMod` service request   *OS-9 for 68K Technical Manual*

malloc()

Allocate Memory from Arena

Syntax

```
#include <stdlib.h>
void *malloc(size_t size);
```

Description

`malloc()` allocates space for an object. The value of the object is indeterminate. `malloc()` returns either a null pointer (if sufficient free memory is not available) or a pointer to the allocated space.

`size`
: is the size of the memory block to allocate. (Input)

  If `size` is zero, NULL is returned.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`calloc()`

`free()`

`_os_srqmem()`

`_os9_srqmem()`

`realloc()`

`F$SRqMem`	*OS-9 for 68K Technical Manual*
`F_SRQMEM`	*OS-9 Technical Manual*

_mallocmin()

Set Minimum Allocation Size

Syntax

```
#include <stdlib.h>
void _mallocmin(unsigned size);
```

Description

`_mallocmin()` sets the minimum amount of memory that allocation functions may request from the system.

`size`
: is the minimum allocation size in bytes. (Input)

  `size` cannot be less than the system memory block size. Size must be greater than or equal to the larger of the system memory block size or 4K. If a smaller size is requested, `size` is automatically set to the system memory block size.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`clib.l`

See Also

`calloc()`

`_lcalloc()`

`_lmalloc()`

`_lrealloc()`

`malloc()`

`realloc()`

mblen()

Determine Number of Bytes in Multibyte Character

Syntax

```
#include <stdlib.h>
int mblen(
    const char *str,
    size_t num);
```

Description

`mblen()` determines the number of bytes contained in the multibyte character pointed to by `str`, if `str` is a not a null pointer. `mblen()` is similar to the following; however, the shift state of `mbtowc()` is unaffected:

```
mbtowc((wchar_t *)0, s, n);
```

If `str` is a null pointer, `mblen()` returns a non-zero value (if the multibyte character encodings have state-dependent encodings) or returns a zero value.

If `str` is not a null pointer, `mblen()` returns:

- `0` if `str` points to the null character.
- The number of bytes contained in the multibyte character if the next `num` or fewer bytes form a valid multibyte character.
- `-1` if they do not form a valid multibyte character.

`mblen()` is supported for both the `C` and `JAPAN` locales.

`str`
: is a pointer to a multibyte character. (Input)

`num`
: is the number of bytes to search. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`mbtowc()`

mbstowcs()

Convert Sequence of Multibyte Characters

Syntax

```
#include <stdlib.h>
size_t mbstowcs(
   wchar_t *pwcs,
   const char *str,
   size_t num);
```

Description

`mbstowcs()` converts a sequence of multibyte characters that begins in the initial shift state into a sequence of corresponding codes and stores not more than `num` codes in an array. No multibyte characters that follow a null character are examined or converted. A null character is converted into a code with value zero. Each multibyte character is converted as if by a call to `mbtowc()`, except that the shift state of `mbtowc()` is unaffected.

No more than `num` elements are modified in `pwcs`. If copying takes place between overlapping objects, the behavior is undefined.

If an invalid multibyte character is encountered, `mbstowc()` returns `(size_t)-1`. Otherwise, `mbstowcs()` returns the number of array elements modified, not including a terminating zero code, if any.

`mbstowcs()` is supported for both the `C` and `JAPAN` locales.

`pwcs`
: is a pointer to the array into which to store the converted values. (Output)

`str`
: is a pointer to the original sequence of multibyte characters. (Input)

`num`
: specifies the maximum number of elements to modify. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`wcstombs()`

mbtowc()

Determine Number of Bytes in Multibyte Characters

Syntax

```
#include <stdlib.h>
int mbtowc(
    wchar_t *pwc,
    const char *mbchar,
    size_t maxnum);
```

Description

`mbtowc()` determines the number of bytes contained in the multibyte character pointed to by `mbchar`, if `mbchar` is not a null pointer. It then determines the code for the value of type `wchar_t` that corresponds to that multibyte character. The value of the code corresponding to the null character is zero. If the multibyte character is valid and `pwc` is not a null pointer, `mbtowc()` stores the code in `pwc`. At most `maxnum` bytes of `mbchar` are examined. The returned value is never greater than `maxnum` or `MB_CUR_MAX`. `mbtowcs()` is supported for both the `C` and `JAPAN` locales.

`pwc`
: is a pointer to the array in which to store the code. (Output)

`mbchar`
: is a pointer to a multibyte character. (Input)

If `mbchar` is a null pointer, `mbtowc()` returns a non-zero value if multibyte character encodings have state-dependent encodings or returns a zero value.

If `mbchar` is not a null pointer, `mbtowc()` either returns:

- `0` if `mbchar` is a pointer to the null character.
- The number of bytes contained in the converted multibyte character if the next `maxnum` or fewer bytes form a valid multibyte character.
- `-1` if they do not form a valid multibyte character.

`maxnum`
: specifies the maximum number of bytes to examine. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`wctomb()`

memchr()

Memory Search

Syntax

```
#include <string.h>
void *memchr(
    const void *mem_area,
    int chr,
    size_t size);
```

Description

`memchr()` locates the first occurrence of `chr`, converted to an `unsigned char`, in the initial `size` characters, each interpreted as `unsigned char`, of `mem_area`.

`memchr()` returns a pointer to the located character, or a null pointer if the character does not occur in the object.

`mem_area`
: is a pointer to the memory to search. (Input)

`chr`
: is the character for which to search. (Input)

`size`
: is the size of the memory area to search. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

memcmp()

Compare Memory

Syntax

```
#include <string.h>
int memcmp(
    const void *string1,
    const void *string2,
    size_t size);
```

Description

`memcmp()` compares the first `size` characters of `string1` to the first `size` characters of `string2`. `memcmp()` returns an integer that is:

- Positive, if `string1` is greater than `string2`.
- Zero, if `string1` equals `string2`.
- Negative, if `string1` is less than `string2`.

`string1`
: is a pointer to a string to compare. (Input)

`string2`
: is a pointer to a string to compare. (Input)

`size`
: is the number of characters to compare. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

memcpy()

Copy Memory

Syntax

```
#include <string.h>
void *memcpy(
    void *dest,
    const void *source,
    size_t num);
```

Description

`memcpy()` copies characters from one location to another. If copying takes place between overlapping objects, the behavior is undefined. `memcpy()` returns the value of `dest`.

`dest`
: is a pointer to the destination in memory. (Output)

`source`
: is a pointer to the memory to copy into `dest`. (Input)

`num`
: is the number of characters to copy. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

memmove()
Move Memory

Syntax

```
#include <string.h>
void *memmove(
    void *dest,
    const void *source,
    size_t num);
```

Description

`memmove()` copies characters from one location to another. Copying takes place as if the characters from the original location are first copied into a temporary array of `num` characters that does not overlap `dest` and `source`, and then the `num` characters from the temporary array are copied into `dest`. `memmove()` returns the value of `dest`.

`dest`
: is a pointer to the destination in memory. (Output)

`source`
: is a pointer to the memory to copy into `dest`. (Input)

`num`
: is the number of characters to copy. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

memset()

Fill Memory

Syntax

```
#include <string.h>
void *memset(
    void *mem,
    int fill,
    size_t size);
```

Description

`memset()` copies the value of `fill`, converted to an `unsigned char`, into each of the first `size` characters of `mem`. `memset()` returns the value of `mem`.

`mem`
: is a pointer to the memory to fill. (Output)

`fill`
: is the value with which to fill an area of memory. (Input)

`size`
: is the number of characters to fill with `fill`. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

_mkdata_module()

Create Data Memory Module

Syntax

```
#include <module.h>
char *_mkdata_module(
    const char *name,
    unsigned size,
    int attr,
    int perm);
```

Description

`_mkdata_module()` creates a data memory module. Other processes on the system can then access the data module by `modlink()`. The memory in the data module is initially cleared to zeroes.

`_mkdata_module()` returns a pointer to the beginning of the module header.

If the data module cannot be created, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`name`
: is a pointer to the desired module name. (Input)

`size`
: specifies the size of the module in bytes. (Input)

The size value does not include the module header and CRC bytes. The specified size is the amount of memory available for actual data storage.

`attr`
: specifies the module's attribute and revision level. Only the lower 16 bits of `attr` are used.

`perm`
: specifies the module access permissions. Only the lower 16 bits of `perm` are used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_datmod()`

`F$DatMod`	*OS-9 for 68K Technical Manual*
`F_DATMOD`	*OS-9 Technical Manual*

mknod()

Create Directory

Syntax

```
#include <modes.h>
int mknod(
    const char *name,
    int perm);
```

Description

`mknod()` creates a directory file.

`mknod()` returns zero if the directory was successfully created. If the creation failed, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`mknod()` does not make UNIX-style special files as there are no such files on OS-9 for 68K and OS-9. This is a historical function and is likely to be removed in a future release. Use `makdir()` in all new code.

`name`
: is a pointer to the name of the directory. (Input)

`perm`
: specifies the access permissions for the directory. (Input)

  Only the lower 16 bits of `perm` are used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`makdir()`

`_os_makdir()`

`I$MakDir`	*OS-9 for 68K Technical Manual*
`I_MAKDIR`	*OS-9 Technical Manual*

mkstemp()

Overwrite Template to Create File

Syntax

```
#include <stdio.h>
#include <stdlib.h>
int mkstemp(
                char *template);
```

Description

The `mkstemp()` function takes the given file name template and overwrites a portion of it to create a template file, mode S_IREAD/S_IWRITE, returning a file descriptor opened for reading and writing. This avoids the race between testing for a file's existence and opening it for use.

This function returns -1 if no suitable file could be created. If either call fails an error code is placed in the global variable errno.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

sys_clib.l

See Also

`mktemp()`

`create()`

mktemp()
Create Unique File Name

Syntax

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

```
char *mktemp(char *name);
```

Description

`mktemp()` ensures that the name of a temporary file is unique in the system and does not clash with any other file name.

A pointer to a template string is passed to `mktemp()`. The template string should look like a filename with a minimum of three trailing `X`'s. `mktemp()` replaces the `X`'s with a letter and the current process ID. The letter is chosen so that the resulting name does not conflict with an existing file.

`mktemp()` returns a pointer to the file name or `NULL` if more than 256 `mktemp()` files exist.

`name`
: is a pointer to the template string. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`tmpnam()`
`tmpfile()`

mktime()

Convert Broken-Down Time to Calendar Time

Syntax

```
#include <time.h>
```

```
time_t mktime(struct tm *tp);
```

Description

`mktime()` converts the broken-down time, expressed as local time, into a calendar time value with the same encoding as the values returned by `time()`. The original values of the `tm_wday` and `tm_yday` fields of the structure are ignored, and the original values of the other fields are not restricted to the indicated ranges.

On successful completion, the `tm_wday` and `tm_yday` fields of the structure are set appropriately. The other fields are set to represent the specified calendar time, but with their values forced to the indicated ranges. The final value of `tm_mday` is not set until `tm_mon` and `tm_year` are determined.

`mktime()` returns the specified calendar time encoded as a value of type `time_t`. If the calendar time cannot be represented, `mktime()` returns the value `(time_t)-1`.

`tp`
: is a pointer to the broken-down time structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`asctime()`

`getenv()`

`gmtime()`

`localtime()`

`time()`

modcload()

Load Module into Colored Memory

Syntax

```
#include <memory.h>
#include <module.h>
mh_com *modcload(
    const char *modname,
    int mode,
    int memtype);
```

Description

`modcload()` opens the file specified by the pathlist. It reads one or more memory modules from the file into memory until an error or end of file is reached. `modname` is considered a pathlist and all modules in the specified file are loaded. A link is made to the first module loaded from the file and a pointer to it is returned.

If `memtype` is `MEM_ANY`, the module may be loaded in whatever memory the system allocates.

If the load is successful, `modcload()` returns a pointer to the module. If the load fails, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`modname`
: is a pointer to the path to the module. (Input)

`mode`
: is the mode which opens the file to load. (Input)

  If any access `mode` is acceptable, specify zero for `mode`.

`memtype`
: indicates the specific memory type in which to load the module. (Input)

  The `memory.h` header file contains definitions of the memory types that may be specified:

Memory Type	Description
`SYSRAM or MEM_SYS`	System RAM memory
`VIDEO1`	Video memory for plane A
`VIDEO2`	Video memory for plane B.
`MEM_ANY`	No specific memory type.

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

modf()

Return Parts of Real Number

Syntax

```
#include <math.h>
double modf(
    double value,
    double *num);
```

Description

`modf()` breaks `value` into integral and fractional parts, each of which has the same sign as the parameter. It stores the integral part as a double in `num`.

`modf()` returns the signed fractional part of `value`.

`value`
: is a real number. (Input)

`num`
: is a pointer to the integer portion of `value`. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

modlink()

Link to Memory Module

Syntax

```
#include <module.h>
mh_com *modlink(
    const char *modname,
    int typelang);
```

Description

`modlink()` searches the module directory for a module with the same name as that pointed to by `modname` and links to it, provided that `typelang` matches the respective value of Type/Language in the module. If the module is found, the module's link count is incremented by one.

The `module.h` header file contains a structure appropriate for accessing the elements of system-defined memory modules.

If the link is successful, `modlink()` returns a pointer to the module. If the link fails, -1 is returned and the appropriate error code is placed in the global variable `errno`.

`modname`
: is a pointer to the name of the module. (Input)

`typelang`
: is the type and language value of the module. (Input)

  If any module type or language is acceptable, specify zero for `typelang`. Only the lower 16 bits of `typelang` are used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_link()`

`_os_load()`

`F$Link`	*OS-9 for 68K Technical Manual*
`F_LINKM`	*OS-9 Technical Manual*

modload()

Load and Link to Memory Module

Syntax

```
#include <module.h>
mh_com *modload(
    const char *modname,
    int accessmode);
```

Description

`modload()` loads all modules in the file specified by the path `modname`.

A link is made to the first module loaded from the file and a pointer to it is returned.

The `module.h` header file contains a structure appropriate for accessing the elements of system-defined memory modules.

If the load is successful, `modload()` returns a pointer to the module. If the load fails, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

To load a module using the shell `PATH` variable list, see `_os_loadp()` or `modloadp()`.

`modname`
: is a pointer to the name of the module. (Input)

`accessmode`
: specifies the module's access mode. (Input)

  If any module access mode is acceptable, specify zero for `accessmode`. Only the lower 16 bits of `accessmode` are used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_link()`
`_os_load()`
`_os_loadp()`

`F$Load`	*OS-9 for 68K Technical Manual*
`F_LOAD`	*OS-9 Technical Manual*

modloadp()

Load and Link to Memory Module Using PATH

Syntax

```
#include <module.h>
mh_com *modloadp(
    const char *modname,
    int accessmode,
    char *namebuffer);
```

Description

`modloadp()` loads all modules in the file specified by the path `modname`. The `PATH` environment variable determines alternate directories to search for the named module.

`PATH` has a list of directories to search if the program is not found in the module directory or execution directory. `PATH` is set to any number of directory pathlists separated by colons: `/h0/cmds:/d0/cmds:/n0/droid/h0/special_stuff/cmds`

`modloadp()` returns a pointer to the module if the load is successful. If the load is unsuccessful, `-1` is returned and the appropriate error code is placed in `errno`.

`modname`
: is a pointer to the name of the module. (Input)

`accessmode`
: is the access mode for the module. (Input)

: Only the lower 16 bits of `accessmode` are used.

`namebuffer`
: is a pointer to an array containing the pathlist of the successfully loaded module. (Input)

: Any errors other than `EOS_PNNF` leave the path list used for the load attempt intact. `namebuffer` can be NULL if access to the path string is not required.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_loadp()` `modload()_os_load()`

mq_close

Close a Message Queue

Syntax

```
#include <mqueue.h>
```

```
int mq_close(mqd_t mqdes);
```

Description

`mq_close()` removes the association between the message queue descriptor and its message queue. The results of using this descriptor after successful return from `mq_close()`—and until the return of this descriptor from a subsequent `mq_open()`—are undefined.

Upon successful completion `mq_close()` returns a value of 0. Otherwise, the function returns -1 and sets `errno` to indicate the error.

`mqdes`
: is the message queue descriptor. (Input)

  If the process has successfully attached a notification request to the message queue via `mqdes`, the attachment is removed and the message queue is available for another process to attach for notification.

Errors

`EBADF`	The `mqdes` argument is not a valid message queue descriptor.
`ENOSYS`	`mq_close()` not supported.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	No
Standards:	POSIX

Library

`mq.l`

See Also

`mq_open`

`mq_unlink`

mq_getattr

Get Message Queue Attributes

Syntax

```
#include <mqueue.h>

int mq_getattr(mqd_t mqdes, struct mq_attr *mqstat);
```

Description

`mqdes`

specifies a message queue descriptor. (Input)

`mq_getattr()`gets status information and attributes of the message queue and the open message queue description associated with the message queue descriptor. The results are returned in the `mq_attr` structure referenced by the `mqstat` argument. Upon return, the following members shall have the values associated with the open message queue description as set when the message queue was opened and as modified by subsequent `mq_setattr()` calls: `mq_flags`.

The following attributes of the message queue shall be returned as set at message queue creation: `mq_maxmsg`, `mq_msgsize`. Upon return, the following members within the `mq_attr` structure referenced by the `mqstat` argument shall be set according to the current state of the message queue: `mq_curmsgs`—the number of messages currently on the queue.

OS-9 specifies the following user-defined flag for use with `mq_getattr()` and `mq_setattr()`: `_MQ_O_NOTIFY_IMMEDIATE`. When this flag is specified by the `mq_setattr()` function (`mq_flags` field of `mqstat` parameter) then calls to either `_mq_notify_write()` or `mq_notify()` will notify immediately if appropriate. (Message queue nonfull for `_mq_notify_write()`, and message queue non-empty for `mq_notify()`). This extension provides message queue notification consistency with other OS-9 services such the "send signal on data ready" concept. Upon successful completion `mq_getattr()` returns 0. Otherwise, the function returns -1 and sets `errno` to indicate the error.

`mqstat`

is the argument that references the `mq_attr` structure. (Output)

Errors

EBADF	The `mqdes` argument is not a valid message queue descriptor.
ENOSYS	`mq_getattr()` not supported.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	No
Standards:	POSIX

Library

`mq.l`

See Also

`mq_open`

`mq_send`

`mq_setattr`

mq_notify

Notify Process That a Message is Available on a Queue

Syntax

```
#include <mqueue.h>

int mq_notify(

mqd_t                   mqdes,
   const struct sigevent    *notification);
```

Description

If the argument notification is not `NULL`, this function registers the calling process to be notified of message arrival at an empty message queue associated with `mqdes` the specified message queue descriptor.

If a process has registered for notification of message arrival at a message queue, and some thread is blocked in `mq_receive()` waiting to receive a message when a message arrives at the queue, the arriving message satisfies the appropriate `mq_receive()`. The resulting behavior is as if the message queue remains empty, and no notification is sent. Upon successful completion, `mq_notify()` returns a value of 0. Otherwise, the function returns -1 and sets `errno` to indicate the error.

`mqdes`
: is the specified message queue descriptor. (Input)

`notification`
: is the notification argument. (Input)

The notification specified by the notification argument, `notification`, is sent to the process when the message queue transitions from empty to nonempty. At any time, only one process can be registered for notification by a message queue. If the calling process or any other process has already registered for notification of message arrival at the specified message queue, subsequent attempts to register for that message queue fail.

If notification is `NULL` and the process is currently registered for notification by the specified message queue, the existing registration is removed. When the notification is sent to the registered process, its registration is removed. The message queue is then available for registration.

Errors

`EBADF`	The `mqdes` argument is not a valid message queue descriptor.
`EBUSY`	A process is already registered for notification by the message queue.
`ENOSYS`	`mq_notify()` not supported.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	No
Standards:	POSIX

Library

`mq.l`

See Also

`mq_open`

`mq_send`

`mq_setattr`

`_MQ_0_NOTIFY_IMMEDIATE`

_mq_notify_write

Notify Process of Space Availability in Message Queue

Syntax

```
#include <mqueue.h>
int _mq_notify_write(
mqd_t                         mqdes,
const struct sigevent    *notification);
```

Description

If the arguement notification is not NULL, this function registers the calling process to be notified of message removal at a full message queue associated with the specified message queue descriptor, `mqdes`.

If a process has registered for notification of a message queue and some thread is blocked in `mq_send()` waiting to send a message when the message queue transitions to nonfull, the arriving message will satisfy the appropriate `mq_send()`. The resulting behavior is as if the message queue remains full, and no notification is sent.

`mqdes`
: is the specified message queue descriptor. (Input)

`notification`
: is the notification argument. (Input)

The notification specified by the notification arguement, `notification`, is sent to the process when the message queue transitions from full to nonfull. At any time, only one process may be registered for notification by a message queue. If the calling process or any other process has already registered for notification of the specified message queue, subsequent attempts to register for that message queue will fail.

If notification is NULL and the process is currently registered for notification by the specified message queue, the existing registration is removed. The message queue is then available for registration.

Errors

`EBADF`	The `mqdes` argument is not a valid message queue descriptor.
`EBUSY`	A process is already registered for notification by the message queue.
`ENOSYS`	`mq_notify()` not supported.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	No
Standards:	POSIX

Library

`mq.l`

See Also

`mq_open`

`mq_send`

`mq_setattr`

`_MQ_0_NOTIFY_IMMEDIATE`

mq_open
Open a Message Queue

Syntax

```
#include <mqueue.h>

mqd_t mq_open(const char *name, int oflag, ...);
```

Description

`mq_open()` establishes the connection between a process and a message queue with a message queue descriptor. It creates an open message queue description that refers to the message queue, and it creates a message queue descriptor that refers to that open message queue description.

`mq_open()` does not add or remove messages from the queue.

Upon successful completion, `mq_open()` returns a message queue descriptor. Otherwise, the function returns (`mqd_t`) -1 and sets `errno` to indicate the error.

`name`

points to a string naming a message queue. (Input)

It is unspecified whether the name appears in the file system and is visible to other functions that take pathnames as arguments. The name argument conforms to the construction rules for a pathname. If name begins with the slash character, then processes calling `mq_open()` with the same value of name shall refer to the same message queue object, as long as that name has not been removed. If name does not begin with the slash character, the effect is implementation defined. The interpretation of slash characters other than the leading slash character in name is implementation defined.

If the name argument is not the name of an existing message queue and creation is not requested, `mq_open()` fails and returns an error.

`oflag`

requests the desired receive and/or send access to the message queue. (Input)

The requested access permission to receive messages or send messages is granted if the calling process would be granted read or write access, respectively, to an equivalently protected file.

The value of `oflag` is the bitwise inclusive OR of values from the following list. Applications shall specify exactly one of the first three values (access modes) below in the value of `oflag`:

`O_RDONLY` Open the message queue for receiving messages. The process can use the returned message queue descriptor with `mq_receive()`, but not `mq_send()`. A message queue may be open multiple times in the same or different processes for receiving messages.

`O_WRONLY`	Open the queue for sending messages. The process can use the returned message queue descriptor with `mq_send()` but not `mq_receive()`. A message queue may be open multiple times in the same or different processes for sending messages.
`O_RDWR`	Open the queue for both receiving and sending messages. The process can use any of the functions allowed for `O_RDONLY` and `O_WRONLY`. A message queue may be open multiple times in the same or different processes for sending messages.

Any combination of the remaining flags may be specified in the value of `oflag`:

`O_CREAT`	This option is used to create a message queue, and it requires two additional arguments: `mode`, which is of type `mode_t`, and `attr`, which is a pointer to a `mq_attr` structure. If the pathname, `name`, has already been used to create a message queue that still exists, then this flag has no effect, except as noted under `O_EXCL`. Otherwise, a message queue is created without any messages in it. The user ID of the message queue is set to the effective user ID of the process, and the group ID of the message queue is set to the effective group ID of the process. The "file permission bits" is set to the value of mode. When bits in mode other than file permission bits are set, the effect is implementation defined. If `attr` is `NULL`, the message queue is created with implementation-defined default message queue attributes. If `attr` is non-NULL and the calling process has the appropriate privilege on name, the message queue `mq_maxmsg` and `mq_msgsize` attributes are set to the values of the corresponding members in the `mq_attr` structure referred to by `attr`. If `attr` is non-NULL, but the calling process does not have the appropriate privilege on name, `mq_open()` fails and returns an error without creating the message queue.
`O_EXCL`	If `O_EXCL` and `O_CREAT` are set, `mq_open()` fails if the message queue name exists. The check for the existence of the message queue and the creation of the message queue if it does not exist is atomic with respect to other processes executing `mq_open()` naming the same name with `O_EXCL` and `O_CREAT` set. If `O_EXCL` is set and `O_CREAT` is not set, the result is undefined.
`O_NONBLOCK`	The setting of this flag is associated with the open message queue description and determines whether a `mq_send()` or `mq_receive()` shall wait for resources or messages that are not currently available, or fail with `errno` set to [`EAGAIN`]. See `mq_send()` and `mq_receive()` for details.

Errors

EACCES	The message queue exists and the permissions specified by oflag are denied, or the message queue does not exist and permission to create the message queue is denied.
EEXIST	O_CREAT and O_EXCL are set and the named message queue already exists.
EINTR	The mq_open() operation was interrupted by a signal.
EINVAL	The mq_open() operation is not supported for the given name. The implementation shall document under what circumstances this error may be returned. O_CREAT was specified in oflag, the value of attr is not NULL, and either mq_maxmsg or mq_msgsize was less than or equal to zero.
EMFILE	Too many message queue descriptors or file descriptors are currently in use by this process.
ENAMETOOLONG	The length of the name string exceeds {PATH_MAX}, or a pathname component is longer than {NAME_MAX} while {_POSIX_NO_TRUNC} is in effect.
ENFILE	Too many message queues are currently open in the system.
ENOENT	O_CREAT is not set and the named message queue does not exist.
ENOSPC	There is insufficient space for the creation of the new message queue.
ENOSYS	mq_open() not supported.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	No
Standards:	POSIX

Library

mq.l

See Also

mq_close
mq_send
mq_getattr
mq_receive
mq_setattr
mq_unlink

mq_receive
Receive a Message From a Message Queue

Syntax

```
#include <mqueue.h>

size_t mq_receive(

mqd_t        mqdes,
char         *msg_ptr,
size_t       msg_len,
unsigned int *msg_prio);
```

Description

`mq_receive()` is used to receive the oldest of the highest priority message(s) from the message queue specified by `mqdes`. If the size of the buffer in bytes, specified by `msg_len`, is less than the `mq_msgsize` attribute of the message queue, the function fails and returns an error. Otherwise, the selected message is removed from the queue and copied to the buffer pointed to by `msg_ptr`.

If the specified message queue is empty and `O_NONBLOCK` is not set in the message queue description associated with `mqdes`, `mq_receive()` blocks until a message is enqueued on the message queue or until `mq_receive()` is interrupted by a signal. If more than one thread is waiting to receive a message when a message arrives at an empty queue and the Process Scheduling option is supported, then the thread of highest priority that has been waiting the longest is selected to receive the message. Otherwise, it is unspecified which waiting thread receives the message. If the specified message queue is empty and `O_NONBLOCK` is set in the message queue description associated with `mqdes`, no message is removed from the queue, and `mq_receive()` returns an error.

Upon successful completion, `mq_receive()` returns the length of the selected message in bytes and the message is removed from the queue. Otherwise, no message is removed from the queue, the function returns a -1, and sets `errno` to indicate the error.

`mqdes`
: specifies the message queue. (Input)

`msg_ptr`
: points to the buffer. (Output)

`msg_len`
: specifies the size of the buffer in bytes. (Input)

`msg_prio`
: If `msg_prio` is not NULL, the priority of the selected message is stored in the location referenced by `msg_prio`. (Input)

Errors

`EAGAIN`	`O_NONBLOCK` was set in the message description associated with `mqdes`, and the specified message queue is empty.
`EBADF`	The `mqdes` argument is not a valid message queue descriptor open for reading.
`EMSGSIZE`	The specified message buffer size, `msg_len`, is less than the message size attribute of the message queue.
`EINTR`	The `mq_receive()` operation was interrupted by a signal.
`ENOSYS`	The `mq_receive()` function is not supported by this implementation.
`EBADMSG`	A data corruption problem with the message has been detected.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	No
Standards:	POSIX

Library

`mq.l`

See Also

`mq_send`

mq_send

Send a Message to a Message Queue

Syntax

```
#include <mqueue.h>

int mq_send(

mqd_t         mqdes,
const char    *msg_ptr,
size_t        msg_len,
unsigned int  msg_prio);
```

Description

`mq_send()` adds the message pointed to by the argument `msg_ptr` to the message queue specified by `mqdes`. `msg_len` specifies the length of the message in bytes pointed to by `msg_ptr`. The value of `msg_len` is less than or equal to the `mq_msgsize` attribute of the message queue, otherwise `mq_send()` fails.

If the specified message queue is not full, `mq_send()` behaves as if the message is inserted into the message queue at the position indicated by the `msg_prio` argument. A message with a larger numeric value of `msg_prio` is inserted before messages with lower values of `msg_prio`. A message is inserted after other messages in the queue, if any, with equal `msg_prio`. The value of `msg_prio` is less than `{MQ_PRIO_MAX}`.

If the specified message queue is full and `O_NONBLOCK` is not set in the message queue description associated with `mqdes`, `mq_send()` blocks until space becomes available to enqueue the message, or until `mq_send()` is interrupted by a signal. If more than one thread is waiting to send when space becomes available in the message queue and the Process Scheduling option is supported, then the thread of the highest priority that has been waiting the longest is unblocked to send its message. Otherwise, it is unspecified which waiting thread is unblocked. If the specified message queue is full and `O_NONBLOCK` is set in the message queue description associated with `mqdes`, the message is not queued and `mq_send()` returns an error.

Upon successful completion, `mq_send()` returns a value of 0. Otherwise, no message is enqueued, the function returns -1, and `errno` is set to indicate the error.

`mqdes`
: specifies the message queue. (Output)

`msg_ptr`
: points to the buffer. (Input)

`msg_len`
: specifies the size of the buffer in bytes. (Input)

`msg_prio`If `msg_prio` is not NULL, the priority of the selected message is stored in the location referenced by `msg_prio`. (Input)

Errors

`EAGAIN`	The `O_NONBLOCK` flag is set in the message queue description associated with `mqdes`, and the specified message queue is full.
`EBADF`	The `mqdes` argument is not a valid message queue descriptor open for writing.
`EINTR`	A signal interrupted the call to `mq_send()`.
`EINVAL`	The value of `msg_prio` was outside the valid range.
`EMSGSIZE`	The specified message length, `msg_len`, exceeds the message size attribute of the message queue.
`ENOSYS`	`mq_send()` not supported.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	No
Standards:	POSIX

Library

`mq.l`

See Also

`mq_receive`

`mq_setattr`

mq_setattr

Set Message Queue Attributes

Syntax

```
#include <mqueue.h>

int mq_setattr(

mqd_t             mqdes,
const struct     mq_attr *mqstat,

struct mq_attr   *omqstat);
```

Description

`mq_setattr()` is used to set attributes associated with the open message queue description referenced by the message queue descriptor specified by `mqdes`.

The values of the `mq_maxmsg`, `mq_msgsize`, and `mq_curmsgs` members of the `mq_attr` structure are ignored by `mq_setattr()`.

OS-9 specifies the following user-defined flag for use with `mq_getattr()` and `mq_setattr()`: `_MQ_O_NOTIFY_IMMEDIATE`. When this flag is specified by the `mq_setattr()` function (`mq_flags` field of `mqstat` (input) parameter) then calls to either `_mq_notify_write()` or `mq_notify()` will notify immediately if appropriate.

(Message queue nonfull for `_mq_notify_write()`, and message queue non-empty for `mq_notify()`) This extension provides message queue notification consistency with other OS-9 services such the "send signal on data ready" concept.

Upon successful completion, `mq_setattr()` returns a value of 0 and the attributes of the message queue are changed as specified. Otherwise, the message queue attributes are unchanged, and the function returns a value of -1 and sets `errno` to indicate the error.

The message queue attributes corresponding to the following members defined in the `mq_attr` structure are set to the specified values upon successful completion of `mq_setattr()`:

`mq_flags`
: The value of this member is the bitwise logical OR of zero or more of `O_NONBLOCK` and any implementation-defined flags.

`mqdes`
: specifies the message queue. (Input)

  `omqstat`If `omqstat` is non-NULL, the function `mq_setattr()` stores, in the location referenced by `omqstat`, the previous message queue attributes and the current queue status. (Output)

  These values are the same as would be returned by a call to `mq_getattr()` at that point.

Errors

`EBADF`	The `mqdes` argument is not a valid message queue descriptor.
`ENOSYS`	`mq_setattr()` not supported.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	No
Standards:	POSIX

Library

`mq.l`

See Also

`mq_open`

`mq_send`

mq_unlink

Remove a Message Queue

Syntax

```
#include <mqueue.h>
int mq_unlink(const char *name);
```

Description

`mq_unlink()` removes the message queue named by the pathname `name`.

After a successful call to `mq_unlink()` with name, a call to `mq_open()` with name fails if the flag `O_CREAT` is not set in flags. If one or more processes have the message queue open when `mq_unlink()` is called, destruction of the message queue is postponed until all references to the message queue have been closed. Calls to `mq_open()` to re-create the message queue may fail until the message queue is actually removed. However, the `mq_unlink()` call need not block until all references have been closed; it may return immediately.

Upon successful completion, `mq_unlink()` returns a value of 0. Otherwise, the named message queue is not changed by this function call, and the function returns a value of -1 and sets `errno` to indicate the error.

`name`
is the pathname. (Input)

Errors

`EACCES`	Permission is denied to unlink the named message queue.
`ENAMETOOLONG`	The length of the name string exceeds `{NAME_MAX}` while `{_POSIX_NO_TRUNC}` is in effect.
`ENOENT`	The named message queue does not exist.
`ENOSYS`	`mq_unlink()` not supported.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	No
Standards:	POSIX

Library

`mq.l`

See Also

`mq_close` `mq_open`

munlink()

Unlink from Module

Syntax

```
#include <module.h>
int munlink(mh_com *module);
```

Description

`munlink()` informs the system that the process no longer requires the specified module. The module's link count is decremented, and the module is removed from memory if the link count reaches zero.

`module`
: is a pointer to the module. (Input)

  It must have been a pointer returned by `modcload()`, `modload()`, `modloadp()`, `modlink()`, `_os_link()`, `_os_load()`, or `_os_loadp()`. On error, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`modcload()`

`modlink()`

`modload()`

`modloadp()`

`_os_link()`

`_os_load()`

`_os_loadp()`

`_os_unlink()`

`F$Unlink`	*OS-9 for 68K Technical Manual*
`F_UNLINK`	*OS-9 Technical Manual*

munload()

Unload Module

Syntax

```
#include <module.h>
int munload(
    const char *name,
    int typelang);
```

Description

`munload()` informs the system that the process no longer requires the module `name` which has a type/language of `typelang`. The module's link count is decremented. The module is removed from memory when the link count reaches zero.

On error, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`munload()` differs from `munlink()` in that it unlinks by module name rather than module pointer. Attempting to unlink a module by performing a link to a module by name to determine its address, then unlinking it twice does not work because the first unlink removes the module from the process' address space.

`name`
: is a pointer to the name of the module. (Input)

`typelang`
: specifies the type and language of the module. (Input)

  If `typelang` is zero, any module may be unloaded. Only the lower 16 bits of `typelang` are used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`munlink()`	`_os_link()`
`_os_load()`	`_os_unload()`
`F$UnLoad`	*OS-9 for 68K Technical Manual*
`F_UNLOAD`	*OS-9 Technical Manual*

offsetof()

Expand Value to Integral Constant Expression

Syntax

```
#include <stddef.h>
```

```
int offsetof(type, mbr_desig);
```

Description

`offsetof()` expands to an integral constant expression. The integral constant expression has a type of `size_t`, the value of which is the offset in bytes to the structure member from the beginning of the structure.

`mbr_desig` specifies the member name of the structure for which you want to compute the offset. If the member is a bit field, the behavior is undefined.

`type`
: specifies the type of the structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

open()
Open File

Syntax

```
#include <modes.h>
int open(
    const char *name,
    int mode);
```

Description

`open()` opens an existing file.

`open()` returns a path number identifying the file when I/O is performed. If the open fails, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

The thread enabled version of this function contains a cancel point. For more information see *Using OS-9 Threads*.

`name`
: is a pointer to the name of the file. (Input)

`mode`
: specifies the access mode for the file. (Input)

The values for `mode` are defined in the `modes.h` header file. Only the lower 16 bits of `mode` are used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`close()`
`creat()`
`_os_create()`
`_os_open()`

`I$Open`	*OS-9 for 68K Technical Manual*
`_os_open()`	*OS-9 Technical Manual*

Syntax

```
#include <dir.h>
DIR *opendir(const char *filename);
```

Description

`opendir()` opens the specified directory and associates a directory stream with it. `opendir()` returns a pointer identifying the directory stream in subsequent operations. The pointer `NULL` is returned if `filename` cannot be accessed or if it cannot allocate enough memory to hold the entire `DIR` structure.

`filename`
: is a pointer to the name of the directory. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`sys_clib.l`

See Also

`closedir()`

`readdir()`

`rewinddir()`

`seekdir()`

`telldir()`

_os_acqlk()

Acquire Ownership of Resource Lock

Syntax

```
#include <lock.h>
#include <types.h>
error_code _os_acqlk(
    lk_desc *lock,
    signal_code *signal);
```

Description

`_os_acqlk()` acquires ownership of a resource lock (that is, it attempts to gain exclusive access to a resource).

If the lock is not owned by another process, the calling process is granted ownership and the call returns without error.

If the lock is already owned, the calling process is suspended and inserted into a waiting queue for the resource based on relative scheduling priority.

When ownership of the lock is released, the next process in the queue is granted ownership and is activated. The activated process returns from the `_os_acqlk()` call without error. If a process received a signal while waiting on a lock, the process is activated without gaining ownership of the lock. The process returns from the `_os_acqlk()` call with an `EOS_SIGNAL` error code and the signal code returned in the `signal` pointer.

If a waiting process receives an `S_WAKEUP` signal, the signal code does not register and is zero.

`lock`
: is a pointer to the `lk_desc` structure of the lock that you are trying to acquire. (Input)

`signal`
: is a pointer to the location where `_os_acqlk()` stores the signal that prematurely terminated the acquisition of the lock, if applicable. (Output)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`lock.l`

See Also

`F_ACQLK`	*OS-9 Technical Manual*
`F_CAQLK`	*OS-9 Technical Manual*
`F_CRLK`	*OS-9 Technical Manual*
`F_DDLK`	*OS-9 Technical Manual*
`F_DELLK`	*OS-9 Technical Manual*
`F_RELLK`	*OS-9 Technical Manual*
`F_WAITLK`	*OS-9 Technical Manual*

_os9_alarm_atdate()

Send Signal at Gregorian Date/Time

Syntax

```
#include <alarm.h>
#include <types.h>
error_code _os9_alarm_atdate(
    alarm_id *alrm_id,
    signal_code signal,
    u_int32 time,
    u_int32 date);
```

Description

`_os9_alarm_atdate()` sends a signal to the caller at a specific date and time. The alarm signal is sent anytime the system date/time becomes greater than or equal to the alarm time.

`_os9_alarm_atdate()` only allows you to specify the time to the nearest second. However, it does adjust if the system's date and time have changed (using `_os9_setime()`).

`alrm_id`
: is a pointer to the location where `_os9_alarm_atdate()` stores the alarm ID. (Output)

`signal`
: specifies the signal code. (Input)

`date`
: is in the format `yyyymmdd`. (Input)

`time`
: is in the format `00hhmmss`. (Input)

Attributes

Operating System:	OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$Alarm`	*OS-9 for 68K Technical Manual*

_os_alarm_atime()

Send Signal at Specified Time

Syntax

```
#include <alarm.h>
#include <types.h>
error_code _os_alarm_atime(
    alarm_id *alrm_id,
    signal_code signal,
    u_int32 time);
```

Description

`_os_alarm_atime()` sends a signal when the system time reaches or passes the specified time. The time value is considered to be an absolute value in seconds since 1 January 1970 Greenwich Mean Time.

`alrm_id`
: is a pointer to the location where `_os_alarm_atime()` stores the alarm ID. (Output)

`signal`
: is the signal code of the signal to send. (Input)

`time`
: specifies the time. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_alarm_set()`

`_os9_alarm_atdate()`

`_os9_alarm_atjul()`

`F$Alarm`	*OS-9 for 68K Technical Manual*
`F_ALARM`	*OS-9 Technical Manual*

_os9_alarm_atjul()

Send Signal at Julian Date/Time

Syntax

```
#include <alarm.h>
#include <types.h>
error_code _os9_alarm_atjul(
    alarm_id *alrm_id,
    signal_code signal,
    u_int32 time,
    u_int32 date);
```

Description

`_os9_alarm_atjul()` sends a signal to the caller at a specific Julian date and time. The alarm signal is sent anytime the system date/time becomes greater than or equal to the alarm time.

`_os9_alarm_atjul()` only allows you to specify the time to the nearest second. However, it does adjust if the system's date and time have changed (using `_os9_setime()`).

`alrm_id`
: is a pointer to the location where `_os9_alarm_atjul()` stores the alarm ID. (Output)

`signal`
: specifies the signal code. (Input)

`time`
: is the seconds after midnight. (Input)

`date`
: is the Julian day number. (Input)

Attributes

Operating System:	OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$Alarm`	*OS-9 for 68K Technical Manual*

_os_alarm_cycle()

Send Signal at Specified Time Intervals

Syntax

```
#include <alarm.h>
#include <types.h>
error_code _os_alarm_cycle(
    alarm_id *alrm_id,
    signal_code signal,
    u_int32 time);
```

Description

`_os_alarm_cycle()` sends a signal after the specified time interval has elapsed and then resets the alarm. This provides a recurring periodic signal. The time interval may be specified in system clock ticks; or, if the high order bit is set, the low 31 bits are considered a time in 256ths of a second. The minimum time interval allowed is 2 system clock ticks.

`alrm_id`
: is a pointer to the location where `_os_alarm_cycle()` stores the alarm ID. (Output)

`signal`
: is the signal code of the signal to send. (Input)

`time`
: specifies the time interval between signals. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_alarm_set()`

`F$Alarm`	*OS-9 for 68K Technical Manual*
`F_ALARM, A_CYCLE`	*OS-9 Technical Manual*

_os_alarm_delete()

Remove Pending Alarm Request

Syntax

```
#include <alarm.h>
#include <types.h>

error_code _os_alarm_delete(
    alarm_id alrm_id);
```

Description

`_os_alarm_delete()` removes a cyclic alarm or any alarm that has not expired.

`alrm_id`
: specifies the alarm to remove. (Input)

  If `alrm_id` is zero, all pending alarm requests for the owner are removed.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$Alarm`	*OS-9 for 68K Technical Manual*
`F_ALARM`, `F_DELET`	*OS-9 Technical Manual*

_os_alarm_reset()

Reset Existing Alarm Request

Syntax

```
#include <alarm.h>
#include <types.h>

error_code _os_alarm_reset(
    alarm_id alrm_id,
    signal_code signal,
    u_int32 time);
```

Description

`_os_alarm_reset()` sets an existing alarm to send after the specified time interval has elapsed.

`alrm_id`
: is the alarm ID to reset. (Input)

`signal`
: is the signal code of the signal to send. (Input)

`time`
: may be specified in system clock ticks; or, if the high order bit is set, the low 31 bits are considered a time in 256ths of a second. (Input)

  Usually, the minimum time interval allowed is 2 clock ticks.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_alarm_set()`

`F$Alarm`	*OS-9 for 68K Technical Manual*
`F_ALARM, A_RESET`	*OS-9 Technical Manual*

_os_alarm_set()

Send Signal After Specified Time Interval

Syntax

```
#include <alarm.h>
#include <types.h>
error_code _os_alarm_set(
    alarm_id *alrm_id,
    signal_code signal,
    u_int32 time);
```

Description

This function sends a signal after specified time interval has elapsed.

`alrm_id`
: is a pointer to the location where `_os_alarm_set()` stores the alarm ID. (Output)

`signal`
: is the signal code of the signal to send. (Input)

`time`
: may be specified in system clock ticks; or, if the high order bit is set, the low 31 bits are considered a time in 256ths of a second. (Input)

Usually, the minimum time interval allowed is 2 system clock ticks.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$Alarm`	*OS-9 for 68K Technical Manual*
`F_ALARM, A_SET`	*OS-9 Technical Manual*

_os_alias()

Create Device Alias

Syntax

```
#include <io.h>
#include <types.h>
error_code _os_alias(
    const char *alias_name,
    const char *real_name);
```

Description

`_os_alias()` creates an alternate name for a device pathlist. Processes can then reference a specific device pathlist with a shorter or more convenient name.

Do not use a real device name as `alias_name`.

`alias_name`
is a pointer to the alternate name. (Input)

`real_name`
is a pointer to the actual device name; it must exist. (Input)

OS-9 does not validate its existence.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`I_ALIAS`	*OS-9 Technical Manual*

_os9_allbit()

Set Bits in Bit Map

Syntax

```
#include <memory.h>
#include <types.h>
error_code _os9_allbit(
    u_int32 bit_number,
    u_int32 count,
    void *address);
```

Description

`_os9_allbit()` sets bits in a buffer that represents a bit map. Bit numbers range from `0` to `n - 1`, where `n` is the number of bits in the bit map.

`bit_number`
: specifies the bit number of the first bit to set. (Input)

  Only the lower 16 bits of `bit_number` are used.

`count`
: specifies the number of bits to set. (Input)

  Only the lower 16 bits of `count` are used.

`address`
: is a pointer to the base address of a bit map. (Input/Output)

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os9_schbit()`

`_os9_delbit()`

`F$AllBit` *OS-9 for 68K Technical Manual*

_os9_allpd()

Allocate Fixed-Length Block of Memory

Syntax

```
#include <process.h>
#include <types.h>
error_code _os9_allpd(
    void *table,
    u_int16 *number,
    void **ptr);
```

Description

`_os9_allpd()` allocates fixed-length blocks of system memory. It allocates and initializes (to zeros) a block of storage and returns its address.

`table`
: is a pointer to the process/path table. (Input)

`number`
: is a pointer to the location where `_os9_allpd()` stores the process/path number. (Output)

`ptr`
: is a pointer to the location where `_os9_allpd()` stores the pointer to the process/path descriptor. (Output)

Attributes

Operating System:	OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os9_findpd()`

`_os9_retpd()`

`F$AllPD` *OS-9 for 68K Technical Manual*

_os_alltsk()

Allocate Task

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_alltsk(pr_desc *proc_desc);
```

Description

`_os_alltsk()` initializes the protection hardware for a newly activated process.

`_os_alltsk()` only performs a useful function on MMU/SSM systems. On non-MMU/SSM systems, `_os_alltsk()` simply returns without initializing the protection hardware.

`proc_desc`
is a pointer to the process descriptor. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$AllTsk`	*OS-9 for 68K Technical Manual*
`F_ALLTSK`	*OS-9 Technical Manual*

_os_alocproc()

Allocate Process Descriptor

Syntax

```
#include <process.h>
#include <types.h>

error_code _os_alocproc(
    process_id *proc_id,
    pr_desc **proc_desc);
```

Description

`_os_alocproc()` allocates and initializes a process descriptor. The descriptor's address is stored in the process descriptor table.

`proc_id`
: is a pointer to the location where `_os_alocproc()` stores the process ID. (Output)

`proc_desc`
: is a pointer to the location where `_os_alocproc()` stores the pointer to the process descriptor. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$AllPrc`	*OS-9 for 68K Technical Manual*

_os_altmdir()

Set Alternate Working Module Directory

Syntax

```
#include <moddir.h>
#include <types.h>
error_code _os_altmdir(const char *name);
```

Description

`_os_altmdir()` establishes an alternate working module directory for a process.

`name`
: specifies the name of the module directory. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F_ALTMDIR` *OS-9 Technical Manual*

_os_aproc()

Insert Process in Active Process Queue

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_aproc(process_id proc_id);
```

Description

`_os_aproc()` inserts the process specified by `proc_id` (input) into the active process queue so that it may be scheduled for execution.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System and User (User only for OS-9)
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_nproc()`

`F$AProc` *OS-9 for 68K Technical Manual*

`F_ALLPRC` *OS-9 Technical Manual*

`_os_suspend()`

_os9_aproc()

Insert Process in Active Process Queue

Syntax

```
#include <process.h>
#include <types.h>

error_code _os9_aproc(pr_desc *proc_desc);
```

Description

`_os9_aproc()` inserts a process into the active process queue so that it may be scheduled for execution.

`proc_desc`
is a pointer to the process descriptor. (Input)

Attributes

Operating System:	OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_nproc()`

`F$AProc` *OS-9 for 68K Technical Manual*

_os_attach()

Attach New Device to System

Syntax

```
#include <io.h>
#include <modes.h>
#include <types.h>
error_code _os_attach(
    const char *name,
    u_int32 mode,
    dev_list **dev_tbl);
```

Description

`_os_attach()` causes a new I/O device to become known to the system or verifies that the device is already attached.

All available access modes are defined in the following location:
`MWOS\<OS>\SRC\DEFS\modes.h`

For a list of all available access modes, refer to the section, "Access Modes and Permissions," in Chapter 3 of the *OS-9 Technical Manual*.

If the descriptor `name` is found, `_os_attach()` links to the I/O device's file manager and device driver.

If the device was already attached, `_os_attach()` returns a pointer to the pointer to the device table entry containing the address of the I/O device's file manager and device driver in `dev_tbl`.

If the device is not already attached, `_os_attach()` creates a new device table entry and initializes the device. It returns a pointer to the pointer to the entry in `dev_tbl`.

`name`
: is a pointer to the I/O device's name. (Input)

`mode`
: is the access mode. It can be `FAM_READ`, `FAM_WRITE`, `S_IREAD`, or `S_IWRITE`. `mode` may be used to verify that subsequent read and/or write operations are permitted. (Input)

  Only the lower 16 bits of `mode` are used.

`dev_tbl`
: is a pointer to the location where `_os_attach()` stores the pointer to the device list entry. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_detach()`

`I$Attach`	*OS-9 for 68K Technical Manual*
`I_ATTACH`	*OS-9 Technical Manual*

_os_cache()

Cache Control

Syntax

For OS-9 for 68K:

```
#include <cache.h>* for OS-9 for 68K systems
#include <regs.h>
#include <types.h>

error_code _os_cache(u_int32 control);
```

For OS-9:

```
#include <regs.h>
#include <types.h>

error_code _os_cache(
    u_int32 control,
    void *addr,
    u_int32 size);
```

Description

`_os_cache()` performs operations on the system instruction and/or data caches, if there are any.

Any program that builds or changes executable code in memory must flush the instruction cache with `_os_cache()` before executing the new code. This is necessary because the hardware instruction cache is not updated by data (write) accesses and may contain the unchanged instruction(s). For example, if a subroutine builds a system call on its stack, you must execute the `_os_cache()` call to flush the instruction cache before executing the temporary instructions.

Refer to your operating system technical manual for a description of the possible values for `control`.

`control`

If `control` is zero, the system instruction and data caches are flushed. (Input)

Only non-super-group, user-state processes may perform this operation.

`addr`

specifies the target address for the flush operation. (Input)

`size`

indicates the size of the target memory area to be flushed. (Input)

The cache should be flushed before trying to disable the data cache.

Only super-group processes may perform precise operations of `F$CCtl`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_scache()`

`F$CCtl`	*OS-9 for 68K Technical Manual*
`F_CCTL`	*OS-9 Technical Manual*

_os_caqlk()

Acquire Ownership of Resource Lock

Syntax

```
#include <lock.h>
#include <types.h>
error_code _os_caqlk(lk_desc *lock);
```

Description

`_os_caqlk()` is used to conditionally acquire ownership of a resource lock. If another process does not own the lock, the calling process is granted ownership and the call returns without error.

If the lock is already owned, the calling process is not suspended. Instead, it returns from the `_os_caqlk()` call with an `EOS_NOLOCK` error and is not granted ownership of the resource lock.

`lock`
: is a pointer to the lock. (Input)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`lock.l`

See Also

`F_ACQLK`	*OS-9 Technical Manual*
`F_CAQLK`	*OS-9 Technical Manual*
`F_CRLK`	*OS-9 Technical Manual*
`F_DDLK`	*OS-9 Technical Manual*
`F_DELLK`	*OS-9 Technical Manual*
`F_RELLK`	*OS-9 Technical Manual*
`F_WAITLK`	*OS-9 Technical Manual*

_os_chain()

Execute New Primary Module

Syntax

```
#include <process.h>
#include <module.h>
#include <types.h>
error_code _os_chain(
    u_int32 priority,
    u_int32 path_cnt,
    const char *mod_name,
    const void *params,
    u_int32 param_size,
    u_int32 mem_size,
    u_int32 type_lang);
```

Description

`_os_chain()` executes a new program without the overhead of creating a new process. It is functionally similar to a Fork command followed by an Exit. `_os_chain()` effectively resets the calling process' program and data memory areas and begins executing a new primary module. Open paths are not closed or otherwise affected.

OS-9 for 68K: `_os_chain()` never returns to the calling process.

OS-9: an error is returned only if there is not enough memory to hold the parameters. If an error occurs during the `chain`, it is returned as an exit status to the parent of the process performing the `chain`.

On OS-9, a threaded process may only chain from the `main()` thread and may not chain if multiple threads are active in the process.

`priority`
: is the priority of the process. (Input)

  Only the lower 16 bits of `priority` are used.

`path_cnt`
: specifies the number of I/O paths to copy. (Input)

  Only the lower 16 bits of `path_cnt` are used.

`mod_name`
: is a pointer to the new program to execute. (Input)

`params`
: is a pointer to the parameter block. (Input)

`param_size`
specifies the size of the parameter block. (Input)

`mem_size`
specifies the additional memory size in bytes. (Input)

`type_lang`
specifies the desired module type/language. (Input)

`type_lang`
must be either program/object (`MT_PROGRAM`, `ML_OBJECT`) or zero (for any). Only the lower 16 bits of `type_lang` are used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_fork()`

`_os_load()`

`F$Chain`	*OS-9 for 68K Technical Manual*
`F_CHAIN`	*OS-9 Technical Manual*

_os_chainm()

Execute New Primary Module Given Pointer to Module

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_chainm(
   u_int32 priority,
   u_int32 path_cnt,
   mh_com *mod_head,
   void *params,
   u_int32 param_size,
   u_int32 mem_size);
```

Description

`_os_chainm()` executes a new program without the overhead of creating a new process. It is functionally similar to a fork command followed by an exit. `_os_chainm()` effectively resets the calling process' program and data memory areas and begins executing a new primary module. Open paths are not closed or otherwise affected.

`_os_chainm()` is similar to `_os_chain()`. However, it is passed a pointer to the module in memory to chain to instead of the module name.

An error is returned only if there is not enough memory to hold the parameters. If an error occurs during the `_os_chainm()`, it is returned as an exit status to the parent of the process performing the `_os_chainm()`.

A threaded process may only chain from the `main()` thread and may not chain if multiple threads are active in the process.

`priority`
: is the priority of the process. (Input)

  Only the lower 16 bits of `priority` are used.

`path_cnt`
: is the number of I/O paths to copy. (Input)

  Only the lower 16 bits of `path_cnt` are used.

`mod_head`
: is a pointer to the module header. (Input)

`params`
: is a pointer to the parameter block. (Input)

`param_size`
: specifies the size of the parameter block. (Input)

`mem_size`
specifies the additional memory size in bytes. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F_CHAIN`	*OS-9 Technical Manual*
`F_CHAINM`	*OS-9 Technical Manual*
`F_EXIT`	*OS-9 Technical Manual*
`F_FORK`	*OS-9 Technical Manual*
`F_LOAD`	*OS-9 Technical Manual*

_os_chdir()

Change Working Directory

Syntax

```
#include <modes.h>
#include <types.h>
error_code _os_chdir(
    const char *name,
    u_int32 mode);
```

Description

_os_chdir() changes a process' working directory to the directory file specified by the pathlist. You may change the execution or the data directory (or both), depending on the access mode you specify. The specified file must be a directory file, and the caller must have access permission for the specified mode.

All available access modes are defined in the following location:
MWOS\<OS>\SRC\DEFS\modes.h

- For a list of all available access modes, refer to the section, "Access Modes and Permissions," in Chapter 3 of the *OS-9 Technical Manual*.

name

is a pointer to the pathlist. (Input)

mode

specifies the access mode. (Input)

Only the lower 16 bits of mode are used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

os_lib.l

See Also

I$ChgDir	*OS-9 for 68K Technical Manual*
I_CHDIR	*OS-9 Technical Manual*

_os_chkmem()

Check Memory Block's Accessibility

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_chkmem(
    u_int32 size,
    u_int32 mode,
    void *mem_ptr,
    pr_desc *proc_desc);
```

Description

`_os_chkmem()` determines if a process has access to a specified memory block.

`_os_chkmem()` only performs a useful function on MMU systems. On non-MMU systems, `_os_chkmem()` simply returns without checking the memory block's accessibility.

`size`
: specifies the size of the memory area. (Input)

`mode`
: specifies the permissions to check. (Input)

  Only the lower 16 bits of `mode` are used.

`mem_ptr`
: is a pointer to the beginning of the memory to check. (Input)

`proc_desc`
: is a pointer to the process descriptor of the target process. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$ChkMem`	*OS-9 for 68K Technical Manual*
`F_CHKMEM`	*OS-9 Technical Manual*

_os_chmdir()

Change Process' Current Module Directory

Syntax

```
#include <moddir.h>
#include <types.h>
error_code _os_chmdir(const char *name);
```

Description

`_os_chmdir()` changes a process' current module directory to the directory specified by `name`.

`name`
: is a pointer to a full pathlist or a pathlist relative to the current module directory. (Input)

  To change to the system's root module directory, specify a slash (`/`) for `name`.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_close()

Close Path to File/Device

Syntax

```
#include <modes.h>
#include <types.h>
error_code _os_close(path_id path);
```

Description

`_os_close()` terminates the I/O path specified by `path`.

`path`
: is the path ID returned from a previous call to `_os_open()`, `_os_create()`, or `_os_dup()`. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_create()`

`_os_detach()`

`_os_dup()`

`_os_exit()`

`_os_open()`

`I$Close`	*OS-9 for 68K Technical Manual*
`I_CLOSE`	*OS-9 Technical Manual*

_os_clrsigs()

Clear Process Signal Queue

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_clrsigs(process_id proc_id);
```

Description

`_os_clrsigs()` removes any queued signals that have been sent to the target process.

`proc_id`
: specifies the target process ID number. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_sigmask()`

_os_cmdperm()
Change Permissions of Module Directory

Syntax

```
#include <moddir.h>
#include <types.h>
error_code _os_cmdperm(
    const char *name,
    u_int32 perm);
```

Description

`_os_cmdperm()` changes the access permissions of an existing module directory. This makes it possible to restrict access to a particular module directory.

`name`
: is a pointer to the name of the existing module directory. (Input)

`perm`
: specifies the new permissions. (Input)

Only the lower 16 bits of `perm` are used.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_cmpnam()

Compare Two Names

Syntax

```
#include <strings.h>
#include <types.h>
error_code _os_cmpnam(
    const char *pattern,
    const char *string,
    u_int32 length,
    int32 *cmp_result);
```

Description

`_os_cmpnam()` compares a target name to a source pattern to determine if they are equal. `_os_cmpnam()` is not case-sensitive; it does not differentiate between upper and lower case characters.

OS-9 for 68K: If the error `EOS_PNNF` is returned, the strings differ and the integer at the address passed in `cmp_result` is not changed.

OS-9: If the error `EOS_DIFFER` is returned, the strings differ and the integer at `cmp_result` has the following meaning:

Table 2-12. _os_cmpnam() Parameter cmp_result Values

Integer	Description
`positive`	The target name is less than the pattern string.
`negative`	The target string is greater than the pattern string.

On OS-9 for 68K, you never receive an `EOS_DIFFER` error. On OS-9, you never receive an `EOS_PNNF` error.

`pattern`
: is a pointer to the pattern string. (Input)

  Two wildcard characters are recognized in the pattern string:

  - A question mark `(?)` matches any single character.
  - An asterisk `(*)` matches any string.

`string`
: is a pointer to the target name string. (Input)

  The target name must be terminated by a null byte.

`length`
: specifies the length of the pattern string. (Input)

`cmp_result`
is a pointer to the location where `_os_cmpnam()` stores the lexicographic result of the comparison. (Output)

`_os_cmpnam()`
returns zero if the target string is the same as the pattern string.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$CmpNam`	*OS-9 for 68K Technical Manual*
`F_CMPNAM`	*OS-9 Technical Manual*

_os_config()

Configure an Element

Syntax

```
#include <sysglob.h>
error_code _os_config(
    u_int32 code,
    void *param);
```

Description

`os_config()` is a wildcard call that configures elements of the operating system which may or may not be process specific. It dynamically reconfigures operating system resources at runtime. The target resources may be system-wide resources or they may be process-specific, depending on the nature of the configuration call being made.

`code`
: is the configuration command code. (Input)

`param`
: is a pointer to any additional parameters required by the specified configuration function. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

See Also

`_os_ioconfig()`

_os_cpy_ioproc()

Get Pointer to I/O Process Descriptor

Syntax

```
#include <process.h>
#include <io.h>
#include <types.h>
error_code _os_cpy_ioproc(
    process_id proc_id,
    void *buffer,
    u_int32 count);
```

Description

`_os_cpy_ioproc()` copies the I/O process descriptor for the specified process into a buffer.

`process_id`
: is the process ID. (Input)

`buffer`
: is a pointer to the buffer in which to copy the I/O process descriptor. The format of the data copied is specified by the `io_proc` structure in `io.h`. (Output)

`count`
: specifies the number of bytes to copy. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_cpymem()

Copy External Memory

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_cpymem(
    process_id proc_id,
    void *from,
    void *to,
    u_int32 count);
```

Description

`_os_cpymem()` copies external memory into your buffer for inspection.

`_os_cpymem()` can copy portions of the system's address space. This is especially helpful in examining modules. Any memory in the system may be viewed in this way.

`proc_id`
: specifies the process ID of the owner of the external memory. (Input) Using a process ID of 0 allows access to the system memory.

`from`
: is a pointer to the external process' memory to copy. (Input)

`to`
: is a pointer to the caller's destination buffer. (Output)

`count`
: is the number of bytes to copy. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_move()`

_os_crc()

Generate CRC

Syntax

```
#include <module.h>
#include <types.h>
error_code _os_crc(
    void *start,
    u_int32 count,
    int32 *accum);
```

Description

`_os_crc()` generates or checks the CRC (cyclic redundancy check) values of sections of memory. Compilers, assemblers, and other module generators use `_os_crc()` to generate a valid module CRC.

If the CRC of a new module is to be generated, the CRC is accumulated over the module (excluding the CRC). The accumulated CRC is complemented and stored in the correct position in the module.

The CRC is calculated over a specified number of bytes starting at the source address. It is not necessary to cover an entire module in one call, because the CRC may be accumulated over several calls. The CRC accumulator must be initialized to `-1` before the first `_os_crc` call for any particular module.

To generate the CRC of an existing module, the calculation must be performed on the entire module, including the module CRC. The CRC accumulator contains the CRC constant bytes if the module CRC is correct. The CRC constant is defined in `module.h` as `CRCCON`. The value is `0x00800fe3`.

To generate the CRC for a module:

1. Initialize the accumulator to `-1`.
2. Perform the CRC over the module.
3. Call `F_CRC` with a NULL value for `start`.
4. Complement the CRC accumulator.
5. Write the contents of the accumulator to the module.

The CRC value is three bytes long, in a four-byte field. To generate a valid module CRC, you must include the byte preceding the CRC in the check. You must initialize this byte to zero. For convenience, if a data pointer of zero is passed, the CRC is updated with one zero data byte. `_os_crc` always returns `0xff` in the most significant byte of the `accum` parameter, so `accum` may be directly stored (after complement) in the last 4 bytes of a module as the correct CRC.

Refer to your operating system technical manual for more information on how your operating system uses CRCs for modules.

`start`
: is a pointer to the section of memory. (Input)

`count`
: specifies the byte count for the section of memory. (Input)

`accum`
: is a returned value. It is a pointer to the CRC accumulator. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$CRC`	*OS-9 for 68K Technical Manual*
`F_CRC`	*OS-9 Technical Manual*

_os_create()

Create Path to New File

Syntax

```
#include <modes.h>
#include <types.h>
error_code _os_create(
    const char *name,
    u_int32 mode,
    path_id *path,
    u_int32 perm, ...);
```

Description

`_os_create()` creates a new file.

- On multifile devices, the new file is entered in the directory structure.
- On non-multifile devices, `create` is synonymous with `open`.

`name`
: is a pointer to the path name of the new file. (Input)

`mode`
: specifies the access mode. (Input)

  If data is to be written to the file, `mode` must have the `FAM_WRITE` or `S_IWRITE` bit set. Only the lower 16 bits of `mode` are used.

  All available access modes are defined in the following location: `MWOS\<OS>\SRC\DEFS\modes.h`

`path`
: is a pointer to the location where `_os_create()` stores the path number that identifies the file in subsequent I/O service requests until the file is closed. (Output)

`perm`
: specifies the attributes to use for the new file. (Input)

  Only the lower 16 bits of `perm` are used.

  If either the `FAM_SIZE` bit or the `S_ISIZE` (initial file size) bit is set, you can also pass an initial file size estimate as a variable argument.

  If either the `FAM_NOCREATE` bit or the `S_IEXCL` (exclusive) bit is set, an error is returned if `name` already exists. If neither `FAM_NOCREATE` nor `S_EXCL` are set, any existing file called `name` is deleted.

By default, if the pathlist specifies a file name that already exists, `_os_create()` recreates the file.

On OS-9 for 68K, the binding for this call exists for compatibility. If speed is an issue, use `_os9_create()`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_attach()`

`_os_open()`

`_os_close()`

`_os_makdir()`

`I$Create`	*OS-9 for 68K Technical Manual*
`I_CREATE`	*OS-9 Technical Manual*

_os9_create()

Create Path to New File

Syntax

```
#include <modes.h>
#include <types.h>
error_code _os9_create(
    const char *name,
    u_int32 mode,
    path_id *path,
    u_int32 perm, ...);
```

Description

`_os9_create()` creates a new file.

- On multifile devices, the new file name is entered in the directory structure.
- On non-multifile devices, `create` is synonymous with `open`.

By default, if the pathlist specifies an existing file name, `_os9_create()` returns an error.

`name`

is a pointer to the path name. (Input)

`mode`

specifies the access mode. (Input)

If data is to be written to the file, `mode` must have the write bit set. Only the lower 16 bits of `mode` are used.

`path`

is a pointer to the location where `_os9_create()` stores the path number. (Output)

`perm`

specifies the attributes to use for the new file. (Input)

Only the lower 16 bits of `perm` are used.

If either the `FAM_SIZE` bit or the `S_ISIZE` (initial file size) bit is set, you can also pass an initial file size estimate as a variable argument.

All available permissions are defined in the following location: `MWOS\<OS>\SRC\DEFS\modes.h`

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_attach()`

`_os_close()`

`_os_makdir()`

`_os_open()`

`I$Create` *OS-9 Technical Manual*

_os_crlk()

Create New Resource Lock Descriptor

Syntax

```
#include <lock.h>
#include <types.h>
error_code _os_crlk(lk_desc **lock);
```

Description

`_os_crlk()` creates a new resource lock descriptor. A resource lock descriptor is allocated and initialized to a free state (one not currently owned).

`lock`
: is a pointer to the location where `_os_crlk()` stores the pointer to the lock descriptor. (Output)

`lock`
: is used as a handle to perform further operations on the lock.

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`lock.l`

See Also

`F_ACQLK`	*OS-9 Technical Manual*
`F_CAQLK`	*OS-9 Technical Manual*
`F_CRLK`	*OS-9 Technical Manual*
`F_DDLK`	*OS-9 Technical Manual*
`F_DELLK`	*OS-9 Technical Manual*
`F_RELLK`	*OS-9 Technical Manual*
`F_WAITLK`	*OS-9 Technical Manual*

_os_datmod()
Create Data Module

Syntax

```
#include <module.h>
#include <types.h>
error_code _os_datmod(
    const char *mod_name,
    u_int32 size,
    u_int16 *attr_rev,
    u_int16 *type_lang,
    u_int32 perm,
    void **mod_exec,
    mh_data **mod_head);
```

Description

`_os_datmod()` creates a data module with the specified attribute/ revision and clears the data portion of the module. The module is created and entered into the system module directory. `_os_datmod()` stores the module's attribute and revision at the located pointed to by `attr_rev`. It also stores the module's actual type and language at the location pointed to by the `type_lang` parameter.

Be careful not to alter the data module's header or name string to prevent the module from becoming unknown to the system.

The created module contains at least `size` usable data bytes but may be somewhat larger. The module itself is larger by at least the size of the module header, CRC, and name string; it is rounded up to the nearest system memory allocation boundary.

`mod_name`
: is a pointer to the module name string. (Input)

`size`
: is the size of the data portion. (Input)

`attr_rev`
: The module's attribute and revision word. (Input)

`type_lang`
: The module's type and language word. (Output)

`perm`
: specifies the access permissions for the module. (Input)

  Only the lower 16 bits of `perm` are used.

`mod_exec`
: is a pointer to the location where `_os_datmod()` stores the pointer to the module data. (Output)

`mod_head`
: is a pointer to the location where `_os_datmod()` stores the pointer to the module header. (Output)

`color`
: is the memory color type. If color is zero, `MEM_ANY` is the specified memory type.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_setcrc()`

`_os_move()`

`F$DatMod`	*OS-9 Technical Manual*
`F_DATMOD`	*OS-9 Technical Manual*

_os_ddlk()

Check for Deadlock Situation

Syntax

```
#include <process.h>

#include <types.h>

error_code _os_ddlk(process_id proc_id);
```

Description

`_os_ddlk()` checks for a deadlock situation between processes. A search for the current process (calling process) in the linked list of potential conflictors is begun from the process specified by `proc_id`.

If the calling process is already in the linked list of processes, an `EOS_DEADLK` error is returned to the caller.

If the process is not in the linked list, the current process is added to the list associated with `proc_id`.

`_os_ddlk()` is useful for preventing a deadlock situation when protecting multiple resources from simultaneous accesses. The deadlock list usually represents the list of processes waiting to acquire access to an associated resource.

`proc_id`
: specifies the process with which to begin the search. (Input)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`lock.l`

See Also

`F_ACQLK`	*OS-9 Technical Manual*
`F_CAQLK`	*OS-9 Technical Manual*
`F_CRLK`	*OS-9 Technical Manual*
`F_DDLK`	*OS-9 Technical Manual*
`F_DELLK`	*OS-9 Technical Manual*
`F_RELLK`	*OS-9 Technical Manual*
`F_WAITLK`	*OS-9 Technical Manual*

_os9_delbit()

Deallocate in Bit Map

Syntax

```
#include <memory.h>
#include <types.h>
error_code _os9_delbit(
    u_int32 bit_number,
    u_int32 count,
    void *address);
```

Description

`_os9_delbit()` clears bits in a buffer that represents a bit map. Bit numbers range from `0` to `n - 1`, where `n` is the number of bits in the bitmap.

`bit_number`
: specifies the bit number of the first bit to clear. (Input)

  Only the lower 16 bits of `bit_number` are used.

`count`
: specifies the number of bits to clear. (Input)

  Only the lower 16 bits of `count` are used.

`address`
: is a pointer to the base address of a bitmap. (Output)

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os9_allbit()`

`_os_cpymem()`

`_os9_schbit()`

`F$DelBit` *OS-9 Technical Manual*

_os_delete()
Delete File

Syntax

```
#include <modes.h>
#include <types.h>
error_code _os_delete(
    const char *name,
    u_int32 mode);
```

Description

`_os_delete()` deletes a file. The caller must have non-sharable write access to the file (the file may not already be open) or an error results.

Attempts to delete from non-multifile devices result in an error. The access mode specifies the data or execution directory (but not both) in the absence of a full pathlist. Only the lower 16 bits of `mode` are used.

`name`
: is a pointer to the file to delete. (Input)

`mode`
: specifies the access mode. (Input)

  Possible values for `mode` include:

  `FAM_READ FAM_WRITE FAM_EXEC`

  `S_IREAD S_IWRITE S_IEXEC`

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_attach()`
`_os_create()`
`_os_detach()`
`_os_open()`

`I$Delete`	*OS-9 Technical Manual*
`I_DELETE`	*OS-9 Technical Manual*

_os_dellk()

Delete Existing Lock Descriptor

Syntax

```
#include <lock.h>
#include <types.h>
error_code _os_dellk(lk_desc *lock);
```

Description

`_os_dellk()` deletes an existing lock descriptor. It does not check for suspended processes still waiting to acquire the lock; an implementation using locks must release all processes waiting on a resource lock before deleting it. Failure to release suspended processes prior to deletion could result in system corruption.

`lock`
: is a pointer to the `lk_desc` structure for the lock to delete. (Input)

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`lock.l`

See Also

`F_ACQLK`	*OS-9 Technical Manual*
`F_CAQLK`	*OS-9 Technical Manual*
`F_CRLK`	*OS-9 Technical Manual*
`F_DDLK`	*OS-9 Technical Manual*
`F_DELLK`	*OS-9 Technical Manual*
`F_RELLK`	*OS-9 Technical Manual*
`F_WAITLK`	*OS-9 Technical Manual*

_os_delmdir()

Delete Existing Module Directory

Syntax

```
#include <moddir.h>
#include <types.h>
error_code _os_delmdir(const char *name);
```

Description

`_os_delmdir()` deletes an existing module directory. The directory must be empty.

`name`
: is a pointer to the module directory. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F_DELMDIR`	*OS-9 Technical Manual*

_os_deltsk()

Deallocate Process Descriptor

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_deltsk(pr_desc *proc_desc);
```

Description

`_os_deltsk()` returns the process' protection resources when the process terminates.

`_os_deltsk()` only performs a useful function on MMU/SSM systems. On non-MMU/SSM systems, `_os_deltsk()` simply returns without deallocating the process descriptor.

`proc_desc`
: is a pointer to the process descriptor. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_alltsk()`

`_os_chkmem()`

`_os_protect()`

`_os_permit()`

`F$DelTsk`	*OS-9 for 68K Technical Manual*
`F_DELTSK`	*OS-9 Technical Manual*

_os_detach()

Remove Device from System

Syntax

```
#include <io.h>
#include <types.h>
error_code _os_detach(dev_list *dev_tbl);
```

Description

`_os_detach()` removes a device from the system device table if no other process is using the device.

OS-9 for 68K: If an invalid address is passed in `dev_tbl`, the system may crash or undergo severe damage.

`dev_tbl`
is a pointer to the address of the device table entry. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_attach()`

`_os_close()`

`I$Detach`	*OS-9 for 68K Technical Manual*
`I_DETACH`	*OS-9 Technical Manual*

_os_dexec()

Execute Debugged Program

Syntax

```
#include <dexec.h>
#include <types.h>
error_code _os_dexec(
   process_id proc_id,
   dexec_mode mode,
   void *params,
   u_int32 *num_instr,
   u_int32 num_bpts,
   void **brk_pts,
   u_int32 *tot_instr,
   dexec_status *status,
   u_int32 *except,
   void **addr,
   error_code *exit_status);
```

Description

OS-9 for 68K:

`_os_dexec()` controls the execution of a suspended child process created by either `_os9_dfork()`or by `_os_dfork()`. OS-9 for 68k uses `_os9_dfork()` and OS-9 uses `_os_dfork()`. The process performing `_os_dexec()` is suspended, and its debugged child process is executed instead. This process terminates and control returns to the parent after the specified number of instructions have been executed, a breakpoint is reached, or an unexpected exception occurs. The parent and the child processes are never active at the same time.

An `_os_dexit()` call must be made for the resources (memory) of the debugged process to be returned.

Refer to your operating system technical manual for system-specific information.

Tracing is allowed through subroutine libraries, intercept routines, and OS-9 for 68K user-state trap handlers. This is not a problem, but may seem strange at times.

`proc_id`
: is the process ID of the child to execute. (Input)

`mode`
: specifies the debug mode. (Input)

`params`
: is the parameter list pointer. (Input)

`num_instr`
: points to the location where the number of instructions to execute is passed. (Input/Output)

`_os_dexec()`
: also stores the number of instructions not executed at the location pointed to by `num_instr`. If the integer at `num_instr` is zero, commands are executed continuously.

`num_bpts`
: specifies the number of breakpoints in the list. (Input)

  Maximum of 16 break points allowed.

`brk_pts`
: is a pointer to the pointer to the breakpoint list. (Input)

`tot_instr`
: points to where the number of instructions executed so far is passed. (Input/Output)

`_os_dexec()`
: also stores the updated total number of instructions at the location pointed to by `tot_instr`.

`status`
: is a pointer to the location where `_os_dexec()` stores the return status. (Output)

`except`
: is a pointer to the location where `_os_dexec()` stores the exception that the child received. (Output)

`addr`
: is a pointer to the location where `_os_dexec()` stores the violation address. (Output)

`exit_status`
: is a pointer to the location where `_os_dexec()` stores the exit status of the child. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_dfork()`

`_os9_dfork()`

`_os_dexit()`

`F$DExec`	*OS-9 for 68K Technical Manual*
`F_DEXEC`	*OS-9 Technical Manual*
`F_DFORK`	*OS-9 Technical Manual*

_os_dexit()

Exit Debugged Program

Syntax

```
#include <dexec.h>
#include <types.h>
error_code _os_dexit(process_id proc_id);
```

Description

`_os_dexit()` terminates a suspended child process created by `_os_dfork()`. To allow examination of the child after its termination, normal termination by the child process does not release any resources.

`proc_id`
is the process ID of the child to terminate. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_exit()`

`_os_dfork()`

`_os9_dfork()`

`_os_dexec()`

`F$DExit`	*OS-9 Technical Manual*
`F_DEXIT`	*OS-9 Technical Manual*

_os_dfork()

Fork Process Under Control of Debugger

Syntax

```
#include <dexec.h>
#include <types.h>

error_code _os_dfork(
    u_int32 priority,
    u_int32 path_cnt,
    const char *mod_name,
    const void *params,
    u_int32 param_size,
    u_int32 mem_size,
    process_id *proc_id,
    u_int32 type_lang,
    regs *reg_stack,
    fregs *fregstack);
```

Description

`_os_dfork()` creates a new process which becomes a child of the caller. It sets up the process' memory, MPU registers, and standard I/O paths. In addition, `_os_dfork()` allows a debugger utility to create a process whose execution can be closely controlled. The created process is not placed in the active queue, but is left in a suspended state. This allows the debugger to control its execution through the `_os_dexec()` and `_os_dexit()` calls.

`priority`
: is the priority of the new process. (Input)

  Only the lower 16 bits of `priority` are used.

`path_cnt`
: is the number of I/O paths for the child to inherit. (Input)

  Only the lower 16 bits of `path_cnt` are used.

`mod_name`
: is a pointer to the module name. (Input)

`params`
: is a pointer to the parameter block. (Input)

`param_size`
: specifies the size of the parameter block. (Input)

`mem_size`
specifies any additional stack space to allocate. (Input)

`mem_size`
is specified in bytes.

`proc_id`
is a pointer to the location where `_os_dfork()` stores the child process ID. (Output)

`type_lang`
specifies the desired type and language. (Input)

Only the lower 16 bits of `type_lang` are used.

`reg_stack`
is a pointer to the register buffer. (Input)

`freg_stack`
is a pointer to the floating point register buffer. (Input)

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_dexit()`

`_os_fork()`

`_os9_dfork()`

`_os_dexec()`

`F$DExit`	*OS-9 Technical Manual*
`F_DFORK`	*OS-9 Technical Manual*

_os9_dfork()

Fork Process Under Control of Debugger

Syntax

```
#include <dexec.h>
#include <types.h>
error_code _os9_dfork(
    u_int32 priority,
    u_int32 path_cnt,
    const char *mod_name,
    const void *params,
    u_int32 param_size,
    u_int32 mem_size,
    process_id *proc_id,
    u_int32 type_lang,
    void *reg_buf);
```

Description

`_os9_dfork()` creates a new process which becomes a child of the caller. It sets up the new process' memory, MPU registers, and standard I/O paths. In addition, `_os9_dfork()` allows a debugger utility to create a process whose execution can be closely controlled. The process is not placed in the active queue, but is left in a suspended state. This allows the debugger to control its execution through the `_os_dexec()` and `_os_dexit()` system calls.

`priority`
: is the priority of the new process. (Input)

  Only the lower 16 bits of `priority` are used.

`path_cnt`
: is the number of the I/O paths for a child to inherit. (Input)

  Only the lower 16 bits of `path_cnt` are used.

`mod_name`
: is the module name pointer. (Input)

`params`
: is a pointer to an additional parameter block. (Input)

`param_size`
: is the size of the parameter block. (Input)

`mem_size`
: specifies any additional stack space to allocate. (Input)

`mem_size`
is specified in bytes.

`proc_id`
is a pointer to the location where `_os9_dfork()` stores the child process ID. (Output)

`type_lang`
specifies the desired type and language. (Input)

Only the lower 16 bits of `type_lang` are used.

`reg_buf`
is a pointer to a copy of all child registers. (Input)

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_dexec()`

`_os_dexit()`

`_os_fork()`

`F$DFork` *OS-9 for 68K Technical Manual*

_os_dforkm()

Fork Process Under Control of Debugger

Syntax

```
#include <dexec.h>
#include <types.h>
error_code _os_dforkm(
    u_int32 priority,
    u_int32 path_cnt,
    mh_com *mod_head,
    void *params,
    u_int32 param_size,
    u_int32 mem_size,
    process_id *proc_id,
    regs *reg_stack,
    fregs *fregstack);
```

Description

`_os_dforkm()` creates a new process which becomes a child of the caller. It sets up the process' memory, MPU registers, and standard I/O paths. In addition, `_os_dforkm()` allows a debugger utility to create a process whose execution can be closely controlled. The created process is not placed in the active queue, but is left in a suspended state. This allows the debugger to control its execution through the `_os_dexec()` and `_os_dexit()` calls. `_os_dforkm()` is similar to `_os_dfork()`. However, `_os_dforkm()` is passed a pointer to the module to fork rather than the module name.

`priority`
: is the priority of the new process. (Input)

  Only the lower 16 bits of `priority` are used.

`path_cnt`
: is the number of I/O paths for the child to inherit. (Input)

  Only the lower 16 bits of `path_cnt` are used.

`mod_head`
: is a pointer to the module header. (Input)

`params`
: is a pointer to the parameter block. (Input)

`param_size`
: specifies the size of the parameter block. (Input)

`mem_size`
specifies any additional stack space to allocate. (Input)

`proc_id`
is a pointer to the location where `_os_dforkm()` stores the child process ID. (Output)

`reg_stack`
is a pointer to the register buffer. (Input)

`fregstack`
is a pointer to the floating point register buffer. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_fork()`

`_os_dexec()`

`_os_dexit()`

`_os_dfork()`

_os_dup()

Duplicate Path

Syntax

```
#include <modes.h>
#include <types.h>
error_code _os_dup(
    path_id dup_path,
    path_id *new_path);
```

Description

`_os_dup()` returns a synonymous path number for an existing file or device.

`_os_dup()` always uses the lowest available path number. For example, if you perform an `_os_close()` on path `#0` and an `_os_dup()` on path `#4`, path `#0` is returned as the new path number. Therefore, service requests using either the old or new path numbers operate on the same file or device.

It is not advised for more than one process to be performing I/O on the same path concurrently.

`dup_path`
is the path number of the path to duplicate. (Input)

`new_path`
is a pointer to the location where `_os_dup()` stores the new path number for the same path. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`I$Dup`	*OS-9 for 68K Technical Manual*
`I_DUP`	*OS-9 Technical Manual*

_os_ev_allclr()

Wait for All Bits Defined by Mask to Become Clear

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_allclr(
    event_id ev_id,
    int32 *value,
    signal_code *signal,
    u_int32 mask);
```

Description

`_os_ev_allclr()` waits until an `_os_ev_signal()` occurs that clears all of the bits corresponding to the set bits in the mask.

`ev_id`
: identifies the event. (Input)

`value`
: is a pointer to the location where `_os_ev_allclr()` stores the actual event value. (Output)

`signal`
: is a pointer to the location where `_os_ev_allclr()` stores the signal code. (Output)

  If the process receives a signal while in the event queue, it is activated even though the event has not actually occurred.

`mask`
: specifies the activation mask. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_ALLCR`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os_ev_allset()

Wait for Event to Occur

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_allset(
    event_id ev_id,
    int32 *value,
    signal_code *signal,
    u_int32 mask);
```

Description

`_os_ev_allset()` waits until an `_os_ev_signal()` occurs that sets all of the bits corresponding to the set bits in the mask.

`ev_id`
: identifies the event. (Input)

`value`
: is a pointer to the location where `_os_ev_allset()` stores the actual event value. (Output)

`signal`
: is a pointer to the location where `_os_ev_allset()` stores the signal code. (Output)

  If the process receives a signal while in the event queue, it is activated even though the event has not actually occurred.

`mask`
: specifies the activation mask.(Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_ALLSET`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os_ev_anyclr()

Wait for Event to Occur

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_anyclr(
    event_id ev_id,
    int32 *value,
    signal_code *signal,
    u_int32 mask);
```

Description

`_os_ev_anyclr()` waits until an `_os_ev_signal()` occurs that clears any of the bits corresponding to the set bits in the mask.

`ev_id`
: identifies the event. (Input)

`value`
: is a pointer to the location where `_os_ev_anyclr()` stores the actual event value. (Output)

`signal`
: is a pointer to the location where `_os_ev_anyclr()` stores the signal code. (Output)

  If the process receives a signal while in the event queue, it is activated even though the event has not actually occurred.

`mask`
: specifies the activation mask. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_ANYCLR`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os_ev_anyset()

Wait for Event to Occur

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_anyset(
    event_id ev_id,
    int32 *value,
    signal_code *signal,
    u_int32 mask);
```

Description

`_os_ev_anyset()` waits until an `_os_ev_signal()` occurs that sets any of the bits corresponding to the set bits in the mask.

`ev_id`
: identifies the event. (Input)

`value`
: is a pointer to the location where `_os_ev_anyset()` stores the actual event value. (Output)

`signal`
: is a pointer to the location where `_os_ev_anyset()` stores the signal code. (Output)

If the process receives a signal while in the event queue, it is activated even though the event has not actually occurred.

`mask`
: specifies the activation mask. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_ANYSET`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os_ev_change()

Wait for Event to Occur

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_change(
    event_id ev_id,
    int32 *value,
    signal_code *signal,
    u_int32 mask,
    u_int32 pattern);
```

Description

`_os_ev_change()` waits for an event to occur. That is, it waits until an `_os_ev_signal()` occurs that changes any of the bits corresponding to the set bits in `mask`.

`ev_id`
: identifies the event. (Input)

`value`
: is a pointer to the location where `_os_ev_change()` stores the actual event value. (Output)

`signal`
: is a pointer to the location where `_os_ev_change()` stores the signal code. (Output)

  If the process receives a signal while in the event queue, it is activated even though the event has not actually occurred.

`mask`
: specifies the activation mask. (Input)

`pattern`
: specifies the wait pattern. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_CHANGE`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os_ev_creat()

Create New Event

Syntax

```
#include <events.h>

#include <types.h>

error_code _os_ev_creat(
    int32 winc,
    int32 sinc,
    u_int32 perm,
    event_id *ev_id,
    const char *name,
    int32 value,
    u_int32 color);
```

Description

`_os_ev_creat()` allows you to create events dynamically as needed. When an event is created, an initial value is specified, as well as increments to apply each time the event is waited for or an event signal occurs. Subsequent `_os_event` calls use the returned ID number to refer to the created event.

`winc`

specifies the auto-increment value for `_os_ev_wait()`. (Input)

Only the lower 16 bits of `winc` are used. (Input)

`sinc`

specifies the auto-increment value for `_os_ev_signal()`. (Input)

Only the lower 16 bits of `sinc` are used.

`perm`

specifies the access permissions. (Input)

Only the lower 16 bits of `perm` are used.

OS-9 for 68K ignores `perm`.

`ev_id`

is a pointer to the location where `_os_ev_creat()` stores the event identifier. (Output)

`name`

is a pointer to the event name string. (Input)

`value`

specifies the initial event variable value. (Input) `color`

specifies the memory type for the event structure. (Input)

Only the lower 16 bits of `color` are used.

OS-9 for 68K ignores `color`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_ev_delete()`

`_os_ev_signal()`

`_os_ev_wait()`

`_os9_ev_wait()`

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_CREAT`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os_ev_delete()

Delete Existing Event

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_delete(const char *name);
```

Description

`_os_ev_delete()` removes an event from the system event table, freeing the entry for use by another event. An event may not be deleted unless its use count is zero.

`name`
: is a pointer to the event's name string. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_ev_creat()`

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_DELET`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os_ev_info()

Return Event Information

Syntax

```
#include <events.h>
#include <types.h>
```

OS-9 for 68K:

```
error_code _os_ev_info(
    event_id ev_id,
    u_int32 size,
    ev_infostr *buffer);
```

OS-9:

```
error_code _os_ev_info(
    event_id ev_id,
    u_int32 size,
    void *buffer);
```

Description

`_os_ev_info()` returns event information in the caller's buffer. The returned information is defined by the `ev_infostr` event information structure defined in the `events.h` header file. On OS-9, the name of the event is appended to the end of the information structure; `buffer` and `size` must be large enough to accommodate the name of the target event.

`_os_ev_info()` returns the event information block for the first active event whose index is greater than or equal to this index. If no such event exists, an error is returned.

`ev_id`
: specifies the event index to use to begin the search. (Input)

`size`
: specifies the buffer size. (Input)

`buffer`
: is a pointer to the buffer containing the event information. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`	*OS-9 for 68K Technical Manual*
`F_EVENT, EV_INFO`	*OS-9 for 68K Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 for 68K Technical Manual*

_os9_ev_info()

Return Event Information

Syntax

```
include <events.h>
#include <types.h>
error_code _os9_ev_info(
   u_int32 *index,
   ev_infostr *buffer);
```

Description

`os9_ev_info()` returns event information in the caller's buffer. The returned information is defined by the `ev_infostr` event information structure defined in `events.h`. `_os9_ev_info()` also stores the event index of the valid event found (if any) at the location pointed to by index.

`index`
: The event index to begin the search for a valid event is passed at the location pointed to by `index`. (Input)

`buffer`
: is a pointer to a buffer large enough to hold the event information. (Output)

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`os_lib.l`

See Also

`F$Event` *OS-9 for 68K Technical Manual*

_os_ev_link()

Link to Existing Event by Name

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_link(
    const char *name,
    event_id *ev_id);
```

Description

`_os_ev_link()` determines the ID number of an existing event. To keep the use count synchronized properly, you must perform an `_os_ev_unlink()` call when the event is longer be used.

`name`
: is a pointer to the event name string. (Input)

`ev_id`
: is a pointer to the location where `_os_ev_link()` stores the event identifier. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_ev_unlink()`

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_LNK`	*OS-9 Technical Manual*
`F_EVENT, EV_UNLNK`	*OS-9 Technical Manual*

_os_ev_pulse()

Signal Event Occurrence

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_pulse(
    event_id ev_id,
    int32 *value,
    u_int32 actv_flag);
```

Description

`_os_ev_pulse()` signals an event occurrence. The event value is set to what is passed at the location `value`, and the signal auto-increment is not applied. Then, the `_os_ev_signal()` search routine is executed and the original event value is restored.

`ev_id`
: identifies the event. (Input)

`value`
: The value to pulse the event to is passed at the location pointed to by `value`. (Input/Output)

  `_os_ev_pulse()` also stores the event value prior to the pulse at the location pointed to by `value`.

`actv_flag`
: specifies which process(es) to activate. (Input)

- If `actv_flag` is one, all processes in range are activated.
- If `actv_flag` is zero, the first process in the event queue waiting for that range is activated.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_ev_signal()`

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_PULSE`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os_ev_read()

Read Event Value Without Waiting

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_read(
    event_id ev_id,
    int32 *value);
```

Description

`_os_ev_read()` reads the value of an event without waiting for or affecting the event variable.

`ev_id`
: identifies the event. (Input)

`value`
: is a pointer to the location where `_os_ev_read()` stores the current event value. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_READ`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os_ev_set()

Set Event Variable and Signal Event Occurrence

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_set(
    event_id ev_id,
    int32 *value,
    u_int32 actv_flag);
```

Description

`_os_ev_set()` signals that an event has occurred. The current event variable is set to the value passed at `value`. Then, the event queue is searched for the first process waiting for that event.

`ev_id`
: identifies the event. (Input)

`value`
: is a pointer to the location where `_os_ev_set()` stores the event value prior to the set operation. (Output)

`actv_flag`
: specifies which process(es) to activate. (Input)

- If `actv_flag` is one, all processes in range are activated.
- If `actv_flag` is zero, the first process in the event queue waiting for that range is activated.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_ev_signal()`

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_SET`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os_ev_setand()

Set Event Variable and Signal Event Occurrence

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_setand(
    event_id ev_id,
    int32 *value,
    u_int32 mask,
    u_int32 actv_flag)
```

Description

`_os_ev_setand()` signals that an event has occurred. The current event variable is ANDed with the value passed in `mask`. Then, the event queue is searched for the first process waiting for that event value.

`ev_id`
: identifies the event. (Input)

`value`
: is a pointer to the location where `_os_ev_setand()` stores the event value prior to the logical operation. (Output)

`mask`
: is the event mask. (Input)

`actv_flag`
: specifies which process(es) to activate. (Input)

- If `actv_flag` is one, all processes in range are activated.
- If `actv_flag` is zero, the first process in the event queue waiting for that range is activated.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_SETAND`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os_ev_setor()

Set Event Variable and Signal Event Occurrence

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_setor(
    event_id ev_id,
    int32 *value,
    u_int32 mask,
    u_int32 actv_flag);
```

Description

`_os_ev_setor()` signals that an event has occurred. The current event variable is ORed with the value passed in `mask`. Then, the event queue is searched for the first process waiting for that event value.

`ev_id`
: identifies the event. (Input)

`value`
: is a pointer to the location where `_os_ev_setor()` stores the event value prior to the logical operation. (Output)

`mask`
: is the event mask. (Input)

`actv_flag`
: specifies which process(es) to activate. (Input)

- If `actv_flag` is one, all processes in range are activated.
- If `actv_flag` is zero, the first process in the event queue waiting for that range is activated.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_SETOR`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os_ev_setr()

Set Relative Event Variable and Signal Event Occurrence

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_setr(
    event_id ev_id,
    int32 *value,
    u_int32 actv_flag);
```

Description

`_os_ev_setr()` signals that an event has occurred. The current event value is incremented by `value` (output). Then, the event queue is searched for the first process waiting for that event value. Arithmetic underflows or overflows are set to `0x80000000` (minimum integer) or `0x7fffffff` (maximum integer), respectively.

`ev_id`
: identifies the event. (Input)

The amount to add to the event value is passed at the location pointed to by `value`.

- OS-9 for 68K: `_os_ev_setr()` stores the event value before the increment at `value`.
- OS-9: `_os_ev_setr()` stores the event value after the increment at `value`.

`actv_flag`
: specifies which process(es) to activate. (Input)

- If `actv_flag` is one, all processes in range are activated.
- If `actv_flag` is zero, the first process in the event queue waiting for that range is activated.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_ev_set()`

`_os_ev_signal()`

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT, EV_SETR`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os_ev_setxor()

Set Event Variable and Signal Event Occurrence

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_setxor(
    event_id ev_id,
    int32 *value,
    u_int32 mask,
    u_int32 actv_flag);
```

Description

`_os_ev_setxor()` signals that an event has occurred. The current event value is EXCLUSIVE-ORed with `mask`. Then, the event queue is searched for the first process waiting for that event value.

`ev_id`
: identifies the event. (Input)

`value`
: is a pointer to the location where `_os_ev_setxor()` stores the event value prior to the logical operation. (Output)

`mask`
: specifies the event mask. (Input)

`actv_flag`
: specifies which process(es) to activate. (Input)

- If `actv_flag` is one, all processes in range are activated.
- If `actv_flag` is zero, the first process in the event queue waiting for that range is activated.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_SETXOR`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os_ev_signal()

Signal Event Occurrence

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_signal(
    event_id ev_id,
    int32 *value,
    u_int32 actv_flag);
```

Description

`_os_ev_signal()` signals that an event has occurred. The current event variable is updated with the signal auto-increment that was specified when the event was created. Then, the event queue is searched for the first process waiting for that event value.

`ev_id`
: identifies the event that has occurred. (Input)

`value`
: is a pointer to the location where `_os_ev_signal()` stores the event value prior to the signal operation. (Output)

`actv_flag`
: specifies which process(es) to activate. (Input)

- If `actv_flag` is one, all processes in the event queue with a value in range are activated.
- If `actv_flag` is zero, the first process in the event queue waiting for that range is activated.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os_ev_tstset()

Wait for Event to Occur

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_tstset(
    event_id ev_id,
    int32 *value,
    signal_code *signal,
    u_int32 mask);
```

Description

`_os_ev_tstset()` waits for an event to occur. The event variable is ANDed with the value in `mask`. If the result is not zero, the calling process is suspended in a FIFO event queue until an `_os_ev_signal()` occurs that clears all of the bits corresponding to the set bits in the mask. Then, the bits corresponding to the set bits in the mask are set.

`ev_id`
: identifies the event. (Input)

`value`
: is a pointer to the location where `_os_ev_tstset()` stores the actual event value. (Output)

`signal`
: is a pointer to the location where `_os_ev_tstset()` stores the signal code. (Output)

If a process in the event queue receives a signal, it is activated even though the event has not actually occurred.

`mask`
: specifies the activation mask. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_TSTSET`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os_ev_trywait()

Perform a Non-blocking Event Wait

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_trywait(
    event_id ev_id,
    int32 *value,
    int32 min_val,
    int32 max_val);
```

Description

`_os_ev_trywait()` performs a non-blocking event wait. If the event value is currently in the range between the minimum and maximum activation values the wait auto-increment (specified at creation) is added to the event variable. If the current value is not in range, the error EAGAIN is returned.

`ev_id`
: identifies the event. (Input)

`value`
: is a pointer to the location where _os_ev_trywait() stores the actual event value before the wait increment was applied. (Output)

`min_val`
: is the minimum activation value. (Input)

`max_val`
: is the maximum activation value. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_ev_signal()` `_os_ev_wait()`
`_os9_ev_wait()`

In the *OS-9 Technical Manual*:

`F_EVENT`	`F_EVENT, EV_WAIT`
`F_EVENT, EV_TRYWAIT`	`F_EVENT, EV_SIGNL`

_os_ev_unlink()

Unlink Event

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_unlink(event_id ev_id);
```

Description

`_os_ev_unlink()` decrements the use count of an event. When the use count reaches zero, you can delete the event using `_os_ev_delete()`.

`ev_id`
: identifies the event. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_ev_delete()`

`_os_ev_link()`

`F$Event`	*OS-9 for 68K Technical Manual*
`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_UNLNK`	*OS-9 Technical Manual*
`F_EVENT, EV_DELET`	*OS-9 Technical Manual*

_os_ev_wait()

Wait for Event to Occur

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_wait(
    event_id ev_id,
    int32 *value,
    signal_code *signal,
    int32 min_val,
    int32 max_val);
```

Description

`_os_ev_wait()` waits for an event to occur. It waits until an event call places the value in the range between the minimum and maximum activation values. Then, the wait auto-increment (specified at creation) is added to the event variable.

`ev_id`
: identifies the event. (Input)

`value`
: is a pointer to the location where `_os_ev_wait()` stores the actual event value. (Output)

`signal`
: is a pointer to the location where `_os_ev_wait()` stores the signal code. (Output)

: If a process in the event queue receives a signal, it is activated even though the event has not actually occurred.

`min_val`
: is the minimum activation value. (Input)

`max_val`
: is the maximum activation value. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_ev_signal()`

`_os_ev_waitr()`

`_os9_ev_waitr()`

`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_WAIT`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os9_ev_wait()

Wait for Event to Occur

Syntax

```
#include <events.h>
#include <types.h>
error_code _os9_ev_wait(
    event_id ev_id,
    int32 *value,
    int32 min_val,
    int32 max_val);
```

Description

`_os9_ev_wait()` waits for an event to occur. It waits until an event call places the value in range between the minimum activation value and the maximum activation value. Then, the wait auto-increment (specified at creation) is added to the event variable.

If a process in the event queue receives a signal, it is activated even though the event has not actually occurred.

`ev_id`
: specifies the event. (Input)

`value`
: is a pointer to the location where `_os9_ev_wait()` stores the actual event value. (Output)

`min_val`
: specifies the minimum activation value. (Input)

`max_val`
: specifies the maximum activation value. (Input)

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$Event` *OS-9 for 68K Technical Manual*

_os_ev_waitr()

Wait for Relative Event to Occur

Syntax

```
#include <events.h>
#include <types.h>
error_code _os_ev_waitr(
    event_id ev_id,
    int32 *value,
    signal_code *signal,
    int32 *min_val,
    int32 *max_val);
```

Description

`_os_ev_waitr()` waits for an event to occur. It waits until an event call places the value in the range between the minimum and maximum activation values, where the integers at locations `min_val` and `max_val` are relative to the current event value. Then, the wait auto-increment (specified at creation) is added to the event variable.

The event value is added to `min_val` and `max_val`, and the actual values are returned to the caller. If an underflow or overflow occurs on the addition, the values `0x80000000` (minimum integer) and `0x7fffffff` (maximum integer) are used, respectively.

`ev_id`
: identifies the event. (Input)

`value`
: is a pointer to the location where `_os_ev_waitr()` stores the actual event value. (Output)

`signal`
: is a pointer to the location where `_os_ev_waitr()` stores the signal code if a signal activates the process. (Output)

`min_val`
: is a pointer to location where `_os_ev_waitr()` stores the minimum absolute activation value. (Input/Output)

  The minimum relative activation value is passed at the location pointed to by `min_val`.

`max_val`
: is a pointer to the location where `_os_ev_waitr()` stores the maximum absolute activation value. (Input/Output)

  The maximum relative activation value is passed at the location pointed to by `max_val`.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_ev_signal()`

`_os_ev_wait()`

`_os9_ev_waitr()`

`F_EVENT`	*OS-9 Technical Manual*
`F_EVENT, EV_SETOR`	*OS-9 Technical Manual*
`F_EVENT, EV_SIGNL`	*OS-9 Technical Manual*

_os9_ev_waitr()

Wait for Relative Event to Occur

Syntax

```
#include <events.h>
#include <types.h>
error_code _os9_ev_waitr(
    event_id ev_id,
    int32 *value,
    int32 *min_val,
    int32 *max_val);
```

Description

`_os9_ev_waitr()` waits for an event to occur. It waits until an event call places the value in the range between the minimum and maximum activation values, where `min_val` and `max_val` are relative to the current event value. Then, the wait auto-increment (specified at creation) is added to the event variable.

The event value is added to `min_val` and `max_val` respectively, and the actual values are returned to the caller. If an underflow or overflow occurs on the addition, the values `$80000000` (minimum integer) and `$7fffffff` (maximum integer) are used, respectively.

`ev_id`
: specifies the event. (Input)

`value`
: is a pointer to the location where `_os9_ev_waitr()` stores the actual event value. (Output)

`min_val`
: is a pointer to the location where `_os9_ev_waitr()` stores the minimum absolute value. (Input/Output)

  The minimum relative activation value is passed at the location pointed to by `min_val`.

`max_val`
: is the pointer to the location where `_os9_ev_waitr()` stores the maximum absolute value. (Input/Output)

  The maximum relative activation value is passed at the location pointed to by `max_val`.

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os9_ev_wait()`
`F$Event` *OS-9 for 68K Technical Manual*

_os_exec()

Start Child Process

Syntax

```
#include <process.h>
#include < dexec.h>  /* used when _os_dfork(),
                     /* _os9_dfork(), or _os_dforkm()
                     /* is specified as func */
#include <types.h>
error_code _os_exec(
   u_int32 (*func)(),
   u_int32 priority,
   u_int32 pathcnt,
   void  *modname,
   char **argv,
   char **envp,
   u_int32  datasize, ...);
```

Description

`_os_exec()` prepares the parameter and environment list before creating a process. The function to create a new process passes information to the new process as binary data specified by a pointer and size. It is up to the forked process to interpret the data.

The first seven parameters are identical for `_os_fork()`, `_os_forkm()`, `_os_chain()`, `_os_chainm()`, `_os_dfork()`, or `_os_dforkm()`. Four additional parameters may be required (`add1`, `add2`, `add3`, and `add4`) and have different meaning depending on the function specified by `func`:

Table 2-13. _os_exec() Additional Parameters

Call	Parameter	Definition
`_os_fork()`	`add1`	Child process ID returns to the location of the `add1` pointer
	`add2`	Type/language of the new process
	`add3`	*Orphan: `0` = Normal child process `1` = Process not associated with parent
`_os_forkm()`	`add1`	The child process ID returns to the location of the `add1` pointer
	`add2`	*Orphan: `0` = Normal child process `1` = Process not associated with parent
`_os_chain()`	`add1`	Type/language of the new process

Table 2-13. _os_exec() Additional Parameters (Continued)

Call	Parameter	Definition
`_os_chainm()`		Does not use the extra parameters
`_os_dfork()`	`add1`	Child process ID returns to the location of the `add1` pointer
	`add2`	Type/language of the new process
	`add3`	Pointer to register stack for child process
	`add4`	Pointer to floating point register stack for child process
`_os9_dfork()`	`add1`	Child process ID returns to the location of the `add1` pointer
	`add2`	Type/language of the new process
	`add3`	Pointer to register stack for child process
`_os_dforkm()`	`add1`	Child process ID returns to the location of the `add1` pointer
	`add2`	Pointer to register stack for child process
	`add3`	Pointer to floating point register stack for child process

*On OS-9 for 68K, the `orphan` flag must be set to zero.

If you are using `_os_exec()` when `func` indicates a chain function, you must provide a full pathlist for the module or verify that the module is already in memory.

For OS-9, a threaded process may only chain from the `main()` thread and may not chain if multiple threads are active in the process.

`_os_exec()` returns the value of `(*func)()`, which returns `0` if successful. Otherwise, it returns an error number.

`func`

is a pointer to one of the following functions that create a new process. (Input)

- OS-9 for 68K: `_os_fork()`, `_os9_dfork()`, or `_os_chain()`
- OS-9: `_os_fork()`, `_os_forkm()`, `_os_chain()`, `_os_chainm()`, `_os_dfork()`, or `_os_dforkm()`

`priority`

is the priority value at which the new process is to run. (Input)

Only the lower 16 bits of `priority` are used. If `priority` is zero, the new process receives the priority of the calling process.

`pathcnt`

is the number of open paths to pass to the new process. (Input)

Normally, `pathcnt` is three, causing the three standard paths to be passed. A value of zero passes no open paths. Only the lower 16 bits of `pathcnt` are used.

`modname`
: is a pointer to a string naming the new primary module or a pointer to the module in the case of the functions ending in `m` (`_os_forkm()`, `_os_chainm()`, and `_os_dforkm()`). (Input)

`argv`
: is a pointer to the parameter pointer list that the new process is to receive. (Input)

  By convention, `argv[0]` is the name of the new module. The end of the `argv` list is marked by a null pointer.

`envp`
: is a pointer to the environment pointer list containing environment variables that the new process is to receive. (Input)

  The end of the `envp` list is also marked by a null pointer.

`datasize`
: is the additional memory (in bytes) to allocate to the new process' stack memory. (Input)

  A `datasize` of zero indicates default stack size required by process.

Example

```
#include <process.h>
#include <dexec.h>
#include <errno.h>
#include <cglob.h>
#include <types.h>
                       /* Use the environment pointer given */
                       /* to you by the shell.            */
char *argblk[] =
{
   0,0,0,0,0,0,        /* Create an array of pointers to  */
};                     /* become argv[] of child process. */
main()
{
  u_int16 prior = 0;   /* Priority of Child process  */
                       /* 0 is same as parent        */
  u_int16 paths = 3;   /* number of paths to inherit */
                       /* stdin, stdout, stderr      */
  u_int32 edata = 0;   /* No Extra Data Space        */
  process_id child_id; /* child id number            */
```

```
  char  orphan = 0;    /* make this child a normal   */
                       /* child not an orphan        */
  u_int16 type_lang;   /* type language of child     */

  type_lang  =  mktypelang(MT_PROGRAM, ML_OBJECT);

  argblk[0] = "dir";   /* Child process is "dir" */
  argblk[1] = "-e";    /* With a -e option */
  argblk[2] = "-a",    /* And a -a option */
  argblk[3] = 0;     /* Make sure end of options is a null ptr */

  if ((errno = _os_exec(_os_fork, prior, paths,
                        argblk[0], argblk, _environ,
                        edata, &child_id, type_lang,
                        orphan)) != SUCCESS)
     _os_exit(_errmsg(errno,
              "Problem Creating Child %s\n",
               argblk[0]));

/*If we get this far, the _os_exec() was successful*/
  _os_ wait(0);        /* Wait for child process to die */
/* die*/
   printf("The Child's ID number was %d\n",
           child_id);
}
```

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

os_lib.l

See Also

_os_chain()	_os_chainm()	_os_dfork()
_os_dforkm()	_os_fork()	_os_forkm()
os9fork(), os9forkc()	os9exec()	os9kexec()

os9exec()

OS-9 for 68K System Call Processing

Syntax

```
include <process.h>

int os9exec(
   int  (*func)(),
   const char  *modname,
   char  **argv,
   char  **envp,
   unsigned int  stacksize,
   int  priority,
   int  pathcnt);
```

Description

`os9exec()` is a high-level fork/chain interface that prepares the parameter and environment list before a process is created.

`os9forkc()` and `chainc()` are C-level hooks to the system calls. By themselves, they provide no real parameter information. This leaves the interpretation of a raw parameter string up to the `cstart` portion of the C program. Problems can occur when handling quotes and control characters.

If `func` is `os9forkc()` or `os9fork()` and the initial attempt to create the child process fails due to `EOS_PNNF` (path name not found), `os9exec()` calls `modloadp()` with `modname` to load the module from disk and attempts the fork again. This action is the same as the shell handling of executable files.

If you use `os9exec()` when `func` is `chain()` or `chainc()`, you must either:

- Ensure that the module is in memory or in your current execution directory. (See `modlink()`, `modload()`, and `modloadp()`.)
- Provide a full pathlist to the module.

For OS-9, a threaded process may only chain from the `main()` thread and may not chain if multiple threads are active in the process.

`os9exec()` returns the value of `(*func)()`. This is the ID of the child process for `os9fork()`. `-1` is returned on error.

Any program that executes a C program must do so using the `os9exec()` interface. The `cstart` module can handle parameter strings passed by `os9fork()` and `chain()`, but no environment is available and the `argv` pointer list is separated by white space.

`os9exec()` is not automatically available if you are using ANSI or extended-ANSI modes. To use `os9exec()` in one of these modes, link with `sys_clib.l`.

`os9exec()`
: provides more precise control over the parameter strings and enables the environment variables to be easily inherited from the parent process. (Input)

`os9exec()`
: closely resembles the UNIX `execve()` system call.

`func`
: is a pointer to a function that creates a new process. (Input)

  This function is normally `chain()`, `chainc()`, `os9fork()`, or `os9forkc()`. `func` passes information to a new process as binary data specified by a pointer and size. It is up to the forked process to interpret the data.

`modname`
: is a pointer to a string naming the new primary module. (Input)

`argv`
: is a pointer to the parameter pointer list that the new process receives. (Input)

  By convention, `argv[0]` is the name of the new module and a null pointer marks the end of the `argv` list.

`envp`
: is a pointer to the environment pointer list that the new process receives. (Input)

  A null pointer marks the end of the `envp` list. You can set `envp` to point to the environment list of the current process to allow the child to inherit that environment.

`stacksize`
: specifies the additional memory (in bytes) to allocate to the new process' stack memory. (Input)

  A `stacksize` of zero indicates the default stack size the process requires.

`priority`
: is the priority at which the new process runs. (Input)

  If `priority` is zero, the new process receives the priority of the calling process.

`pathcnt`
: is the number of open paths to pass to the new process. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Example

The following code fragment is an example call to `os9exec()`.

The `argblk` array contains pointers to the parameters in the order that the new program is to receive them. The new process receives a copy of the parameters, not the addresses of the parameters.

This example passes the current environment by naming the global variable `_environ`.

```
extern int os9forkc();
extern char **_environ;

char *argblk[] = {
     "rename",
     "-x",
     "oldname",
     "newname",
     0,
};

main ()
{
    int pid;
    if ((pid = os9exec(os9forkc,argblk[0],argblk,
        _environ,0,0,3)) > 0) wait(0);
    else printf ("can't fork %s",argblk[0]);
}
```

Library

`sys_clib.l`

The primary purpose of the `sys_clib.l` library is to provide a library for compatibility with the Microware K&R C compiler. For additional information, refer to *Appendix A*.

See Also

`chainc()`, `chain()`

`modlink()`

`modload()`

`modloadp()`

`_os_exec()`

`os9fork()`, `os9forkc()`

_os_exit()

Terminate Calling Process

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_exit(status_code status);
```

Description

`_os_exit()` allows a process to terminate itself. Its data memory area is deallocated and its primary module is unlinked. All open paths are automatically closed.

`status`
: is the status code returned to the parent process. (Input)

  The parent must perform an `_os_wait()` or an `_os_exit()` before the process descriptor is returned to free memory.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_aproc()`
`_os_close()`
`_os_findpd()`
`_os_fork()`
`_os9_retpd()`
`_os_srtmem()`
`_os_unlink()`
`_os_wait()`

`F$Exit`	*OS-9 for 68K Technical Manual*
`F_EXIT`	*OS-9 Technical Manual*

_os_findpd()

Find Process Descriptor

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_findpd(
    process_id proc_id,
    pr_desc **proc_desc);
```

Description

`_os_findpd()` converts a process number to the absolute address of its process descriptor data structure.

`proc_id`
: specifies the process ID. (Input)

`proc_desc`
: is a pointer to the location where `_os_findpd()` stores the pointer to the process descriptor. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_alocproc()`

`_os_rtnprc()`

`F$FindPD`	*OS-9 for 68K Technical Manual*
`F_FINDPD`	*OS-9 Technical Manual*

_os9_findpd()

Find Fixed Block of Memory

Syntax

```
#include <process.h>
#include <types.h>
error_code _os9_findpd(
    u_int32 number,
    void **address,
    void *table);
```

Description

`_os9_findpd()` converts a table index to the absolute address of its data structure.

`number`
: is the number of the table element. Only the lower 16 bits of `number` are used. (Input)

`address`
: is a pointer to the location where `_os9_findpd()` stores the table entry pointer. (Output)

`table`
: is a pointer to the table to use. (Input)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os9_allpd()`

`_os9_retpd()`

`F$FindPD` *OS-9 for 68K Technical Manual*

_os_firq()

Add/Remove Device from Fast IRQ Table (System-State Only)

Syntax

```
#include <regs.h>
error_code _os_firq(
    u_int32 vector,
    u_int32 priority,
    void *irq_entry,
    void *statics);
```

Description

`_os_firq()` installs an IRQ service routine into or removes one from the system's fast IRQ system.

This fast IRQ system provides a faster interrupt response context than the normal IRQ vector polling scheme (provided through `_os9_irq()`).

- To place a routine into the fast IRQ system, set `irq_entry` to a non-zero value.
- To remove a routine from the fast IRQ system, set `irq_entry` to zero.

Only one `_os_firq()` routine can be active at a time per vector. An attempt to install a second routine on a vector using `_os_firq()` causes an `EOS_VCTBSY` error. If additional devices are required to be on the same vector as an `_os_firq()` device, use `_os9_irq()` to install them.

The interrupt stack provided is a small "default" IRQ stack. The service routine must ensure that this stack is not overflowed. The `init` module's "IRQ stack" value does not affect this stack; the `init` module value is used to control the `_os9_irq()` polling system stack.

`vector`
: specifies the vector number. (Input)

`priority`
: specifies the priority. (Input)

`priority`
: is reserved and must be zero.

`irq_entry`
: is a pointer to the IRQ service routine's entry point. (Input)

  If `irq_entry` is zero, the IRQ service routine is deleted.

`statics`
: is a pointer to the global static storage. (Input)

Attributes

Operating System:	OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_irq()`

`F$FIRQ` *OS-9 for 68K Technical Manual*

_os_fmod()

Find Module Directory Entry

Syntax

```
#include <module.h>
#include <types.h>
error_code _os_fmod(
    u_int32 *type_lang,
    mod_dir **moddir_entry,
    char *mod_name);
```

Description

`_os_fmod()` searches the module directory for a module whose name, type, and language match the parameters. If found, a pointer to the module directory entry is returned in `moddir_entry`.

`type_lang`
: specifies the type and language of the module. (Input)

  Only the lower 16 bits of `type_lang` are used.

`moddir_entry`
: is a pointer to the location where `_os_fmod()` stores the pointer to the module directory entry. (Output)

`mod_name`
: is a pointer to the module name. (Input)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_fork()

Create New Process

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_fork(
   u_int32 priority,
   u_int32 path_cnt,
   const char *mod_name,
   const void *params,
   u_int32 param_size,
   u_int32 mem_size,
   process_id *proc_id,
   u_int32 type_lang,
   u_int32 orphan);
```

Description

`_os_fork()` creates a new process which becomes a child of the caller. It sets up the new process' memory, MPU registers, and standard I/O paths.

If the `orphan` flag is non-zero, the new process executes without a parent. If the `orphan` flag is zero, the new process is the child of the calling process. On OS-9 for 68K if the `orphan` flag is set to a non-zero value, the `EOS_PARAM` error is returned.

`priority`
: specifies the priority of the new process. (Input)

  Only the lower 16 bits of `priority` are used. If `priority` is zero, the new process inherits the same priority as the calling process.

`path_cnt`
: specifies the number of I/O paths for the child to inherit. (Input)

  Only the lower 16 bits of `path_cnt` are used.

`mod_name`
: is the module name pointer. (Input)

`params`
: is a pointer to the parameter block. (Input)

`param_size`
: specifies the size of the parameter block. (Input)

`mem_size`
: specifies any additional stack space to allocate. (Input)

`proc_id`
: is a pointer to the location where `_os_fork()` stores the child process ID. (Output)

`type_lang`
: specifies the desired type and language. (Input)

  Only the lower 16 bits of `type_lang` are used. If `type_lang` is zero, any module may be loaded regardless of type and language.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_wait()`

`_os_exit()`

`_os_chain()`

`F$Fork`	*OS-9 Technical Manual*
`F_FORK`	*OS-9 Technical Manual*

os9fork(), os9forkc()

Create Process

Syntax

```
#include <process.h>
#include <types.h>

int os9fork(
    const char *modname,
    int parmsize,
    const char *parmptr,
    int type,
    int lang,
    int datasize,
    int prior);

int os9forkc(
    const char *modname,
    int parmsize,
    const char *parmptr,
    int type,
    int lang,
    int datasize,
    int prior,
    int pathcnt);
```

Description

`os9forkc()` creates a process that runs concurrently with the calling process. When the new process terminates, its exit status is available to the forking (parent) process. The new process inherits the standard paths (0, 1, and 2) plus any additional paths indicated by `pathcnt`.

If the fork is unsuccessful, `-1` is returned and the appropriate error code is placed in the global variable `errno`. If the fork is successful, the process ID number of the new process is returned.

`os9fork()` is the same as `os9forkc()` without a `pathcnt` parameter.

`_os_exec()` is the preferred method to fork C programs.

Beware of forking to a system module. It only makes sense to fork to a program of type object module. `os9fork()` is a historical function and is likely to be removed in a future release. Use `os9forkc()` instead.

`modname`
: is a pointer to a null-terminated module name. (Input)

`parmsize`
: specifies the size of the parameter list. (Input)

  Generally, you must set `parmsize` equal to `strlen(parmptr)+1`.

`parmptr`
: is a pointer to a null-terminated string to pass to the new process. (Input)

`type`
: specifies the type of module. (Input)

  If `type` is zero, any module may be forked, regardless of type.

`lang`
: specifies the module language. (Input)

  If `lang` is zero, any module may be forked, regardless of language.

`datasize`
: gives extra memory to the new program. (Input)

  If no extra memory is required, set `datasize` to zero.

`prior`
: is the new priority at which to run the program. (Input)

  Indicate zero if no priority change is desired.

`pathcnt`
: is the number of the parent's open paths for the new process to inherit. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

The purpose of `sys_clib.l` is to provide a library for compatibility with the Microware K&R C compiler. For more information, refer to *Appendix A*.

See Also

`_os_chain()`
`_os_exec()`
`_os_fork()`

`F$Chain`	*OS-9 for 68K Technical Manual*
`F$Fork`	*OS-9 for 68K Technical Manual*
`F_CHAIN`	*OS-9 Technical Manual*
`F_FORK`	*OS-9 Technical Manual*

_os_forkm()

Create New Process by Module Pointer

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_forkm(
   u_int32 priority,
   u_int32 path_cnt,
   mh_com *mod_head,
   void *params,
   u_int32 param_size,
   u_int32 mem_size,
   process_id *proc_id,
   u_int32 orphan);
```

Description

`_os_forkm()` creates a new process which becomes a child of the caller. It sets up the new process' memory, MPU registers, and standard I/O paths. The new process is forked by a module pointer. `_os_forkm()` assumes that the module pointer is the primary module pointer for the new process.

If the `orphan` flag is non-zero, the new process executes without a parent. If the `orphan` flag is zero, the new process is the child of the calling process. Only the lower 16 bits of `orphan` are used.

`priority`
: specifies the priority of the new process. (Input)

  Only the lower 16 bits of `priority` are used. If `priority` is zero, the new process inherits the same priority as the calling process.

`path_cnt`
: specifies the number of I/O paths for the child to inherit. (Input)

  Only the lower 16 bits of `path_cnt` are used.

`mod_head`
: is the module name pointer. (Input)

`params`
: is a pointer to the parameter block. (Input)

`param_size`
: specifies the size of the parameter block. (Input)

`mem_size`
specifies any additional stack space to allocate. (Input)

`proc_id`
is a pointer to the location where `_os_forkm()` stores the child process ID. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_fork()`

Syntax

```
#include <memory.h>
#include <types.h>
error_code _os_get_blkmap(
    void *start,
    void *buffer,
    u_int32 size,
    u_int32 *min_alloc,
    u_int32 *num_segs,
    u_int32 *tot_mem,
    u_int32 *free_mem);
```

Description

`_os_get_blkmap()` copies the address and size of the system's free RAM blocks into your buffer for inspection. It also returns information concerning the free RAM as noted by the parameters. A series of structures showing the address and size of free RAM blocks is returned in your buffer.

Although `_os_get_blkmap()` returns the address and size of the system's free memory blocks, you cannot assume that these blocks are free to use. Use `_os_srqmem()` to request free memory blocks.

`start`
: is a pointer to the address to begin reporting the segments. (Input)

`buffer`
: is a pointer to the buffer to use. (Input)

`size`
: specifies the buffer size in bytes. (Input)

`min_alloc`
: is a pointer to the location where `_os_get_blkmap()` stores the minimum memory allocation size for the system. (Output)

`num_segs`
: is a pointer to the location where `_os_get_blkmap()` stores the number of memory fragments in the system. (Output)

`tot_mem`
: is a pointer to the location where `_os_get_blkmap()` stores the total RAM found by the system at startup. (Output)

`free_mem`
: is a pointer to the location where `_os_get_blkmap()` stores the current total free RAM available. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_mem()`
`_os_srqmem()`

`F$GBlkMap()`	*OS-9 for 68K Technical Manual*
`F_GBLKMP`	*OS-9 Technical Manual*

_os_getdl()

Get System I/O Device List Head Pointer

Syntax

```
#include <io.h>

#include <types.h>

error_code _os_getdl(dev_list **dev_list_ptr);
```

Description

`_os_getdl()` returns a pointer to the first entry in the system's I/O device list.

This pointer should never be accessed directly in user state. You should use `_os_cpymem()` to get a copy of the device list entry.

`dev_list_ptr`
is a pointer to the location where `_os_getdl()` stores the pointer to the first entry in the device list. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_getime()

Get System Date/Time

Syntax

```
#include <time.h>
#include <types.h>
error_code _os_getime(
    time_t *time,
    u_int32 *ticks);
```

Description

`_os_getime()` returns the current system time in the number of seconds since a date specified in Greenwich Mean Time.

To determine the specified date, refer to the applicable manual, *OS-9 for 68K Technical Manual* or *OS-9 Technical Manual*.

On OS-9 for 68K, the binding for this call performs conversions which allow compatibility with OS-9. If speed is a consideration, see `_os9_getime()`.

`_os_getime()` returns a date and time of zero (with no error) if no previous call to `_os_setime()` has been made. A tick rate of zero indicates the clock is not running.

`time`
: is a pointer to the location where `_os_getime()` stores the current time. (Output)

`ticks`
: is a pointer to the location where `_os_getime()` stores the clock tick rate in ticks per second in the most significant word and the current tick in the least significant word. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_setime()`
`_os9_getime()`

`F$Time`	*OS-9 for 68K Technical Manual*
`F_TIME`	*OS-9 Technical Manual*

_os9_getime()

Get System Date/Time

Syntax

```
#include <time.h>
#include <types.h>
error_code _os9_getime(
    u_int32 format,
    u_int32 *time,
    u_int32 *date,
    u_int16 *day,
    u_int32 *ticks);
```

Description

`_os9_getime()` returns the current system date and time. In the normal (Gregorian) format, `time` is expressed as `00hhmmss` and `date` as `yyyymmdd`. The Julian format expresses `time` as seconds since midnight and `date` as the Julian day number.

The following figures illustrate values returned at the pointers.

Figure 2-7. Gregorian Formats

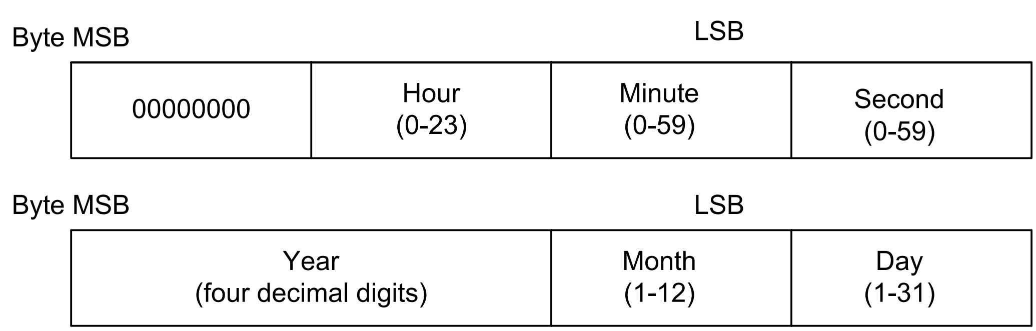
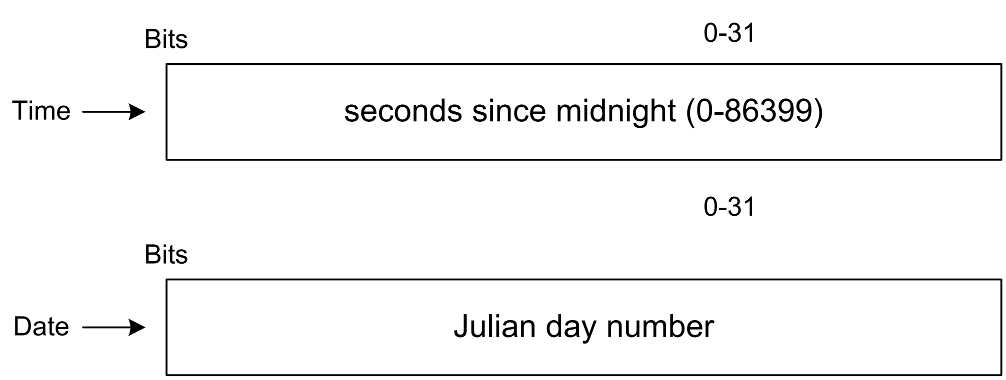


Figure 2-8. Julian Formats



`_os9_getime()` returns a date and time of zero (with no error) if no previous call to `_os9_setime()` is made after the system start-up. A tick rate of zero indicates the clock is not running.

`format`
: specifies the format of the returned date and time:. (Input)

Table 2-14. _os9_getime() Format Values

Format	Date and Time Returned
0	Gregorian format
1	Julian format
2	Gregorian format with ticks
3	Julian format with ticks

`time`
: is a pointer to the location where `_os9_getime()` stores the current system time. (Output)

`date`
: is a pointer to the location where `_os9_getime()` stores the current system date. (Output)

`day`
: is a pointer to the location where `_os9_getime()` stores the day of the week, where `0` is Sunday and `6` is Saturday. (Output)

`ticks`
: is a pointer to the location where `_os9_getime()` stores the clock tick data. (Output)

If `ticks` are requested, the clock tick rate in ticks per second is returned in the most significant word at the location pointed to by `ticks`. The least significant word contains the current tick.

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os9_setime()`	`_os_julian()`
`_os_getime()`	
`F$Time`	*OS-9 for 68K Technical Manual*

_os_get_ioproc()

Get Pointer to I/O Process Descriptor

Syntax

```
#include <io.h>
#include <types.h>
error_code _os_get_ioproc(
    process_id proc_id,
    io_proc **proc);
```

Description

`_os_get_ioproc()` returns a pointer to the I/O process descriptor for the specified process.

`proc_id`
: specifies the process ID of the process. (Input)

`proc`
: is a pointer to the location where `_os_get_ioproc()` stores the pointer to the I/O process descriptor. (Output)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_get_mdp()

Get Current and Alternate Module Directory Pathlists

Syntax

```
#include <moddir.h>
#include <types.h>
error_code _os_get_mdp(
    char *current,
    char *alternate);
```

Description

`_os_get_mdp()` returns pathlists to the current and alternate module directories.

`current` and `alternate` should point to buffers of at least 64 bytes to accommodate the directory names.

`current`
: is a pointer to the location where `_os_get_mdp()` stores the pathlist of the current module directory. (Output)

`alternate`
: is a pointer to the location where `_os_get_mdp()` stores the pathlist of the alternate module directory. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_get_moddir()

Get Copy of Module Directory

Syntax

For OS-9 for 68K:

```
#include <module.h>
#include <types.h>
error_code _os_get_moddir(
    void *buffer,
    u_int32 *count);
```

For OS-9:

```
#include <moddir.h>
#include <types.h>
error_code _os_get_moddir(
    void *buffer,
u_int32   *count);
```

Description

`_os_get_moddir()` copies the process' current module directory into your buffer for inspection.

Although the module directory contains pointers to each module in the system, never access the modules directly. Use `_os_cpymem()` to copy portions of the system's address space for inspection.

`buffer`
: is a pointer to the buffer. (Output)

For more information on the structure of the buffer (`mod_dir`) refer to the appropriate header file. (For OS-9 for 68K, the header file is `module.h`. For OS-9, the header file is `moddir.h`.)

`count`
: The maximum number of bytes to copy is passed at the location pointed to by `count`. (Input/Output)

`_os_get_moddir()` also stores the actual number of bytes copied at the location pointed to by `count`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_cpymem()`

`_os_move()`

_os_getpd()

Find Path Descriptor

Syntax

```
#include <io.h>
#include <types.h>
error_code _os_getpd(
    path_id path,
    pd_com **pd);
```

Description

`_os_getpd()` converts the path number to the absolute address of its path descriptor data structure.

`path`
: specifies the path number. (Input)

`pd`
: is a pointer to the location where `_os_getpd()` stores the address of the path descriptor. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os9_allpd()`

`_os9_retpd()`

_os_get_prdesc()

Get State Descriptor Copy

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_get_prdesc(
     process_id  procid,
     void        *buffer,
     u_int32     *count);
```

Description

`_os_get_prdesc()` copies a process' or thread's state descriptor into a buffer for inspection. The format of the returned data is a `pr_desc` structure.

The preprocessor macro `_USE_V3_0_PROCDESC` must be defined to correctly use this function.

`procid`
: is the requested process or thread ID. (Input)

`buffer`
: is a pointer to the buffer to use. (Output)

`count`
: The maximum number of bytes to copy is passed at the location pointed to by `count`. (Input/Output)

  `_os_get_prdesc()` also stores the actual number of bytes copied at the location pointed to by `count`.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_get_prsrc()`

`_os_gprdsc()`

_os_get_prsrc()

Get Resource Descriptor Copy

Syntax

```
#include <process.h>
#include <types.h>
error_code  _os_get_prsrc(
                  process_id  procid,
                  void        *buffer,
                  u_int32     *count);
```

Description

`_os_get_prsrc()` copies a process' resource descriptor into a buffer for inspection. All the threads within a process share the same resource descriptor. The format of the returned data is a `pr_src` structure.

The preprocessor macro `_USE_V3_0_PROCDESC` must be defined to correctly use this function.

`procid`
: is the requested process or thread ID. (Input)

`buffer`
: is a pointer to the buffer to use. (Output)

`count`
: The maximum number of bytes to copy is passed at the location pointed to by `count`. (Input/Output)

  `_os_get_prsrc()` also stores the actual number of bytes copied at the location pointed to by `count`.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_get_prdesc()`

`_os_gprdsc()`

_os_get_prtbl()

Get Copy of Process Descriptor Block Table

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_get_prtbl(
    void *buffer,
    u_int32 *count);
```

Description

`_os_get_prtbl()` copies the process descriptor block table into the caller's buffer for inspection.

Although `_os_get_prtbl()` returns pointers to all process descriptors, never access the process descriptors directly. Instead, use `_os_gprdsc()` to inspect specific process descriptors.

`buffer`
: is a pointer to the buffer. (Output)

`count`
: The maximum number of bytes to copy is passed at the location pointed to by `count`. (Input/Output)

  `_os_get_prtbl()` also stores the actual number of bytes copied at the location pointed to by `count`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_alocproc()`

`_os_gprdsc()`

_os_getstat()

Get File/Device Status

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_getstat(
    path_id path,
    u_int32 code,
    void *pb);
```

Description

`_os_getstat()` is a wildcard call used to handle individual device parameters that are not uniform on all devices or are highly hardware dependent.

The exact operation of this call depends on the device driver and file manager associated with the path.

The mnemonics for the status codes are located in the `sg_codes.h` header file.

The status codes that are currently defined by Microware and the functions that they perform are described in this manual. The functions have an `_os_gs_ prefix`.

This function is available within OS-9 for 68K, where it resides in the conv_lib.l library. However, it can be used only with DPIO file managers and drivers, such as SoftStax.

`path`
: is the path number. (Input)

`code`
: is the `GetStat` code. (Input)

`pb`
: is a pointer to the parameter block. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_getsys()

Examine System Global Variable

Syntax

```
#include <sysglob.h>
#include <types.h>
error_code _os_getsys(
    u_int32 offset,
    u_int32 size,
    glob_buff *sysvar);
```

Description

`_os_getsys()` enables a process to examine a system global variable. These variables have a `d_` prefix in the system header file `sysglob.h`. Consult the files in the `DEFS` directory for a description of the system global variables.

`offset`
: is the variable's offset in the system globals. (Input)

`size`
: specifies the size of the variable (1, 2, or 4 bytes). (Input)

`sysvar`
: is a pointer to the location where `_os_getsys()` stores the value of the requested system global. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

Example

This example gets the current value of the tick counter:

```
#include <stdio.h>
#include <sysglob.h>

main() {
  Sysglobs sg;
  glob_buff buffer;
  error_code err;

  if ((err = _os_getsys(OFFSET(Sysglobs, d_ticks), sizeof(sg->d_ticks),
&buffer)) != 0)
    printf("Failed to get the current value of the tick counter
(d_ticks)\n");
  else
    printf("Current value of the tick counter (d_ticks) = %d\n",
buffer.lng);

  exit(err);
}
```

See Also

_os_setsys()

_os_gprdsc()

Get Process Descriptor Copy

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_gprdsc(
    process_id procid,
    void *buffer,
    u_int32 *count);
```

Description

`_os_gprdsc()` copies a process descriptor into a buffer for inspection.

`procid`
: is the requested process ID. (Input)

`buffer`
: is a pointer to the buffer to use. (Output)

`count`
: The maximum number of bytes to copy is passed at the location pointed to by `count`. (Input/Output)

  `_os_gprdsc()` also stores the actual number of bytes copied at the location pointed to by `count`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_get_prtbl()`

_os_gregorian()

Get Gregorian Date

Syntax

```
#include <time.h>
#include <types.h>
error_code _os_gregorian(
    u_int32 *time,
    u_int32 *date);
```

Description

`_os_gregorian()` converts Julian dates to Gregorian dates. Gregorian dates are considered the normal calendar dates.

`time`
: is a pointer to the location where the time in seconds since midnight. (Input/Output)

  `_os_gregorian()` stores the time in the form `00hhmmss` in the location pointed to by `time`.

`date`
: is a pointer to the location where the Julian date is passed. (Input/Output)

  `_os_gregorian()` stores the date in the form `yyyymmdd` in the location pointed to by `date`. Refer to your operating system technical manual for more information.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_julian()`

`_os_getime()`

_os9_gs_cdfd()

Return File Descriptor

Syntax

```
#include <cdi.h>
#include <types.h>
error_code _os9_gs_cdfd(
    path_id path,
    u_int32 count,
    void *fdbuf);
```

Description

`_os9_gs_cdfd()` reads the file descriptor describing the path number. The file descriptor may be read for informational purposes only, as there are no user-changeable parameters.

`path`
: specifies the path number. (Input)

`count`
: is the number of bytes to copy. (Input)

  Only the lower 16 bits of `count` are used.

`fdbuf`
: is a pointer to the buffer area for the file descriptor. (Output)

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_gs_cpypd()

Copy Contents of Path Descriptor

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_gs_cpypd(
    path_id path,
    u_int32 *size,
    void *path_desc);
```

Description

`_os_gs_cpypd()` copies the contents of the specified path's path descriptor to your buffer.

If the `size` value is greater than the size of the target path descriptor, the actual size of the path descriptor is returned.

`path`
: is the path number. (Input)

`size`
: The number of bytes to copy from the path descriptor is passed at the location pointed to by `size`. (Input/Output)

  `_os_gs_cpypd()` also stores the actual number of bytes copied at the location pointed to by `size`.

`path_desc`
: is a pointer to the buffer for the path descriptor data. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_gs_cstats()

Get Cache Status Information

Syntax

```
#include <rbf.h>
#include <types.h>
error_code _os_gs_cstats(
    path_id path,
    cachestats *cache_inf);
```

Description

`_os_gs_cstats()` returns a copy of the current `cachestats` structure.

`path`
: specifies the number of a path open on the device. (Input)

`cache_inf`
: is a pointer to the location where `_os_gs_cstats()` stores the structure containing information about RBF caching. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_gs_devnm()

Return Device Name

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_gs_devnm(
    path_id path,
    char *name);
```

Description

`_os_gs_devnm()` returns the name of the device associated with the specified path.

Some networked devices using NFM may require a buffer size of 128 or 256 bytes for the device name.

On OS-9, the buffer pointed to by `name` should be at least 64 bytes to accommodate a device name. On OS-9 for 68K, the buffer pointed to by `name` is a fixed 32 bytes.

`path`
: specifies the path number. (Input)

`name`
: is a pointer to the location where `_os_gs_devnm()` stores the device name. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_gs_devtyp()

Return Device Type

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_gs_devtyp(
    path_id path,
    u_int16 *type,
    u_int16 *class);
```

Description

`_os_gs_devtyp()` returns the type and class of the device associated with the specified path number.

`path`
: specifies the path number. (Input)

`type`
: is a pointer to the location where `_os_gs_devtyp()` stores the device type. (Output)

`class`
: is a pointer to the location where `_os_gs_devtyp()` stores the device class. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_gs_diskfree()

Return Information About RBF Disk Free Space

Syntax

```
error_code _os_gs_diskfree(path_id  path,
                           u_int32  *totblocks,
                           u_int32  *blksize,
                           u_int32  *avail,
                           u_int32  *contig);
```

Description

`_os_gs_diskfree()` returns information about RBF disk free space.

`path`
: specifies the drive's path number. (Input)

`totblocks`
: is set to the total number of blocks on the disk. (Output)

`blksize`
: is set to the size of blocks used on the disk (256, 512, etc.) (Output)

`avail`
: is set to the total number of free blocks on the disk. (Output)

`contig`
: is set to the number of blocks in the largest contiguous area. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_gs_dopt()

Read Device Path Options

Syntax

```
#include <sg_codes.h>

#include <types.h>

error_code _os_gs_dopt(
    path_id path,
    u_int32 *size,
    void *dopts);
```

Description

`_os_gs_dopt()` copies the initial (default) device path options into your buffer. These options are used for initializing new paths to the device.

`path`
: specifies the path number. (Input)

`size`
: The size of the buffer is passed at the location pointed to by `size`. (Input/Output)

  `_os_gs_dopt()` also stores the actual number of bytes copied at the location pointed to by `size`.

`dopts`
: is a pointer to a buffer for the device path options. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_gs_dsize()
Get Number of Blocks on Media

Syntax

```
#include <rbf.h>
#include <types.h>
error_code _os_gs_dsize(
    path_id path,
    u_int32 *totblocks,
    u_int32 *blocksize);
```

Description

`_os_gs_dsize()` gets information about the number of blocks on the media.

`path`
: specifies the drive's path number. (Input)

`totblocks`
: is a pointer to the location where `_os_gs_dsize()` stores the total number of blocks on the device. (Output)

`blocksize`
: is a pointer to the location where `_os_gs_dsize()` stores the size of a disk block in bytes. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_gs_edt()

Get I/O Interface Edition Number

Syntax

```
#include <ioedt.h>
#include <types.h>
error_code _os_gs_edt(
    path_id path,
    u_int32 *edition);
```

Description

`_os_gs_edt()` returns the I/O interface edition number of the driver and validates the compatibility of drivers and file managers.

`path`
: specifies the driver's path number. (Input)

`edition`
: is a pointer to the location where `_os_gs_edt()` stores the driver I/O interface edition number. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_gs_eof()
Test for End of File

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_gs_eof(path_id path);
```

Description

`_os_gs_eof()` returns the `EOS_EOF` error if the current position of the file pointer associated with the specified path is at the end-of-file. SCF never returns `EOS_EOF` with this `GetStat`.

`path`
: specifies the driver's path number. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_gs_fd()
Read File Descriptor Sector

Syntax

```
#include <rbf.h>
#include <types.h>
error_code _os_gs_fd(
    path_id path,
    u_int32 size,
    fd_stats *fdbuf);
```

Description

`_os_gs_fd()` returns a copy of the file descriptor sector for the file associated with the specified path.

`path`
: specifies the driver's path number. (Input)

`size`
: is the number of bytes of the file descriptor to copy. (Input)

`fdbuf`
: is a pointer to the buffer for the file descriptor sector. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_gs_fdaddr()

Get File Descriptor Block Address for Open File

Syntax

```
#include <rbf.h>
#include <types.h>
error_code _os_gs_fdaddr(
    path_id path,
    u_int32 *addr);
```

Description

`_os_gs_fdaddr()` returns the file descriptor block number associated with the specified path number.

`path`
: specifies the driver's path number. (Input)

`addr`
: is a pointer to the location where `_os_gs_fdaddr()` stores the block address of the file descriptor. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_gs_fdinf()

Get Specified File Descriptor Sector

Syntax

```
#include <rbf.h>
#include <types.h>
error_code _os_gs_fdinf(
    path_id path,
    u_int32 size,
    u_int32 fdblk,
    fd_stats *fdbuf);
```

Description

`_os_gs_fdinf()` returns a copy of the specified file descriptor sector for the file associated with the specified file descriptor sector.

Typically, `_os_gs_fdinf()` is used to rapidly scan a directory on a device. You do not need to specify the path number of the file for which you want the file descriptor in `path`. However, `path` must be an open path on the same device as the file. `path` is typically the path number of the directory you are currently scanning.

Only super users may use this call.

`path`
: specifies an open path on a particular device. (Input)

`size`
: specifies the number of bytes of the file descriptor block to copy. (Input)

`fdblk`
: specifies the file descriptor sector number to get. (Input)

`fdbuf`
: is a pointer to the buffer for the file descriptor block. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os9_gs_free()

Return Amount of Free Space on Device

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os9_gs_free(
    path_id path,
    u_int32 *free);
```

Description

`_os9_gs_free()` returns the amount of free space on a device.

`_os9_gs_free()` is only supported by the NRF file manager.

`path`

specifies the path number of the device. (Input)

`free`

is a pointer to the location where `_os9_gs_free()` stores the amount of free space. (Output)

The amount of free space is specified in bytes.

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_gs_luopt()

Read Logical Unit Options

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_gs_luopt(
    path_id path,
    u_int32 *size,
    void *luopts);
```

Description

`_os_gs_luopt()` copies the contents of the logical unit options for a path into the buffer pointed to by `luopts`.

`path`
: specifies the driver's path number. (Input)

`size`
: The size of the buffer is passed at the location pointed to by `size`. (Input/Output)

  `_os_gs_luopt()` also stores the actual number of bytes copied at the location pointed to by `size`. `size` may not be less than the size of the file manager's logical unit option section.

`luopts`
: is a pointer to your buffer. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_gs_parity()
Calculate Parity of File Descriptor

Syntax

```
#include <rbf.h>
#include <types.h>
error_code _os_gs_parity(
    path_id path,
    fd_stats *fdbuf,
    u_int32 *parity);
```

Description

`_os_gs_parity()` uses a 32-bit vertical parity to validate file descriptor structures.

`path`
: specifies an open path to the file with which the file descriptor is associated. (Input)

`fdbuf`
: is a pointer to the file descriptor block. (Input)

`parity`
: is a pointer to the location where `_os_gs_parity()` stores the resulting parity. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_gs_popt()

Read Path Descriptor Option Section

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_gs_popt(
    path_id path,
    u_int32 *size,
    void *user_opts);
```

Description

`_os_gs_popt()` copies the option section of the path descriptor into the variable-sized area pointed to by `user_opts`. You must include `rbf.h`, `sbf.h`, and/or `scf.h` for the corresponding file managers and declare `size` according to the size of the `rbf_opts`, `sbf_opts`, or `scf_opts`.

On OS-9 for 68K, 128 bytes are always allocated by the binding, although only the specified number of bytes are passed back to you.

`path`
: specifies the driver's path number. (Input)

`size`
: The requested number of bytes is passed at the location pointed to by `size`. (Input/Output)

  `_os_gs_popt()` also stores the actual number of bytes copied at the location pointed to by `size`.

`user_opts`
: is a pointer to your buffer. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_gs_pos()

Get Current File Position

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_gs_pos(
    path_id path,
    u_int32 *position);
```

Description

`_os_gs_pos()` returns the current position of the file pointer associated with the specified path.

`path`
: specifies the driver's path number. (Input)

`position`
: is a pointer to the location where `_os_gs_pos()` stores the file position. (Output)

- If the device is opened in block mode (`S_IBLKMODE`), the `position` parameter returns position in terms of blocks.
- If the device is opened in non-block mode (`S_IBLKMODE`), the `position` parameter to `_os_gs_pos()` returns in terms of bytes.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os9_gspump()

Return Data for Specified Process' Memory Map

Syntax

```
#include <process.h>
#include <types.h>
error_code _os9_gspump(
    process_id proc_id,
    u_int32 size,
    void *buffer);
```

Description

`_os9_gspump()` returns data about a specified process' memory map for debugging purposes. One word in this format is returned for each memory block in the system. This information is taken from the process' SSM data structure. If the specified address space is not large enough, only the information that fits in the area is returned.

`proc_id`
: specifies the process ID. (Input)

`size`
: specifies the size of the buffer. (Input)

`buffer`
: is a pointer to the storage buffer. (Output)

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$GSPUMp`	*OS-9 for 68K Technical Manual*

_os_gs_ready()

Test for Data Ready

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_gs_ready(
    path_id path,
    u_int32 *incount);
```

Description

`_os_gs_ready()` checks for data available to be read on the specified path. RBF devices do not return the `EOS_NOTRDY` error because there is always information available to be read on RBF devices. `_os_gs_ready()` returns the number of bytes left in `incount`.

If the device is opened in block mode (`S_IBLKMODE`), `_os_gs_ready` returns the number of blocks available.

`path`
: specifies the driver's path number. (Input)

`incount`
: is a pointer to the location where `_os_gs_ready()` stores the number of characters available to be read. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_gs_size()

Return Current File Size

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_gs_size(
    path_id path,
    u_int32 *size);
```

Description

`_os_gs_size()` returns the current size of the file associated with the specified path.

`path`
: specifies the driver's path number. (Input)

`size`
: is a pointer to the location where `_os_gs_size()` stores the file size. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_id()

Get Process ID / User ID

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_id(
    process_id *proc_id,
    u_int16 *priority,
    u_int16 *age,
    int32 *schedule,
    u_int16 *group,
    u_int16 *user);
```

Description

`_os_id()` returns the caller's process ID number, current process priority and age, scheduling constant, and owner ID.

On OS-9 for 68K, the binding for this call, performs conversions which allow compatibility with OS-9. If speed is a consideration, refer to `_os9_id()`.

`proc_id`
: is a pointer to the location where `_os_id()` stores the current process ID number. (Output)

`priority`
: is a pointer to the location where `_os_id()` stores the priority of the current process. (Output)

`age`
: is a pointer to the location where `_os_id()` stores the age of the current process. (Output)

`schedule`
: is a pointer to the location where `_os_id()` stores the scheduling constant of the current process. (Output)

`group`
: is a pointer to the location where `_os_id()` stores the group number of the current process. (Output)

`user`
: is a pointer to the location where `_os_id()` stores the user number of the current process. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	**OS-9:** user and system **OS-9 for 68K:** user
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os9_id()`

_os9_id()

Get Process ID / User ID

Syntax

```
#include <process.h>
#include <types.h>
error_code _os9_id(
    process_id *proc_id,
    u_int16 *priority,
    u_int16 *group,
    u_int16 *user);
```

Description

`_os9_id()` returns the caller's process ID number, group and user ID, and current process priority.

`proc_id`
: points to the location where `_os9_id()` stores the process ID. (Output)

`priority`
: is a pointer to the location where `_os9_id()` stores the current process priority. (Output)

`group`
: points to the location where `_os9_id()` stores the group ID. (Output)

`user`
: points to location where `_os9_id()` stores the user ID. (Output)

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_initdata()

Initialize Static Storage from Module

Syntax

```
#include <module.h>
#include <types.h>
error_code _os_initdata(
    mh_com *mod_head,
    void *statics);
```

Description

`_os_initdata()` clears the uninitialized data area, copies the module header's initialized data to the specified data area, and clears the remote data area (if it exists). It then adjusts the code and data offsets.

`mod_head`
: is a pointer to the module header. (Input)

`statics`
: is a pointer to the data area. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_intercept()

Set Up Signal Intercept Trap

Syntax

```
#include <signal.h>
#include <types.h>
#include <cglob.h>
error_code _os_intercept(
    void (*func)(),
    void *data_ptr);
```

Description

`_os_intercept()` installs a signal intercept routine. The intercept routine is entered asynchronously because a signal may be sent at any time, similar to an interrupt. The signal code is passed as a parameter to the intercept routine.

`_os_rte()` must be used to exit from the intercept routine (`func`). If the routine fails to use `_os_rte()` at every possible exit, unpredictable results occur.

The intercept routine should be short and fast, such as setting a flag in the process' data area. Avoid complicated system calls (such as I/O). Signal handlers should be careful about the following:

- Calling any function in the library that may be working with static storage structures.
- Calling any function that is not re-entrant.
- Modifying any static storage structure other than a variable of type `volatile sig_atomic_t`

In OS-9 for 68K, `data_ptr` must be `_glob_data` to provide compatibility between OS-9 for 68K and OS-9. Also, each time the intercept routine is called, the state of the processor (such as its registers) is pushed on to the user stack.

`signal()`, `intercept()`, and the POSIX threading library use `_os_intercept()` internally; do not use `_os_intercept()` in combination with any of these.

Only the global data pointer is set up for the signal handler, the proper constant pointer, if applicable, is not automatically set up. `intercept()` and `signal()` properly initialize both the data and constant pointers before calling the signal handling function.

`func`
: is a pointer to the intercept routine's address. (Input)

`data_ptr`
: is a pointer to the intercept routine's global storage. (Input)

  It usually contains the address of the program's data area.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`intercept()`
`_os_rte()`
`_os_send()`
`signal()`

`F$Icpt`	*OS-9 for 68K Technical Manual*
`F_ICPT`	*OS-9 Technical Manual*

_os_ioconfig()

Configure an Element of Process/System I/O

Syntax

```
#include <modes.h>

error_code _os_ioconfig(
    u_int32 code,
    void *param);
```

Description

`_os_ioconfig()` is a wildcard call used to configure elements of the I/O subsystem which may or may not be associated with an existing path. It is intended to be used to dynamically reconfigure system I/O resources at runtime. The target I/O resources may be system-wide resources or they may be process- or path-specific, depending on the nature of the configuration call being made.

`code`
: is the IO configuration command code. (Input)

Refer to the *OS-9 Technical Manual* for a list of valid command codes for your version of the operating system.

`param`
: is a pointer to any additional parameters required by the specified configuration function. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

See Also

`_os_config()`

_os_iodel()

Check for Use of I/O Module

Syntax

```
#include <module.h>
#include <types.h>
error_code _os_iodel(mh_com *mod_head);
```

Description

`_os_iodel()` is executed when the kernel unlinks a file manager, device driver, or device descriptor module. It is used to determine if the I/O system is still using the module.

`mod_head`
: is a pointer to the module header. (Input)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ioexit()

Terminate I/O for Exiting Process

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_ioexit(
   process_id proc_id,
   u_int32 path_cnt);
```

Description

`_os_ioexit()` is executed when the kernel terminates or chains to a process.

If the most significant bit of `path_cnt` is cleared, the process' default data and execution directory paths and all other open paths in the path translation table are closed. The I/O process descriptor is also deallocated.

If the most significant bit of `path_cnt` is set, the remaining bits specify the number of paths to leave open. The default directory paths are not closed, and the I/O process descriptor is not de-allocated.

`proc_id`
: specifies the process ID. (Input)

`path_cnt`
: specifies the number of I/O paths. (Input)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_iofork()

Set Up I/O for New Process

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_iofork(
    process_id par_proc_id,
    process_id new_proc_id,
    u_int32 path_cnt);
```

Description

`_os_iofork()` is executed when the kernel creates a new process. `_os_iofork()` creates an I/O process descriptor for the new process.

`par_proc_id`
: is the parent's process ID. (Input)

`new_proc_id`
: is the process ID of the new process. (Input)

`path_cnt`
: is the number of I/O paths. (Input)

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os9_ioqueue()

Enter I/O Queue

Syntax

```
#include <process.h>
#include <types.h>
error_code _os9_ioqueue(process_id proc_id);
```

Description

`_os9_ioqueue()` links the calling process into the I/O queue and performs an untimed sleep.

`proc_id`
: specifies the process ID of the process currently in control of the device. (Input)

Attributes

Operating System:	OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_findpd()`
`_os_send()`
`_os_sleep()`
`_os9_sleep()`
`F$IOQu` *OS-9 for 68K Technical Manual*

_os_irq()

Add or Remove Device from IRQ Table

Syntax

```
#include <regs.h>
#include <types.h>
error_code _os_irq(
    u_int32 vector,
    u_int32 priority,
    const void *irq_entry,
    void *statics);
```

Description

`_os_irq()` installs an IRQ service routine into the system polling table.

The called `irq` function must not be compiled with `stackcheck` because the stack is out of range at this time.

`vector`
: specifies the vector number. (Input)

  Only the lower 16 bits of `vector` are used.

`priority`
: specifies the priority. (Input)

  Only the lower 16 bits of `priority` are used.

  - If `priority` is 0, the routine is polled first on the vector.
  - If `priority` is 1, the routine is polled first and no other device can have a priority of 1 on the vector.
  - If `priority` is 255, the routine is polled last on the vector.

`irq_entry`
: is a pointer to the IRQ service routine entry point. (Input)

  If `irq_entry` is 0, the call deletes the IRQ service routine.

`statics`
: is a pointer to the global static storage. `statics` must be unique to the device. (Input)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F_IRQ` *OS-9 Technical Manual*

_os9_irq()

Add or Remove Device from IRQ Table

Syntax

```
#include <regs.h>
#include <types.h>
error_code _os9_irq(
    u_int32 vector,
    u_int32 priority,
    const void *irq_entry,
    const void *statics,
    const void *port);
```

Description

`_os9_irq()` installs an IRQ service routine into the system polling table.

`vector`
: specifies the vector number. (Input)

  Only the lower 16 bits of `vector` are used.

`priority`
: specifies the priority. (Input)

  Only the lower 16 bits of `priority` are used.

  - If `priority` is `0`, the routine is polled first on the vector.
  - If `priority` is `255`, the routine is polled last on the vector.

`irq_entry`
: is a pointer to the IRQ service routine entry point. (Input)

  If `irq_entry` is `0`, the call deletes the IRQ service routine.

`statics`
: is a pointer to the global static storage. (Input)

`statics`
: must be unique to the device.

`port`
: is the port address. (Input)

Attributes

Operating System:	OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$IRQ` *OS-9 for 68K Technical Manual*

_os_julian()

Get Julian Date

Syntax

```
#include <time.h>
#include <types.h>
error_code _os_julian(
   u_int32 *time,
   u_int32 *date);
```

Description

`_os_julian()` converts Gregorian dates to Julian dates.

`time`
: is a pointer to the location where the time in the form `00hhmmss` is passed. (Input/Output)

`_os_julian()`
: stores the time in seconds since midnight in the location pointed to by `time`.

`date`
: is a pointer to the location where the date in the form `yyyymmdd` is passed. (Input/Output)

`_os_julian()`
: stores the Julian date in the location pointed to by date.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

os9kexec()

OS-9 Create Process

Syntax

```
#include <process.h>
#include <types.h>
int os9kexec(
   u_int32 (*func)(),
   u_int16 priority,
   u_int16 pathcnt,
   const char *modname,
   char **argv,
   char **envp,
   u_int32 datasize,
   void *extra1,
   void *extra2,
   void *extra3,
   void *extra4);
```

Description

`os9kexec()` is a high-level fork/chain interface that prepares the parameter and environment list before a process is created.

`os9kexec()` closely resembles the UNIX `execve()` system call.

`func`
: is a pointer to one of the following functions that create a new process: `_os_fork()`, `_os_forkm()`, `_os_chain()`, `_os_chainm()`, `_os_dfork()`, and `_os_dforkm()`. (Input)

`func`
: passes information to a new process as binary data specified by a pointer and size. It is up to the forked process to interpret the data.

`priority`
: is the priority at which the new process is to run. (Input)

  If `priority` is zero, the new process receives the priority of the calling process.

`pathcnt`
: is the number of open paths to pass to the new process. (Input)

  Normally, `pathcnt` is `3`, causing the 3 standard paths to be passed. A `pathcnt` of zero passes no open paths.

`modname`
: is a pointer to a string naming the new primary module or to a module in the case of the functions ending in `m` (`_os_forkm()`, `_os_chainm()`, and `_os_dforkm()`). (Input)

`argv`
: is a pointer to the parameter pointer list that the new process receives. (Input)

By convention, `argv[0]` is the name of the new module. A null pointer marks the end of the `argv` list.

`envp`
: is a pointer to the environment pointer list that the new process receives. (Input)

It points to environment variables. A null pointer marks the end of the `envp` list.

`datasize`
: specifies the additional memory (in bytes) to allocate to the new process' stack memory.(Input)

If `datasize` is zero, the default stack size required by the process is used.

The first seven parameters are identical for `_os_fork()`, `_os_forkm()`, `_os_chain()`, `_os_chainm()`, `_os_dfork()`, and `_os_dforkm()`.

The remaining four parameters have different meanings, depending on the function specified by `func`:

Table 2-15. os9kexec() Additional Parameters

Function	Parameter	Definition
`_os_fork()`	`extra1` `(Intput/Output)`	The child process ID returns to where `extra1` points
	`extra2` `(Input)`	Type/language of the new process
	`extra3` `(Input)`	Orphan: `0` = Normal child process `1` = Process not associated with parent
`_os_forkm()`	`extra1` `(Intput/Output)`	The child process ID returns to where `extra1` points
	`extra2` `(Input)`	Orphan: `0` = Normal child process `1` = Process not associated with parent
`_os_chain()`	`extra1` `(Intput/Output)`	Type/language of the new process
`_os_chainm()`		Does not use the extra parameters

Table 2-15. os9kexec() Additional Parameters (Continued)

Function	Parameter	Definition
`_os_dfork()`	`extra1` (`Intput/Output`)	The child process ID returns to where `extra1` points
	`extra2` (`Input`)	Type/language of the new process
	`extra3` (`Input`)	Pointer to register stack for child process
	`extra4` (`Input`)	Pointer to floating point register stack for child process
`_os_dforkm()`	`extra1` (`Intput/Output`)	The child process ID returns to where `extra1` points
	`extra2` (`Input`)	Pointer to register stack for child process
	`extra3` (`Input`)	Pointer to floating point register stack for child process

If `func` indicates a fork function and the initial attempt to create the child process fails due to `EOS_PNNF` (path name not found), `os9kexec()` calls `modloadp()` with `modname` to load the module from disk and attempts the fork again. This action is the same as the shell handling of executable files.

If you use `os9kexec()` when `func` is `_os_chain()` or `_os_chainc()`, you must either:

- Ensure that the module is in memory or in your current execution directory (see `modlink()`, `modload()`, and `modloadp()`).
- Provide a full pathlist to the module.

A threaded process may only chain from the `main()` thread and may not chain if multiple threads are active in the process.

`os9kexec()` returns the value of `(*func)()`, which returns `0` if successful; otherwise, it returns an error number.

Any program that executes a C program should do so using the `os9kexec()` interface. The `cstart` module can handle parameter strings passed by `os9fork()` and `chain()`, but no environment is available and the `argv` pointer list is separated by white space.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

The purpose of `sys_clib.l` is to provide a library for compatibility with the Microware K&R C compiler. For more information, refer to *Appendix A, Prototyping sys_clib.l Functions*.

See Also

`_os_exec()`	`_os_fork()`	`_os_forkm()_os_chain()`
`_os_chainm()`	`_os_dfork()`	`_os_dforkm()`

Example

```
#include <module.h>
#include <types.h>
#include <const.h>
extern  int    _os_fork();
extern  char   **_environ;

char    * argblk[] = {
        "rename",
        "oldname",
        "newname",
        "-x",
        0,
}

main()
{
  u_int16  type_lang = mktypelang (MT_PROGRAM,ML_OBJECT);
  process_id   pid;

  If ((errno = os9kexec (_os_fork,
     0,             * no change in priority
     3,             * pass stdin, stdout, and stderr
     angblk[0],     * pointer to module name
     argblk,        * the argument list
     _environ,      * environment list for new process
     0,             * no extra memory
     &pid           * pointer to the process ID
     type_lang,
     0))            * normal child process
     != SUCCESS)
  printf ("can't fork %s\n", argblk[0]);
  else
     wait(0)
}
```

_os_link()
Link to Memory Module

Syntax

```
#include <module.h>
#include <types.h>
error_code _os_link(
    char **mod_name,
    mh_com **mod_head,
    void **mod_exec,
    u_int16 *type_lang,
    u_int16 *attr_rev);
```

Description

`_os_link()` searches the current module directory (and an alternate module directory in OS-9) for a module whose name, type, and language match the parameters.

The module name is passed at the location pointed to by `mod_name`. On OS-9, if `mod_name` is an explicit module directory pathlist (for example, `/usr/pers1/prog`), `_os_link()` also stores the pointer to the module that was successfully linked (for example, `prog`) at the location pointed to by `mod_name` (input/output).

`mod_head`
: is a pointer to the location where `_os_link()` stores the address of the module's header. (Output)

`mod_exec`
: is a pointer to the location where `_os_link()` stores the absolute address of the module's execution entry point. (Output)

`type_lang`
: The type and language of the module are passed at the location pointed to by `type_lang`. (Input/Output)

  `_os_link()` also stores the actual type and language at the location pointed to by `type_lang`. If `type_lang` is zero (specifying any), any module can be linked to regardless of the type and language.

`attr_rev`
: is a pointer to the location where `_os_link()` stores the attribute and revision level of the module. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_load()`
`_os_unlink()`
`_os_unload()`

`F$Link`	*OS-9 for 68K Technical Manual*
`F_LINK`	*OS-9 Technical Manual*

_os_linkm()

Link to Memory Module by Module Pointer

Syntax

```
#include <module.h>
#include <types.h>
error_code _os_linkm(
    mh_com *mod_head,
    void **mod_exec,
    u_int16 *type_lang,
    u_int16 *attr_rev);
```

Description

`_os_linkm()` causes OS-9 to link to the module specified by `mod_head`.

`mod_head`
: is a pointer to the module. (Input)

`mod_exec`
: is a pointer to the location where `_os_linkm()` stores the absolute address of the module's execution entry point. (Output)

`type_lang`
: is a pointer to where `_os_linkm()` stores the type and language of the module. (Output)

`attr_rev`
: is a pointer to the location where `_os_linkm()` stores the attribute and revision level of the module. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_load()`

`_os_unlink()`

`_os_unload()`

_os_load()

Load Module(s) from File

Syntax

```
#include <module.h>
#include <modes.h>
#include <memory.h>
#include <types.h>
error_code _os_load(
    const char *mod_name,
    mh_com **mod_head,
    void **mod_exec,
    u_int32 mode,
    u_int16 *type_lang,
    u_int16 *attr_rev,
    u_int32 color);
```

Description

`_os_load()` opens a file specified by the pathlist. It reads one or more memory modules from the file into memory until an error or end of file is reached. Then, it closes the file. Modules are loaded into the highest physical memory available of the specified `color` type.

When a module is loaded, its name is added to the system module directory, and the first module read is linked. The returned parameters are the same as those returned by a link call and apply only to the first module loaded.

`_os_load()` does not work on SCF devices.

`mod_name`
: is a pointer to the module name. (Input)

`mod_head`
: is a pointer to the location where `_os_load()` stores the pointer to the module. (Output)

`mod_exec`
: is a pointer to the location where `_os_load()` stores the pointer to the module execution entry point. (Output)

`mode`

specifies the access mode. (Input)

Only the lower 16 bits of `mode` are used.

All available access modes are defined in the following location:
`MWOS\<OS>\SRC\DEFS\modes.h`

For a list of all available access modes, refer to Chapter 3 of the *OS-9 Technical Manual*.

`type_lang`

The type and language of the module are passed at the location pointed to by `type_lang`. (Input/Output)

`_os_load()`

also stores the actual type and language at the location pointed to by `type_lang`. If `type_lang` is zero, any module can be linked to regardless of the type and language.

`attr_rev`

is a pointer to the location where `_os_load()` stores the attribute and revision level of the module. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$Load`	*OS-9 for 68K Technical Manual*
`F_LOAD`	*OS-9 Technical Manual*

_os_loadp()

Load and Link to Memory Module Using PATH

Syntax

```
#include <module.h>
#include <modes.h>
#include <types.h>
error_code _os_loadp(
    const char *name,
    u_int32 mode,
    char *nameptr,
    mh_com **mod_head);
```

Description

`_os_loadp()` opens a file specified by the pathlist. It reads one or more memory modules from the file into memory until an error or end of file is reached; then it closes the file.

The `PATH` environment variable determines the alternate directories to search for the named file.

Refer to your operating system technical manual for information regarding the `PATH` environment variable.

`name`
: is a pointer to the file name. (Input)

`mode`
: specifies the access mode. (Input)

  Only the lower 16 bits of `mode` are used.

  All available access modes are defined in the following location:
  `MWOS\<OS>\SRC\DEFS\modes.h`

  For a list of all available access modes, refer to the section, "Access Modes and Permissions," in Chapter 3 of the *OS-9 Technical Manual*.

`nameptr`
: is a pointer to a buffer for the pathlist of the successfully loaded file. (Input)

  Use NULL to indicate that no complete pathlist is required.

`mod_head`
: is a pointer to the location where `_os_loadp()` stores the pointer to the module. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_load()`

`_os_exec()`

_os_makdir()

Make New Directory

Syntax

```
#include <modes.h>
#include <types.h>
error_code _os_makdir(
    const char *name,
    u_int32 mode,
    u_int32 perm, ...);
```

Description

_os_makdir() creates and initializes a new directory as specified by the pathlist. _os_makdir() is the only way to create a new directory file. _os_makdir() fails on non-multifile devices. _os_makdir() does not return a path number. You should use _os_open() to open a directory. The new directory automatically has its directory bit set in the access permission attributes. The remaining attributes are specified by the bytes passed in mode and perm.

Refer to your operating system technical manual for the available modes and attributes.

name
: is a pointer to the pathlist. (Input)

mode
: specifies the access mode. (Input)

  Only the lower 16 bits of mode are used.

perm
: specifies the access permissions. (Input)

  All available access modes and permissions are defined in the following location: MWOS\<OS>\SRC\DEFS\modes.h

  For a list of all available access modes, refer to the section, "Access Modes and Permissions," in Chapter 3 of the *OS-9 Technical Manual.*

  A variable parameter may be included to specify the initial allocation size.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_makmdir()

Create New Module Directory

Syntax

```
#include <moddir.h>
#include <types.h>
error_code _os_makmdir(
    const char *name,
    u_int32 perm);
```

Description

`_os_makmdir()` creates a new module directory. The name of the new module directory is relative to the current module directory.

`name`
: is a pointer to the name of the new module directory. (Input)

`perm`
: specifies the access permissions for the new module directory. (Input)

  Only the lower 16 bits of `perm` are used.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_mem()

Resize Data Memory Area

Syntax

```
#include <memory.h>
#include <types.h>
error_code _os_mem(
    u_int32 *size,
    void **mem_ptr);
```

Description

`_os_mem()` contracts or expands the process' data memory area. The requested size is rounded up to an even memory allocation block. Additional memory is allocated contiguously upward (towards higher addresses) or deallocated downward from the old highest address.

`size`
: The desired memory size in bytes is passed at the location pointed to by `size`. (Input/Output)

  `_os_mem()` also stores the actual size of the memory at the location pointed to by `size`. If the integer pointed to by `size` is zero, `_os_mem()` treats the call as a request for information and returns the current upper bound in `mem_ptr` and the amount of free memory in `size`.

`mem_ptr`
: is a pointer to the location where `_os_mem()` stores the pointer to the new end of data segment plus 1. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$Mem`	*OS-9 for 68K Technical Manual*
`F_MEM`	*OS-9 Technical Manual*

_os_mkmodule()

Create Data Module of Specified Color Type

Syntax

```
#include <module.h>
#include <memory.h>
#include <types.h>
error_code _os_mkmodule(
    const char *mod_name,
    u_int32 size,
    u_int16 *attr_rev,
    u_int16 *type_lang,
    u_int32 perm,
    void **mod_exec,
    mh_com **mod_head,
    u_int32 color);
```

Description

`_os_mkmodule()` creates a memory module with the specified name and attributes in the specified memory. The module is created with a valid CRC and entered into the system module directory. You can specify the type/language of the module and color of memory in which to make the module.

The created module always begins at offset `$34` within the module. This implies that this call cannot conveniently make program modules, trap handlers, file managers, device drivers, and device descriptors.

`mod_name`
: is a pointer to the name of the data module.(Input)

`size`
: specifies the size of the data portion to clear. (Input)

`attr_rev`
: is a pointer to the location where `_os_mkmodule()` stores the module's attribute and revision. (Output)

`type_lang`
: The type and language for the module are passed at the location pointed to by `type_lang`. (Input/Output)

  `_os_mkmodule()` also stores the actual type and language at the location pointed to by `type_lang`.

`perm`
: specifies the access permissions for the module. (Input)

  Only the lower 16 bits of `perm` are used.

`mod_exec`
: is a pointer to the location where `_os_mkmodule()` stores the pointer to the module data. (Output)

`mod_head`
: is a pointer to the location where `_os_mkmodule()` stores the pointer to the module header. (Output)

`color`
: is the memory color type: `SYSRAM`, `VIDEO1`, or `VIDEO2`. (Input)

  If `color` is zero, no memory type is specified. Consequently, the module is made in whatever memory the system allocates.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_datmod()`

`_os_setcrc()`

`_os_move()`

_os_modaddr()

Find Module Given Pointer

Syntax

```
#include <module.h>
#include <types.h>
error_code _os_modaddr(
   void *mem_ptr,
   mh_com **mod_head);
```

Description

`_os_modaddr()` locates a module given a pointer to any position within the module and returns a pointer to the module's header.

`mem_ptr`
: is a pointer to any position within the module. (Input)

`mod_head`
: is a pointer to the location where `_os_modaddr()` stores the pointer to the module header. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_move()

Move Data (Low Bound First)

Syntax

```
#include <memory.h>
#include <types.h>
error_code _os_move(
    void *from,
    void *to,
    u_int32 count);
```

Description

`_os_move()` is a fast "block-move" subroutine which copies data bytes from one address space to another, usually from system to user or vice versa. This call allows the source and destination buffers to overlap.

`from`
: is a pointer to the source data. (Input)

`to`
: is a pointer to the destination data. (Output)

`count`
: is the byte count to copy. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_nproc()

Start Next Process

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_nproc(void);
```

Description

`_os_nproc()` removes the next process from the active process queue and initiates its execution. `_os_nproc()` does not return to the caller.

The process calling `_os_nproc()` should already be in one of the system's process queues. If not, the process becomes unknown to the system. This occurs even though the process descriptor still exists and is printed out by a `procs` command.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_aproc()`

_os_open()

Open Path to File or Device

Syntax

```
#include <modes.h>
#include <types.h>
error_code _os_open(
    const char *name,
    u_int32 mode,
    path_id *path);
```

Description

`_os_open()` opens a path to an existing file or device as specified by the pathlist. `_os_open()` returns a path number which is used in subsequent service requests to identify the path. If the file does not exist, an error is returned.

A non-directory file may be opened with no `mode` bits set. This allows you to examine characteristics such as the attributes and size by the `_os_getstat()` system requests, but does not permit any actual I/O on the path.

`name`

is a pointer to the path name of the existing file or device. (Input)

`mode`

specifies which subsequent read and/or write operations are permitted. (Input)

Only the lower 16 bits of `mode` are used.

All available access modes are defined in the following location:
`MWOS\<OS>\SRC\DEFS\modes.h`

`path`

is a pointer to the location where `_os_open()` stores the resulting path number. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_attach()`	`_os_close()`	`_os_create()`
`I$Open`	*OS-9 for 68K Technical Manual*	
`I_OPEN`	*OS-9 Technical Manual*	

_os9_panic()

System Catastrophic Occurrence

Syntax

```
#include <process.h>
#include <types.h>
error_code _os9_panic(
    u_int32 panic_code);
```

Description

`_os9_panic()` is called when the kernel detects a disastrous, but not necessarily fatal, system condition. Ordinarily, `_os9_panic()` is undefined and the system dies.

`_os9_panic()` is called only when the kernel believes there are no processes remaining to be executed. Although the system is probably dead at this point, it may not be. Interrupt service routines or system-state alarms could cause the system to become active.

`panic_code`
: specifies the panic code to output. (Input)

Attributes

Operating System:	OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os9_setsvc()`

`F$Panic` *OS-9 for 68K Technical Manual*

_os_permit()

Allow Access to Memory Block

Syntax

```
#include <process.h>
#include <types.h>
#include <modes.h>
error_code _os_permit(
void            *mem_ptr,
u_int32         size,
u_int32         perm,
process_id   pid);
```

Description

`_os_permit()` allows a process to access a block of memory. The `_os_permit()` service routine must update SSM (System Security Module) data structures to show that a process may access the specified memory in the requested mode.

`_os_permit()` only performs a useful function on MMU/SSM systems. On non-MMU/SSM systems, `_os_permit()` simply returns without allowing access to the memory block.

Only super-group users may use the `_os_permit()` function.

`mem_ptr`
: is a pointer to the beginning of the memory area to grant access permissions. (Input)

`size`
: is the size of the memory area. (Input)

`perm`
: is the permissions to grant. (Input)

  Only the lower 16 bits of `perm` are used.

`pid`
: is the process identifier of the target process (not used for OS-9 for 68K). (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$Permit`	*OS-9 for 68K Technical Manual*
`F_PERMIT`	*OS-9 Technical Manual*

_os_perr()

Print Error Message

Syntax

```
#include <errno.h>
#include <types.h>
error_code _os_perr(
    path_id path,
    u_int32 errnum);
```

Description

`_os_perr()` is the system's error reporting facility. It writes an error message to the standard error path. Most OS-9 for 68K systems print `ERROR #mmm.nnn`. Error numbers `000:000` to `063:255` are reserved for the operating system.

If an error path number is specified, the path is searched for a text description of the error encountered. The error message path contains an ASCII file of error messages. Each line may be up to 80 characters long. If the error number matches the first 7 characters in a line (that is, `000:215`), the rest of the line is printed along with the error number.

Error messages may be continued on several lines by beginning each continuation line with a space. An example error file might contain lines like this:

```
000:214 (E$FNA) File not accessible.

An attempt to open a file failed. The file was found, but is not
accessible to you in the requested mode. Check the file's owner ID and
access attributes.

000:215 (E$BPNam) Bad pathlist specified.

The specified pathlist is syntactically incorrect.
```

`path`

is the path to the error message file. (Input)

If `path` is zero, standard format is specified.

`errnum`

is the error number. (Input)

Only the lower 16 bits of `errnum` are used.

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_protect()

Prevent Access to Memory Block

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_protect(
    void *mem_ptr,
    u_int32 size,
    u_int32 perm,
    process_id pid);
```

Description

`_os_protect()` removes a process' permission to access a block of memory. `_os_protect()` only performs a useful function on MMU/SSM systems. On non-MMU/SSM systems, `_os_protect()` simply returns without preventing access to the memory block.

Only super-group users may use the `_os_protect` function.

`mem_ptr`
: is a pointer to the beginning of the memory area to remove access permissions. (Input)

`size`
: specifies the size of memory. (Input)

`perm`
: specifies the permissions to remove. (Input)

  Only the lower 16 bits of `perm` are used.

`pid`
: specifies the process identifier for the target process. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$Protect`	*OS-9 for 68K Technical Manual*
`F_PROTECT`	*OS-9 Technical Manual*

_os_prsnam()

Parse Path Name

Syntax

```
#include <strings.h>
#include <types.h>
error_code _os_prsnam(
    const char *name,
    u_int32 *length,
    char *delimiter,
    char **updated);
```

Description

`_os_prsnam()` parses a string for a valid pathlist element and returns its size. This call parses one element in a pathlist, not the entire pathlist. A valid pathlist element may contain the following characters:

`A - Z`	Upper case letters	.	Periods
`a - z`	Lower case letters	_	Underscores
`0 - 9`	Numbers	$	Dollar signs

Other characters terminate the name and are returned as the pathlist delimiter. Several `_os_prsnam()` calls are needed to process a pathlist with more than one name. `_os_prsnam()` terminates a name when it reaches a delimiter character. Usually, pathlists must be terminated with a null byte.

`name`
: is a pointer to the pathlist string. (Input)

`length`
: is a pointer to the location where `_os_prsnam()` stores the length of the pathlist element. (Output)

`delimiter`
: is a pointer to the location where `_os_prsnam()` stores the pathlist delimiter. (Output)

`updated`
: is a pointer to the location where `_os_prsnam()` stores the pointer to the first character of `name`. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_cmpnam()`

Syntax

```
#include <io.h>
#include <types.h>
error_code _os_rdalst(
    char *buffer,
    u_int32 *count);
```

Description

`_os_rdalst()` copies the system alias list to the caller's buffer. At most, `count` bytes are copied to the buffer. Each alias entry is null terminated.

`buffer`
: is a pointer to the buffer into which to copy the alias list. (Output)

`count`
: The number of total bytes to copy is passed at the location pointed to by `count`. (Input/Output)

  `_os_rdalst()` also stores the actual number of bytes copied at the location pointed to by `count`.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_read()

Read Data from File or Device

Syntax

```
#include <modes.h>

#include <types.h>

error_code _os_read(
    path_id path,
    void *buffer,
    u_int32 *count);
```

Description

`_os_read()` reads the number of bytes from the specified path. The path must previously have been opened in read or update mode. The data is returned exactly as read from the file or device without additional processing or editing such as backspace and line delete. If not enough data is in the file to satisfy the read request, fewer bytes are read than requested, but an end-of-file error is not returned until the next `_os_read()` service request returns an end-of-file error.

If the device is opened in block mode (`S_IBLKMODE`), the `count` parameter passed must be a multiple of the block size of the device, whereas in non-block mode it is interpreted as the number of bytes to read.

`path`
: specifies the path number. (Input)

`buffer`
: is a pointer to the caller's data buffer. (Output)

`count`
: The number of bytes requested to be read is passed at the location pointed to by `count`. (Input/Output)

  `_os_read()` also stores the number of bytes actually read at the location pointed to by `count`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_readln()`	
`I$Read`	*OS-9 for 68K Technical Manual*
`I_READ`	*OS-9 Technical Manual*

_os_readln()

Read Text Line with Editing

Syntax

```
#include <modes.h>
#include <types.h>
error_code _os_readln(
    path_id path,
    void *buffer,
    u_int32 *count);
```

Description

`_os_readln()` reads the specified number of bytes from the input file or device until an end-of-line character is encountered. On SCF-type devices, `_os_readln()` also causes line editing such as backspacing, line delete, echo, and automatic line feed to occur.

If the device is opened in block mode (`S_IBLKMODE`), the `count` parameter passed must be a multiple of the block size of the device, whereas in non-block mode it is interpreted as the number of bytes to read.

`path`
: specifies the path number. (Input)

`buffer`
: is a pointer to the location where the bytes to be read are placed. (Output)

`count`
: The number of bytes requested is passed at the location pointed to by `count`. (Input/Output)

  `_os_readln()` also stores the number of bytes actually read at the location pointed to by `count`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_read()`	
`I$ReadLn`	*OS-9 for 68K Technical Manual*
`I_READLN`	*OS-9 Technical Manual*

_os_rellk()

Release Ownership of Resource Lock

Syntax

```
#include <lock.h>
#include <types.h>
error_code _os_rellk(
   lk_desc *lock);
```

Description

`_os_rellk()` releases ownership of a resource lock and activates the next process waiting to acquire the lock. The next process in the lock's queue is activated and granted exclusive ownership of the resource lock. If no other process is waiting on the lock, the lock is simply marked free for acquisition.

`lock`
: is a pointer to the `lk_desc` structure of the lock to release. (Input)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`lock.l`

See Also

`_os_acqlk()`
`_os_caqlk()`
`_os_crlk()`
`_os_ddlk()`
`_os_dellk()`
`_os_waitlk()`
`F_RELLK` *OS-9 Technical Manual*

_os9_retpd()

Return Fixed Block of Memory

Syntax

```
#include <process.h>
#include <types.h>
error_code _os9_retpd(
    u_int32 number,
    void *table);
```

Description

`_os9_retpd()` deallocates a fixed block of memory.

`number`
: is the number of the table element. (Input)

  Only the lower 16 bits of number are used. (Input)

`table`
: is a pointer to the address of the table to use.

Attributes

Operating System:	OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os9_allpd()`

`_os_findpd()`

_os_rte()

Return from Signal Interrupt Routine

Syntax

```
#include <signal.h>
#include <types.h>
error_code _os_rte(void);
```

Description

`_os_rte()` terminates a process' signal intercept routine and continues executing the main program.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_intercept()`

F$RTE	*OS-9 for 68K Technical Manual*
F_RTE	*OS-9 Technical Manual*

_os_rtnprc()

Deallocate Process Descriptor

Syntax

```
#include <process.h
#include <types.h
error_code _os_rtnprc(
   process_id proc_id);
```

Description

`_os_rtnprc()` deallocates a process descriptor previously allocated by `_os_alocproc()`. You must ensure that the process' system resources are returned before calling `_os_rtnprc()`.

`proc_id`
identifies the process descriptor. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_alocproc()`

`_os_findpd()`

_os9_salarm_atdate()

Execute System-State Subroutine at Gregorian Date/Time

Syntax

```
#include <regs.h>
#include <alarm.h>
#include <types.h>
error_code _os9_salarm_atdate(
    alarm_id *alrm_id,
    u_int32 time,
    u_int32 date,
    REGISTERS *regs);
```

Description

`_os9_salarm_atdate()` executes a system-state subroutine at a specific date and time. The alarm subroutine executes anytime the system date/time becomes greater than or equal to the alarm time.

`_os9_salarm_atdate()` only allows you to specify the time to the nearest second. However, it does adjust if the system's date and time have changed (using `_os9_setime()`).

Functions installed as system-state alarm routines should be compiled without stack checking and with stand-alone constant data pointer calculation (`-bepg`), if appropriate for the target processor. Failure to do so can lead to a system crash or system data structure corruption.

`alrm_id`
: is a pointer to the location where `_os9_salarm_atdate()` stores the alarm ID. (Output)

`time`
: is the time for the alarm to go off in the form `00hhmmss`. (Input)

`date`
: is the date for the alarm to go off in the form `yyyymmdd`. (Input)

`regs`
: is a pointer to the register image to pass to the function. (Input)

  The address of the system-state subroutine to execute should be set in `regs->pc`.

Attributes

Operating System:	OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os9_setime()`
`F_ALARM` *OS-9 for 68K Technical Manual*

_os_salarm_atime()

Execute System-State Subroutine at Specified Time

Syntax

```
#include <alarm.h>
error_code _os_salarm_atime(
   salarm_id *alrm_id,
   u_int32 time,
   u_int32 flags,
   u_int32 (*func)(),
   void *func_pb);
```

Description

`_os_salarm_atime()` executes the specified subroutine after the specified time interval has elapsed. The alarm time is an absolute time, not a relative time. The time value is considered to be a value in seconds since a date specified in Greenwich Mean Time. To determine the specified date, reference the applicable manual, *OS-9 for 68K Technical Manual* or *OS-9 Technical Manual*.

Functions installed as system-state alarm routines should be compiled without stack checking and with stand-alone constant data pointer calculation (`-bepg`), if appropriate for the target processor. Failure to do so can lead to a system crash or system data structure corruption.

`alrm_id`
: is a pointer to the location where `_os_salarm_atime()` stores the alarm ID. (Output)

`time`
: specifies the time when the alarm expires. (Input)

`flags`
: specifies the alarm flags. (Input)

`func`
: is a pointer to a function to execute. (Input)

`func_pb`
: is a pointer to the function's parameter block. (Input)

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_salarm_set()`

`F_ALARM` *OS-9 Technical Manual*

_os9_salarm_atjul()

Execute System-State Subroutine at Julian Date/Time

Syntax

```
#include <regs.h>
#include <alarm.h>
#include <types.h>
error_code _os9_salarm_atjul(
    alarm_id *alrm_id,
    u_int32 time,
    u_int32 date,
    REGISTERS *regs);
```

Description

`_os9_salarm_atjul()` executes a system-state subroutine at a specific Julian date and time. The alarm subroutine is executed anytime the system date/time becomes greater than or equal to the alarm time.

Functions installed as system-state alarm routines should be compiled without stack checking and with stand-alone constant data pointer calculation (`-bepg`), if appropriate for the target processor. Failure to do so can lead to a system crash or system data structure corruption.

`_os9_salarm_atjul()` only allows the time to be specified to the nearest second. However, it does adjust if the system's date and time have changed (using `_os9_setime()`).

`alrm_id`
: is a pointer to the location where `_os9_salarm_atjul()` stores the alarm ID. (Output)

`time`
: is the time for the alarm to go off in seconds after midnight. (Input)

`date`
: is the Julian day number for the alarm to go off. (Input)

`regs`
: is a pointer to the register image to pass to the function. (Input)

  The address of the system-state subroutine to execute should be set in `regs->pc`.

Attributes

Operating System:	OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os9_setime()`
`F$Alarm` *OS-9 for 68K Technical Manual*

_os_salarm_cycle()

Set Cyclic Alarm Clock

Syntax

```
#include <alarm.h>
#include <types.h>
error_code _os_salarm_cycle(
    alarm_id *alrm_id,
    u_int32 time,
    u_int32 flags,
    u_int32 (*func)(),
    void *func_pb);
```

Description

`_os_salarm_cycle()` executes the specified subroutine after the specified time interval has elapsed. Then the alarm is reset to provide recurring periodic execution of the specified subroutine.

Functions installed as system-state alarm routines should be compiled without stack checking and with stand-alone constant data pointer calculation (`-bepg`), if appropriate for the target processor. Failure to do so can lead to a system crash or system data structure corruption.

`alrm_id`
: is a pointer to the location where `_os_salarm_cycle()` stores the alarm ID. (Input)

`time`
: specifies the alarm's time interval. (Input)

  `time` may be specified in system clock ticks; or, if the high order bit is set, the low 31 bits are considered a time in 256ths of a second. Usually, the minimum time interval allowed is 2 system clock ticks.

`flags`
: specifies the alarm flags. (Input)

`func`
: is a pointer to a function to execute. (Input)

`func_pb`
: is a pointer to the function's parameter block. (Input)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_salarm_set()`
`F_ALARM` *OS-9 Technical Manual*

_os9_salarm_cycle()

Execute System-State Subroutine Every N Ticks/Seconds

Syntax

```
#include <regs.h>
#include <alarm.h>
#include <types.>h
error_code _os9_salarm_cycle(
    alarm_id *alrm_id,
    u_int32 time,
    REGISTERS *regs);
```

Description

`_os9_salarm_cycle()` executes a system-state subroutine after the specified time interval has elapsed. Then the alarm is reset to provide recurring periodic execution of the system-state subroutine.

Functions installed as system-state alarm routines should be compiled without stack checking and with stand-alone constant data pointer calculation (`-bepg`), if appropriate for the target processor. Failure to do so can lead to a system crash or system data structure corruption.

Keep cyclic system-state alarms as fast as possible. Schedule them with as long a cycle as possible to avoid consuming a large portion of available CPU time.

`alrm_id`

is a pointer to the location where `_os9_salarm_cycle()` stores the alarm ID. (Output)

`time`

specifies the alarm's time interval. (Input)

time may be specified in system clock ticks; or, if the high order bit is set, the low 31 bits are considered a time in 256ths of a second. Usually, the minimum time interval allowed is 2 system clock ticks.

`regs`

is a pointer to the register image to pass to the function. (Input)

The address of the system-state subroutine to execute should be set in `regs->pc`.

Attributes

Operating System:	OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os9_salarm_set()`
`F$Alarm` *OS-9 for 68K Technical Manual*

_os_salarm_delete()

Remove Pending Alarm Request

Syntax

```
#include <alarm.h>
#include <types.h>
error_code _os_salarm_delete(alarm_id alrm_id);
```

Description

`_os_salarm_delete()` removes a cyclic alarm or any alarm that has not expired.

In a threaded environment, the `alarm_id` is checked to determine the owner of the thread. If a 0 is passed for the `alarm_id`, all pending alarm requests for the system will be removed, which are owned by the system process (forked with `TH_SPOWN`).

Keep cyclic system-state alarms as fast as possible. Schedule them with as long a cycle as possible to avoid consuming a large portion of available CPU time.

`alrm_id`
: specifies the alarm ID. If `alrm_id` is 0 (zero), all pending alarm requests are removed, which are owned by the system process (forked with `TH_SPOWN`). (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$Alarm`	*OS-9 for 68K Technical Manual*
`F_ALARM`	*OS-9 Technical Manual*

_os_salarm_delete_sp()

Delete Installed Alarms

Syntax

```
#include <alarm.h>

#include <types.h>

error_code _os_salarm_delete_sp(alrm_id, flags);
```

Description

`_os_salarm_delete_sp()` takes a flag value to allow correct deletion of installed alarms, thus providing a workaround for a historic OS-9 bug in `_os_salarm_delete`.

Functions installed as system-state alarm routines should be compiled without stack checking and with stand-alone constant data pointer calculation (`-bepg`), if appropriate for the target processor. Failure to do so can lead to a system crash or system data structure corruption.

`alrm_id`

specifies the alarm ID. (Input)

If `alrm_id` is zero, all pending alarm requests are removed.

`flags`

specifies that the alarm(s) to be deleted are owned by either the system process (`TH_SPOWN`) or by the current user process (`flags=0`). (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$Alarm`	*OS-9 for 68K Technical Manual*
`F_ALARM`	*OS-9 Technical Manual*

_os_salarm_reset()

Reset Alarm Clock

Syntax

```
#include <alarm.h>
#include <types.h>
error_code _os_salarm_reset(
   alarm_id alrm_id,
   u_int32 time,
   u_int32 flags,
   u_int32 (*func)(),
   void *func_pb);
```

Description

`_os_salarm_reset()` allows you to change the parameters on an existing alarm.

⚠ Functions installed as system-state alarm routines should be compiled without stack checking and with stand-alone constant data pointer calculation (`-bepg`), if appropriate for the target processor. Failure to do so can lead to a system crash or system data structure corruption.

`alrm_id`
: specifies the alarm ID to reset. (Input)

`time`
: specifies the alarm's time interval or a time. (Input)

  A time interval may be specified in system clock ticks or 256ths of a second. The minimum time interval allowed is 2 system clock ticks.

`flags`
: specifies the alarm flags. (Input)

`func`
: is a pointer to a function to execute. (Input)

`func_pb`
: is a pointer to the function's parameter block. (Input)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_salarm_set()`
F_ALARM *OS-9 Technical Manual*

_os_salarm_set()

Set Alarm Clock

Syntax

```
#include <alarm.h>
#include <types.h>
error_code _os_salarm_set(
   alarm_id *alrm_id,
   u_int32 time,
   u_int32 flags,
   u_int32 (*func)(),
   void *func_pb);
```

Description

`_os_salarm_set()` executes the specified subroutine after the specified time interval has elapsed.

Functions installed as system-state alarm routines should be compiled without stack checking and with stand-alone constant data pointer calculation (`-bepg`), if appropriate for the target processor. Failure to do so can lead to a system crash or system data structure corruption.

`alrm_id`
is a pointer to the location where `_os_salarm_set()` stores the alarm ID. (Output)

`time`
specifies the alarm's time interval or a time. (Input)

`time` may be specified in system clock ticks; or, if the high order bit is set, the low 31 bits are considered a time in 256ths of a second. Usually, the minimum time interval allowed is 2 system clock ticks.

`flags`
specifies the alarm flags. (Input)

`func`
is a pointer to the function to execute. (Input)

`func_pb`
is a pointer to the function's parameter block. (Input)

Attributes

Operating System:	OS-9K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F_ALARM`	*OS-9 Technical Manual*

_os9_salarm_set()

Execute System-State Subroutine after Specified Time Interval

Syntax

```
#include <regs.h>
#include <alarm.h>
#include <types.h>
error_code _os9_salarm_set(
    alarm_id *alrm_id,
    u_int32 time,
    REGISTERS *regs);
```

Description

`_os9_salarm_set()` executes a system-state subroutine after the specified time interval has elapsed.

Functions installed as system-state alarm routines should be compiled without stack checking and with stand-alone constant data pointer calculation (`-bepg`), if appropriate for the target processor. Failure to do so can lead to a system crash or system data structure corruption.

`alarm_id`
: points to the location where `_os9_salarm_set()` stores the alarm ID. (Output)

`time`
: specifies the time interval. (Input)

  The time interval, `time`, may be specified in system clock ticks or 256ths of a second. The minimum time interval allowed is 2 system clock ticks.

`regs`
: is a pointer to the register image to pass to the function. (Input)

  The address of the system-state subroutine to execute should be set in `regs->pc`.

Attributes

Operating System:	OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$Alarm`	*OS-9 for 68K Technical Manual*

_os_scache()

Cache Control

Syntax

```
#include <regs.h>
#include <cache.h>
#include <types.h>
error_code _os_scache(
    u_int32 control,
    void (**cctl)(),
    void **cctl_data,
    void *addr,
    u_int32 size);
```

Description

`_os_scache()` performs operations on the system instruction and/or data caches.

`control`

specifies the cache operation. (Input)

If `control` is zero, the system instruction and data caches are flushed. Non-super group, user-state processes may perform this operation.

The table below illustrates the bits that are defined in the `control` parameter for precise operation. Only system-state and super-group processes can use the `control` parameter for precise operation. All others are reserved. If a reserved bit is set, an `EOS_PARAM` error is returned.

Bit	Name	Description
Bit 0	`C_ENDATA`	If set, enables the data cache.
Bit 1	`C_DISDATA`	If set, disables the data cache.
Bit 2	`C_FLDATA`	If set, flushes the data cache.
Bit 3	`C_INVDATA`	invalidates data cache (if set and supported by hardware).
Bit 4	`C_ENINST`	If set, enables the instruction cache.
Bit 5	`C_DISINST`	If set, disables the instruction cache
Bit 6	`C_FLINST`	If set, flushes the instruction cache.
Bit 7	`C_INVINNST`	If set, invalidates the instruction cache.
Bit 8	`C_ADDR`	If set, flags a target address for flush operation.
Bits 9-14		Reserved for future use by RadiSys.
Bit 15	`C_GETCCTL`	If set, returns a pointer to the cache control routine and cache static global data.
Bit 16	`C_STODATA`	stores data cache (if set and supported by hardware).
Bits 17-31		Reserved for future use by RadiSys.

By OS-9 convention, the terms flush, invalidate, and store are defined as follows:

`Flush`
: Operation by which a cache line is written to main memory and marked as invalid.

`Invalidate`
: Operation by which a cache line is marked as invalid. No write of cache line to main memory is performed.

`Store`
: Operation by which a cache line is written to main memory. The cache line is not marked as invalid.

These specific operations may or may not be supported by a particular hardware configuration. The Flush operation is considered the base operation and will be supported by most processors.

`cctl`
: is a pointer to the location where `_os_scache()` stores the cache routine's address. (Output)

`cctl_data`
: is a pointer to the location where `_os_scache()` stores the cache routine's static storage address. (Output)

`addr`
: is a pointer that specifies the address for the flush operation. (Input)

  This parameter is used when the `C_ADDR` bit of `control` is set. Set `addr` to 0 when `C_ADDR` is not set.

`size`
: indicates the size of the target memory area to be flushed. (Input)

  This parameter is used when the `C_ADDR` bit of `control` is set. Set `size` to 0 when `C_ADDR` is not set.

Any program that builds or changes executable code in memory should flush the instruction cache with `_os_scache()` before executing new code. This is necessary because the hardware instruction cache is not updated by data (`write`) accesses and may contain the unchanged instruction(s). For example, if a subroutine builds a system call on its stack, you must use the `_os_scache()` system call to flush the instruction cache before executing the temporary instructions.

If the `C_GETCCTL` bit of `control` is set, `_os_scache()` returns a pointer to the cache control routine in the cache extension module and a pointer to that routine's static global data. This enables drivers and file managers to call the cache routine directly rather than making a possibly time-consuming `_os_scache()` request. The prototype for this cache control routine is as follows:

```
error_code (*cache_cctl) (u_int32 control,
              void *addr, u_int32 size);
```

The control, addr, and size parameters are as defined earlier. The only exception is the `C_GETCCTL` bit in the `control` parameter. This obviously has no meaning in this context.

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`I_SETSTAT, SS_CACHE`	*OS-9 Technical Manual*
`F_CCTL` (system-state)	*OS-9 Technical Manual*

_os9_schbit()

Search Bit Map for Free Area

Syntax

```
#include <memory.h>
#include <types.h>
error_code _os9_schbit(
   u_int16 *bit_number,
   u_int16 *count,
   void *address,
   void *bitmap_end);
```

Description

`_os9_schbit()` searches the specified buffer which represents a bit map for a free block (cleared bits) of the required length, starting at the beginning bit number. `_os9_schbit()` returns the offset of the first block found of the specified length.

If `_os9_schbit()` returns `SUCCESS`, you should check `count` to make sure that you received the requested number of bits. If `count` is less than the requested amount, `_os9_schbit()` returned the largest number of bits available, starting at `bit_number`.

`bit_number`
: The beginning bit number to search is passed at the location pointed to by `bit_number. (Input/Output)`

  `_os9_schbit()` also stores the beginning bit number found at the location pointed to by `bit_number`.

`count`
: The number of bits needed is passed at the location pointed to by `count`. (Input/Output)

  `_os9_schbit()` also stores the number of bits found at the location pointed to by count.

`address`
: is a pointer to the base address of the bitmap. (Input)

`bitmap_end`
: is a pointer to the end of the bitmap plus one. (Input)

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os9_allbit()`

`_os9_delbit()`

_os_seek()

Reposition Logical File Pointer

Syntax

```
#include <modes.h>
#include <types.h>
error_code _os_seek(
   path_id path,
   u_int32 position);
```

Description

`_os_seek()` repositions the path's file pointer. The file pointer is the 32-bit address of the next byte in the file to read or write. A `seek` may be performed to any value, even if the file is not large enough. Subsequent `write` requests automatically expand the file to the required size, if possible. `read` requests return an end-of-file condition.

If the device is opened in block-mode (`S_IBLKMODE`), the `position` parameter to `_os_seek()` is interpreted by the function as a block to seek to (rather than as a byte to seek to, which is the behavior when in non-block mode).

`path`
: specifies the path number. (Input)

`position`
: specifies the new position in the file. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`I$Seek`	*OS-9 for 68K Technical Manual*
`I_SEEK`	*OS-9 Technical Manual*

_os_sema_init()

Initialize Semaphore Data Structure for Use

Syntax

```
#include <semaphore.h>
error_code _os_sema_init(semaphore *sema);
```

Description

OS-9 for 68K: `_os_sema_init()` is valid in version 3.0 and greater.

`_os_sema_init()` initializes a semaphore data structure for subsequent use. The application should call `_os_sema_init()` before the first use of the semaphore. The semaphore may be part of a data module or it may be part of any data structure within the application.

It is necessary to clear the shared memory area before making the `_os_sema_init()` call. In some instances, such as with driver applications or global variables, initializing the structure to zero will clear the shared memory area automatically.

`sema`
: is a pointer to the semaphore data structure to initialize. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_sema_p()`

`_os_sema_term()`

`_os_sema_v()`

_os_sema_p()

Reserve Semaphore (Acquire Exclusive Access)

Syntax

```
#include <semaphore.h>

error_code _os_sema_p(semaphore *sema);
```

Description

OS-9 for 68K: `_os_sema_p()` is valid in version 3.0 and greater.

`_os_sema_p()` attempts to reserve the semaphore. If the semaphore is busy, the caller is suspended until the current holder releases the semaphore.

`_os_sema_p()` returns an error code if a signal arrives while a process is waiting for a semaphore (i.e., it signals that the process is resuming execution--because of the incoming signal--without obtaining the semaphore).

`sema`
: is a pointer to the semaphore to reserve. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_sema_init()`

`_os_sema_term()`

`_os_sema_v()`

_os_sema_term()

Terminate Use of Semaphore Data Structure

Syntax

```
#include <semaphore.h>
error_code _os_sema_term(semaphore *sema);
```

Description

OS-9 for 68K: `_os_sema_term()` is valid in version 3.0 and greater.

`_os_sema_term()` terminates the use of the semaphore. The application should call `_os_sema_term()` before terminating the application.

Within OS-9 and OS-9 for 68K, each call to `_os_sema_term()` invalidates the sync code of the semaphore. Therefore, the last process to use the semaphore should be the only one to terminate it.

`sema`
: is a pointer to the semaphore data structure to terminate. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_sema_init()`
`_os_sema_p()`
`_os_sema_v()`

_os_sema_v()

Release Semaphore (Release Exclusive Access)

Syntax

```
#include <semaphore.h>

error_code _os_sema_v(semaphore *sema);
```

Description

OS-9 for 68K: `_os_sema_v()` is valid in version 3.0 and greater.

`_os_sema_v()` releases the reservation of a semaphore. If a process is waiting on the semaphore, it is activated, allowing it to attempt to acquire the semaphore.

The `_os_sema_v()` call releases the semaphore, but does not give it to the next process waiting for it. Instead, if the process that issued the `_os_sema_v()` call issues a `_os_sema_p()` call before its slice is up, then it re-obtains the semaphore (i.e., the waiting process if running at the same priority was unable to obtain it).

`sema`
: is a pointer to the semaphore to release. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_sema_init()`
`_os_sema_p()`
`_os_sema_term()`

_os_send()
Send Signal to Another Process

Syntax

```
#include <signal.h>
#include <types.h>
error_code _os_send(
    process_id proc_id,
    signal_code signal);
```

Description

`_os_send()` sends a signal to the specified process. A process may send the same signal to all processes of the same group/user ID by passing zero as the receiving process' ID number.

If the receiving process does not have a signal handler installed, the signal will cause the receiving process to be killed. If the receiving process has a signal handler and is blocked on I/O, then a variety of error or result codes may be returned to the mainline program depending on the I/O system in use. For example, SCF in OS-9 for 68K would return the signal number send by `_os_send()`. SPF would return an error code of `000:233`.

On OS-9 for 68K, the lower 16 bits of the signal value are used. The upper 16 bits are ignored.
There are times in which the kernel sends a signal to a threaded process ID. When this occurs, the kernel looks for the first thread containing a signal handler and delivers the signal to it.

`proc_id`
: is the process ID number for the intended receiver. (Input)

`signal`
: specifies the signal code to send. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_wait()`	`_os_intercept()`	`_os_sleep()`
`F$Send`	*OS-9 for 68K Technical Manual*	
`F_SEND`	*OS-9 Technical Manual*	

_os_setcrc()

Generate Valid CRC in Module

Syntax

```
#include <module.h>
#include <types.h>
error_code _os_setcrc(mh_com *mod_head);
```

Description

`_os_setcrc()` updates the header parity and CRC of a module in memory. The module must have the correct size and sync bytes; other parts of the module are not checked.

Although `_os_setcrc()` and `_setcrc()` functions update the `header` and `crc` of a module in memory, the copy of the module header in the module directory is not affected. Therefore, you have an invalid module directory entry for the memory module with the new CRC; and an error 236 results if links to the module are attempted.

`mod_head`
: is a pointer to the module. (Input)

  The module image must start on a longword address or an exception may occur.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_crc()`

_os_setime()

Set System Time

Syntax

```
#include <time.h>
#include <types.h>
error_code _os_setime(u_int32 time);
```

Description

`_os_setime()` sets the current system time and starts the system real-time clock to produce time slice interrupts.

Only super users may set the time.

On OS-9 for 68K, the binding for this call performs conversions which allow compatibility with OS-9. If speed is a consideration, refer to `_os9_setime()`.

The time is not validated in any way. If time is zero on systems with a battery-backed clock, the actual time is read and set from the real-time clock.

In order to get the system time/date from the real time clock or the battery-backed clock, the month field in the date parameter must be `0`.

`time`

is stored as the number of seconds since a specific date in Greenwich Mean Time. (Input)

`time` is the desired current time in Greenwich Mean Time.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`gmtime()`
`_os_link()`
`_os_getime()`
`_os9_setime()`

`F$STime`	*OS-9 for 68K Technical Manual*
`F_STIME`	*OS-9 Technical Manual*

_os9_setime()

Set System Date/Time

Syntax

```
#include <time.h>
#include <types.h>
error_code _os9_setime(
    u_int32 time,
    u_int32 date);
```

Description

`_os9_setime()` sets the current system date/time and starts the system real-time clock to produce time slice interrupts. Only super users may set the time.

Each value is one byte in length, except for the year which is 2 bytes long. Values must be in hexadecimal format.

The date and time are not checked for validity. On systems with a battery-backed clock, it is usually only necessary to supply the year to the `_os9_setime()` call. The actual date and time are read from the real-time clock.

In order to get the system time/date from the real-time clock or the battery-backed clock, the month field in the date parameter must be `0`.

`time`
: is in the format `00hhmmss`. (Input)

`date`
: is in the format `yyyymmdd`. (Input)

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_link()`
`_os9_getime()`
`F$STime` *OS-9 for 68K Technical Manual*

_os_setpr()

Set Process Priority

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_setpr(
   process_id proc_id,
   u_int32 priority);
```

Description

`_os_setpr()` changes the process priority to the value specified by priority. A super user (group ID zero) may change any process' priority. A non-super user can only change the priorities of processes with the same user ID.

`proc_id`
: is the process ID. (Input)

`priority`
: specifies the new priority. (Input)

`65535`
: is the highest priority; `0` is the lowest.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$SPrior`	*OS-9 for 68K Technical Manual*
`F_SPRIOR`	*OS-9 Technical Manual*

_os_setstat()

Set File/Device Status

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_setstat(
    path_id path,
    u_int32 code,
    void *pb);
```

Description

`_os_setstat()` is a wildcard call used to handle individual device parameters that are not uniform on all devices or are highly hardware dependent.

The exact operation of this call depends on the device driver and file manager associated with the path. The mnemonics for the status codes are located in the `sg_codes.h` header file. This manual describes the status codes currently defined by Microware and the functions that they perform. These calls have an `_os_ss_` prefix.

This function is available within OS-9 for 68K, where it resides in the `conv_lib.l` library. However, it can be used only with DPIO file managers and drivers, such as SoftStax.

`path`

is the path number. (Input)

`code`

is the `SetStat` code. (Input)

Only the lower 16 bits of code are used.

`pb`

is a pointer to the parameter block.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_setsvc()

Service Request Table Initialization

Syntax

```
#include <svctbl.h>
#include <types.h>
error_code _os_setsvc(
    u_int32 count,
    u_int32 state_flag,
    void *init_tbl,
    void *params);
```

Description

`_os_setsvc()` adds or replaces a system service in OS-9's user and privileged system service request tables.

Use `get_static()` from `cpu.l` to acquire your current static storage pointer.

Valid service request codes range from `0` to `255`.

The available service request codes are located in the `funcs.h` file.

`count`
: is a count of the entries in the initialization table. (Input)

`state_flag`
: specifies whether user or system state tables, or both, are updated. (Input)

- If `state_flag` is `USER_STATE (1)`, only the user table is updated.
- If `state_flag` is `SYSTEM_STATE (2)`, only the system table is updated.
- If `state_flag` is `USER_STATE OR`'ed with `SYSTEM_STATE (3)`, both tables are updated.

`init_tbl`
: is a pointer to the initialization table. (Input)

An example initialization table might look like this:

```
error_code printmsg(), service();

svctbl syscalls[] =
{
   {F_PRINT, printmsg,  0, 1, 1},
   {F_SERVICE, service, 0 , 1, 1}
};
```

`params`
: may be a pointer to anything, but is intended to be a pointer to global static storage. (Input)

When a system call is used, the `params` data pointer is used as the global static storage pointer for the function.

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os9_setsvc()

Service Request Table Initialization

Syntax

```
#include <funcs.h>
#include <types.h>
extern void svctbl(void);    /* svctbl is in the code area */

_asm("
svctbl:
dc.w %0
dc.w routine-*-2
dc.w %0+SysTrap
dc.w sys_routine-*-2
dc.w -1
", F_DBGLOG);
```

Description

`_os9_setsvc()` adds or replaces function requests in OS-9 for 68K's user and privileged system service request tables. To install a system-state-only system call, `SysTrap` is added to the function code number. Otherwise, both the system- and user-state dispatch tables are updated.

The OS-9 for 68K service request codes are located in `/MWOS/OS9/SRC/DEFS`.

`dc.w %0`
: is system-state and user-state request code.

`dc.w routine-*-2`
: is an offset to the routine.

`dc.w %0+SysTrap`
: updates system-state request code.

`dc.w sys_routine-*-2`
: is an offset to a routine.

Attributes

Operating System:	OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_setsys()

Set System Global Variables

Syntax

```
#include <sysglob.h>
#include <types.h>
error_code _os_setsys(
   u_int32 offset,
   u_int32 size,
   glob_buff sysvar);
```

Description

`_os_setsys()` changes a system global variable. These variables have a `d_` prefix and are located in the system library `sysglob.h`. Consult the files in the `DEFS` directory for a description of the system global variables. Only super users may change system variables. Super users must be extremely careful when changing system global variables.

Refer to your operating system technical manual for the system global variables that may be changed.

`offset`
  is the offset to the system global variables. (Input)

`size`
  specifies the size of the target variable. (Input)

`sysvar`
  is the new value for the system global variable. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_setuid()

Set User ID Number

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_setuid(owner_id user_id);
```

Description

`_os_setuid()` changes the current user ID to `user_id`.

`user_id`
    is the desired group/user ID number. (Input)

The following restrictions apply to `_os_setuid()`:

- Users with group ID zero may change their IDs to anything without restriction.
- A primary module owned by a group zero user may change its ID to anything without restriction.
- Any primary module may change its user ID to match the module's owner.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_sgetstat()

GetStat Call Using System Path Number

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_sgetstat(
    path_id spath,
    u_int32 code,
    void *pb);
```

Description

`_os_sgetstat()` makes a specific `GetStat` or `SetStat` call.

`spath`
: is the system path number. (Input)

`code`
: is the `GetStat` code. (Input)

`pb`
: is a pointer to the parameter block corresponding to the function being performed. (Input)

  If the function does not have a parameter block (for example, `_os_ss_reset()`), `pb` should be `NULL`.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_sgs_devnm()

Return Device Name

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_sgs_devnm(
    path_id path,
    char *namebuf);
```

Description

`_os_sgs_devnm()` returns the name of the device associated with the specified system path number.

`path`
: is the system path number. (Input)

`namebuf`
: is a pointer to the location where `_os_sgs_devnm()` stores the device name. (Output)

Attributes

Operating System:	OS-9K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_siglngj()

Set Signal Mast Value and Return on Specified Stack Image

Syntax

```
#include <signal.h>
#include <types.h>
error_code _os_siglngj(
    void *usp,
    u_int16 siglvl);
```

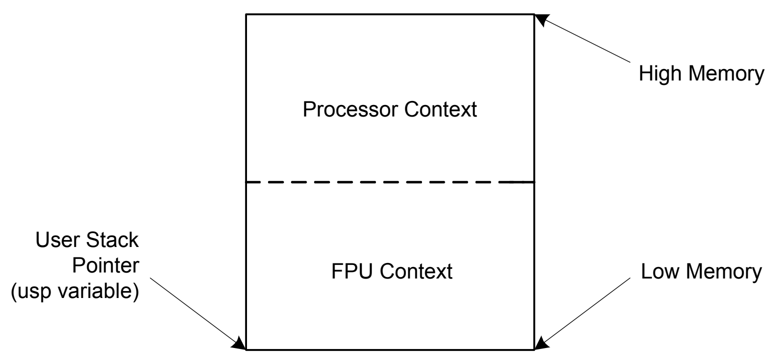
Description

`F_SIGLNGJ` allows processes to perform `longjump()` operations from their signal intercept routines and unmask signals in one operation.

The operating system takes appropriate precautions to verify that the memory location pointed to by the `usp` variable is accessible to the process and to ensure that the process does not attempt to make a state change.

The stack image pointed to by the `usp` variable must have the format shown in Figure 2-9.

Figure 2-9. _os_siglngj() Required Stack Image



The specific format of the processor context is defined by the `longstk` structure definition found in the `reg<CPU Family>.h` file for the associated processor. The format of the floating-point context varies depending on whether the target system has a hardware floating-point unit versus floating-point emulation software.

For floating-point hardware, the stack image is the same as that defined by the `fregs` structure definition found in the associated `reg<CPU Family>.h` header file.

For floating-point emulation, the floating-point context differs from the hardware implementation context in that it may contain additional context information specific to the `FPU` module performing the emulation. The definition for the floating-point context as used by the `FPU` module is the `fpu_context` structure which is also defined in the associated `reg<CPU Family>.h` header file for the target processor.

If a particular application needs to access the contents of the process context, it may use the size of these structures for indexing. Alternatively, the application can determine the size of the FPU context at runtime by accessing the kernel globals field, d_fpusize, which contains the size of the FPU context.

usp
: is a pointer to the new process stack image.

siglvl
: is the new signal level value.

This call is usually used by nested intercept routines to resume execution in the process at a different location from where the process was interrupted by the original signal. When this call is made, the operating system performs the following functions:

- Validates and copies the target process stack image from the memory buffer pointed to by the usp variable to the process' system-state stack
- Sets the process' signal mask to the value specified in the siglvl variable
- Returns to the process restoring the context copied from the user state process stack image

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

os_lib.l

See Also

_os_sigmask()
_os_send()

_os_sigmask()

Mask/Unmask Signals During Critical Code

Syntax

```
#include <signal.h>
#include <types.h>
error_code _os_sigmask(int32 mode);
```

The only function that `_os_sigmask` provides in system-state processes is to wake up that process. It does not interrupt code that is currently executing.

Description

`_os_sigmask()` enables signals to reach the calling process or disables signals from reaching the calling process. If a signal is sent to a process whose mask is disabled, the signal is queued until the process mask becomes enabled.

Signals are analogous to hardware interrupts and should be masked sparingly.

`mode`
: is the process signal level. (Input)

Table 2-16. _os_sigmask() Parameter Mode Values

If Mode Is	The Mask Level Is
`0`	Cleared
`1`	Set or incremented
`-1`	Decremented

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_sleep()`
`_os_wait()`

Example

To ensure that an entire structure can be cleared without the reception of a signal one might use:

```
_os_sigmask(1);
memset(sptr, 0, sizeof(*sptr));
_os_sigmask(-1);
```

The state of the signal mask is preserved using this method.

To avoid a race condition:

```
_os_sigmask(1);
sig_received = FALSE;
sleep(0);           * sleep does an implied
                            * _os_sigmask(0);
```

_os_sigreset()

Reset Signal Intercept Context Stack

Syntax

```
#include <signal.h>

error_code _os_sigreset(void);
```

Description

`_os_sigreset()` resets the context stack for a signal intercept. Normally, the operating system keeps the state of the process on the system stack while a signal intercept routine executes. If signals are unmasked during the intercept routine and another signal occurs before the intercept routine finishes, another state is pushed on the system stack.

Similarly, if the intercept routine does a `longjmps()`and then unmasks signals, more states are placed on the system stack by subsequent signals.

To prevent the system stack from overflowing, whenever a program uses `longjmp()` calls out of an intercept routine or unmasks signals in an interrupt service routine with the intent of never using `_os_rte()` to return, it should use `_os_sigreset()`:

```
if(setjmp(x) != 0) {
    _os_sigreset();
    _os_sigmask(-1);
}
```

If the code actually expects to return through the nested intercept routines with multiple `_os_rte()` calls, the states must be left where they are and `_os_sigreset()` should not be called.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_rte()`

_os_sigrs()

Resize Current Process' Signal Queue Block

Syntax

```
#include <signal.h>
#include <types.h>
error_code _os_sigrs(u_int32 signals);
```

Description

`_os_sigrs()` allows a process to change the maximum number of signals that are queued on its behalf.

`_os_sigrs()` can be used to increase or decrease the number of signals queued. An error is returned (EOS_PARAM) if a request is made to reduce the number of queued signals while there are signals pending. The initial default for the system is specified in the system `Init` module.

`signals`
: is the new maximum number of signals. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_sleep()

Put Calling Process to Sleep

Syntax

```
#include <signal.h>
#include <types.h>
error_code _os_sleep(
   u_int32 *ticks,
   signal_code *signal);
```

Description

`_os_sleep()` deactivates the calling process until the requested number of ticks have elapsed.

`_os_sleep()` cannot be used to time more accurately than ± 1 tick because it is not known when the `_os_sleep()` request was made during the current tick.

The system clock must be running to perform a timed sleep. The system clock is not required to perform an indefinite sleep or to give up a time slice.

`ticks`
: The length of time to sleep in ticks/second is passed at the location pointed to by `ticks`. (Input)

- If `ticks` is zero, the process sleeps indefinitely.
- If `ticks` is one, the process gives up a time slice but does not necessarily sleep for one tick.
- `_os_sleep()` stores the number of ticks left to sleep when awakened prematurely at the location pointed to by `ticks`. If `_os_sleep()` completes without interruption, `ticks` contains the value `0`.

`time`
: may be specified in system clock ticks; or, if the high order bit is set, the low 31 bits are considered a time in 256ths of a second.

`signal`
: is a pointer to the location where `_os_sleep()` stores the last signal the process received. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_send()`

`_os_wait()`

_os9_sleep()

Put Calling Process to Sleep

Syntax

```
#include <signal.h>
#include <types.h>
error_code _os9_sleep(u_int32 *ticks);
```

Description

`_os9_sleep()` deactivates the calling process until the requested number of ticks have elapsed.

`_os9_sleep()` cannot be used to time more accurately than ±1 tick because it is not known when the `_os9_sleep()` request was made during the current tick.

The system clock must be running to perform a timed sleep. The system clock is not required to perform an indefinite sleep or to give up a time slice.

`ticks`
: The requested number of ticks is passed at the location pointed to by `ticks`. (Input/Output)

- If `ticks` is zero, the process sleeps indefinitely.
- If `ticks` is one, the process gives up a time slice but does not necessarily sleep for one tick.
- `_os9_sleep()` stores the number of ticks left to sleep when awakened prematurely at the location pointed to by ticks. If `_os9_sleep()` completes without interruption, `ticks` contains the value `0`.

`time`
: may be specified in system clock ticks; or, if the high order bit is set, the low 31 bits are considered a time in 256ths of a second.

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_send()`

`_os_wait()`

_os_slink()

Install User Subroutine Module

Syntax

```
#include <module.h>
#include <types.h>
error_code _os_slink(
    u_int32 sub_num,
    const char *mod_name,
    void **lib_exec,
    void **mem_ptr,
    mh_com **mod_head);
```

Description

`_os_slink()` attempts to link or load the named module. It returns a pointer to the execution entry point and a pointer to the library's static data area for subsequent calls to the subroutine. The calling program must store and maintain the subroutine's entry point and data pointer. The calling program must also set the subroutine library's data pointer and dispatch to the correct subroutine.

You can remove a subroutine by passing a null pointer for the name of the module and specifying the subroutine number.

A process can link to a maximum of 16 subroutine libraries, numbered from `0` to `15`.

`sub_num`
: is the subroutine number. (Input)

  Only the lower 16 bits of `sub_num` are used.

`mod_name`
: is a pointer to the name of the subroutine module. (Input)

`lib_exec`
: is a pointer to the location where `_os_slink()` stores the pointer to the subroutine entry point. (Output)

`mem_ptr`
: is a pointer to the location where `_os_slink()` stores the pointer to the subroutine static memory. (Output)

`mod_head`
: is a pointer to the location where `_os_slink()` stores the pointer to the module header. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_tlink()`

_os_slinkm()

Install User Subroutine Library Module by Module Pointer

Syntax

```
#include <module.h>
#include <types.h>
error_code _os_slinkm(
    u_int32 sub_num,
    mh_com *mod_head,
    void **lib_exec,
    void **mem_ptr);
```

Description

`_os_slinkm()` is passed a pointer to the subroutine library module to install. It returns a pointer to the execution entry point and a pointer to the library's static data area for subsequent calls to the subroutine. The calling program must store and maintain the subroutine's entry point and data pointer. The calling program must also set the subroutine library's data pointer and dispatch to the correct subroutine.

`sub_num`
: is the subroutine number. (Input)

  Only the lower 16 bits of `sub_num` are used.

`mod_head`
: is a pointer to the module header. (Input)

`lib_exec`
: is a pointer to the location where `_os_slinkm()` stores the pointer to the subroutine library entry point. (Output)

`mem_ptr`
: is a pointer to the location where `_os_slinkm()` stores the pointer to the subroutine library static memory. (Output)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_slink()` `_os_tlink()`

_os_srqmem()

System Memory Request

Syntax

```
#include <memory.h>
#include <types.h>
error_code _os_srqmem(
    u_int32 *size,
    void **mem_ptr,
    u_int32 color);
```

Description

`_os_srqmem()` allocates a block of a specific memory type.

The byte count of allocated memory and the pointer to the allocated block must be saved if the memory is ever to be returned to the system.

`size`

The byte count of the requested memory is passed at the location pointed to by `size`. (Input/Output)

`_os_srqmem()` also stores the actual number of bytes allocated at the location pointed to by size. If size is `0xFFFFFFFF`, the largest block of free memory of the specified type is allocated to the calling process.

`mem_ptr`

is a pointer to the location where `_os_srqmem()` stores the pointer to the allocated memory block. (Output)

`color`

specifies the memory type. (Input)

Only the lower 16 bits of `color` are used.

- If `color` is non-zero, the search is restricted to memory areas of that color. The area with the highest priority is searched first.
- If `color` is zero, the search is based only on priority.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os9_srqmem()`
`_os_srtmem()`
`_os_mem()`

`F$SRqCMem`	*OS-9 for 68K Technical Manual*
`F_SRQMEM`	*OS-9 Technical Manual*

_os9_srqmem()

System Memory Request

Syntax

```
#include <memory.h>
#include <types.h>
error_code _os9_srqmem(
    u_int32 *size,
    void **mem_ptr);
```

Description

`_os9_srqmem()` allocates a memory block from the top of available RAM.

The byte count of allocated memory and the pointer to the allocated block must be saved if the memory is ever to be returned to the system.

`size`

The size of the memory block is passed at the location pointed to by `size`. (Input/Output)

`_os9_srqmem()` also stores the actual number of bytes allocated at the location pointed to by size. If size is `0xFFFFFFFF`, the largest block of free memory is allocated to the calling process.

`mem_ptr`

is a pointer to the location where `_os9_srqmem()` stores the pointer to the allocated memory block. (Output)

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_srtmem()`
`_os_mem()`
`_os_srqmem()`
`F$SRqMem` *OS-9 for 68K Technical Manual*

_os_srtmem()

Return System Memory

Syntax

```
#include <memory.h>
#include <types.h>
error_code _os_srtmem(
    u_int32 size,
    void *mem_ptr);
```

Description

`_os_srtmem()` deallocates memory when it is no longer needed.

`size`
: specifies the byte count of the returned memory. (Input)

`mem_ptr`
: is a pointer to the memory block to return. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_srqmem()`

`_os_mem()`

_os_ss_attr()

Set File Attributes

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_ss_attr(
    path_id path,
    u_int32 attr);
```

Description

`_os_ss_attr()` changes a file's attributes to the new value, if possible. You cannot set the directory bit of a non-directory file or clear the directory bit of a non-empty directory.

`path`
: specifies the path number of the file. (Input)

`attr`
: specifies the new values for the file attributes. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_break()

Send Break Conditional to Serial Line

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_ss_break(path_id path);
```

Description

`_os_ss_break()` sends a break conditional to the serial line.

`path`
: specifies the path number. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`I_SETSTAT, SS_BREAK` *OS-9 Technical Manual*

_os_ss_cache()

Enable/Disable RBF Caching

Syntax

```
#include <rbf.h>

#include <types.h>

error_code _os_ss_cache(
    path_id path,
    u_int32 enblflag,
    u_int32 drvcsize);
```

Description

`_os_ss_cache()` enables and disables RBF caching on an RBF device.

`path`
: specifies the path number. (Input)

`enblflag`
: is the cache enable/disable flag. (Input)

- If `enblflag` is zero, caching is disabled.
- If `enblflag` is non-zero, caching is enabled.

`drvcsize`
: is the memory size for the cache. (Input)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os9_ss_close()

Notify Driver that Path Has Been Closed

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os9_ss_close(path_id path);
```

Description

`_os9_ss_close()` notifies a driver that a path has been closed.

`path`
    specifies the path number that was closed. (Input)

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_dcoff()

Set Signal to Be Sent when DCDL Goes False

Syntax

```
#include <scf.h>
#include <types.h>
error_code _os_ss_dcoff(
    path_id path,
    signal_code signal);
```

Description

`_os_ss_dcoff()` sets the signal code to be sent when the Data Carrier Detect line becomes false.

`path`
: specifies the path number. (Input)

`signal`
: is the signal code to send. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_ss_dcon()`

_os_ss_dcon()

Set Signal to Be Sent when DCDL Goes True

Syntax

```
#include <scf.h>
#include <types.h>
error_code _os_ss_dcon(
    path_id path,
    signal_code signal);
```

Description

`_os_ss_dcon()` sets the signal code to be sent when the Data Carrier Detect line becomes true.

`path`
: specifies the path number. (Input)

`signal`
: is the signal code to send. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_ss_dcoff()`

_os_ss_dopt()

Set Device Path Options

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_ss_dopt(
    path_id path,
    u_int32 size,
    void *dopts);
```

Description

`_os_ss_dopt()` sets the initial (default) device path options (`dopts`). These options initialize new paths to the device.

`path`
: specifies the path number. (Input)

`size`
: specifies the size of the options area. (Input)

`dopts`
: is a pointer to the default options for the device. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_dsrts()
Disable RTS Line

Syntax

```
#include <scf.h>
#include <types.h>
error_code _os_ss_dsrts(path_id path);
```

Description

`_os_ss_dsrts()` disables the RTS line on serial devices.

`path`
specifies the path number. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT, SS_DSRTS`	*OS-9 Technical Manual*

_os_ss_enrts()

Enable RTS Line

Syntax

```
#include <scf.h>
#include <types.h>
error_code _os_ss_enrts(path_id path);
```

Description

`_os_ss_enrts()` enables the RTS line on serial devices.

`path`
: specifies the path number. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT, SS_ENRTS`	*OS-9 Technical Manual*

_os_ss_erase()

Erase Tape

Syntax

```
#include <sbf.h>
#include <types.h>
error_code _os_ss_erase(
    path_id path,
    u_int32 blocks);
```

Description

`_os_ss_erase()` erases a portion of the tape.

`path`
: specifies the tape drive's path number. (Input)

`blocks`
: specifies the number of blocks to erase. (Input)

- If `blocks` is `0xffffffff`, SBF erases until the end-of-tape is reached.
- If `blocks` is positive, SBF erases the amount of tape equivalent to that number of blocks.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_fd()

Write File Descriptor Sector

Syntax

```
#include <rbf.h>
#include <types.h>
error_code _os_ss_fd(
    path_id path,
    fd_stats *fdinfo);
```

Description

`_os_ss_fd()` changes the file descriptor sector data. The path must be open for write. To change the file descriptor sector data, you must first `read` the sector, `make` the changes, and then `write` the sector.

`path`
: specifies the path number. (Input)

`fdinfo`
: is a pointer to the file descriptor's buffer. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_fillbuff()

Fill Path Buffer with Data

Syntax

```
#include <scf.h>

#include <types.h>

error_code _os_ss_fillbuff(
    path_id path,
    char *buffer,
    u_int32 size);
```

Description

`_os_ss_fillbuff()` fills the input path buffer with the data in buffer.

`path`
: specifies the path number. (Input)

`buffer`
: is a pointer to the location of your buffer. (Input)

`size`
: specifies the size of your buffer. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_flushmap()

Flush Cached Bit Map Information for RBF Device

Syntax

```
#include <rbf.h>
#include <types.h>
error_code _os_ss_flushmap(
   path_id path);
```

Description

`_os_ss_flushmap()` flushes the cached bit map information for an RBF device. This is normally only performed after the bit `map` on the disk is changed by a utility such as format.

`path`
: is the path number for any file on the device or the entire device (for example, a path open to `/h0@`). (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_hdlink()

Make Hard Link to Existing File

Syntax

```
#include <rbf.h>
#include <types.h>
error_code _os_ss_hdlink(
    path_id path,
    char **link_path);
```

Description

`_os_ss_hdlink()` creates a new directory entry. This directory entry points to the file descriptor block of an open file. `_os_ss_hdlink()` updates the pathlist pointer.

`path`
: is the path number of an existing file. (Input)

`link_path`
: The new name for the directory entry is passed at the location pointed to by `link_path`. (Input/Output)

  `_os_ss_hdlink()` also stores the updated pathlist pointer at the location pointed to by `link_path`.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_link_adj()

Set Link Count of a File

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_ss_link_adj()(
   path_id  path,
   u_in32 fd_addr,
   int32 link_adj)
```

Description

This `I_SETSTAT` call sets the link count of a file. The link count of a file indicates the number of hard links in the file system that point to a particular file. This call can be used to correct the link count of files under corrupt file system conditions. File link counts can only be adjusted by super-user processes.

`path`	Input
`fd_addr`	Input
`link_adj`	Input

Attributes

Operating System:	OS-9
State:	User; System; I/O; IRQ
Threads:	Safe
Re-entrant:	Yes

Library

`oslib.l`

See Also

`_os_ss_hdlink()`

`_os_setstat()`

_os_ss_lock()

Lock Out Record

Syntax

```
#include <rbf.h>
#include <types.h>
error_code _os_ss_lock(
    path_id path,
    u_int32 size);
```

Description

`_os_ss_lock()` locks out a section of the file from the current file pointer position up to the specified number of bytes.

`path`
: is the file's path number.

`size`
: is the size of the section to lockout.

- If `size` is zero, all locks are removed (record lock, EOF lock, and file lock).
- If `size` is `$ffffffff`, the entire file is locked out regardless of the file pointer's location. This is a special type of file lock that remains in effect until released by an `_os_ss_lock()` with `size` set to zero, a `read` or `write` of zero bytes, or the file is closed.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_luopt()

Write Logical Unit Options

Syntax

```
#include &lt;sg_codes.h&gt;
#include &lt;types.h&gt;
error_code _os_ss_luopt(
    path_id path,
    u_int32 size,
    void *luopts);
```

Description

`_os_ss_luopt()` writes the logical unit options for a path to a buffer.

`path`
: is the path number. (Input)

`size`
: specifies the buffer size of the logical unit options area. (Input)

`luopts`
: is a pointer to the logical unit options. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os9_ss_open()

Notify Driver that Path Has Been Opened

Syntax

```
#include <modes.h>
#include <types.h>
error_code _os9_ss_open(path_id path);
```

Description

`_os9_ss_open()` is an internal call for drivers.

`path`
: specifies the path number.

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_popt()

Write Option Section of Path Descriptor

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_ss_popt(
   path_id path,
   u_int32 size,
   void *user_opts);
```

Description

`_os_ss_popt()` writes the option section of the path descriptor from the options buffer pointed to by `user_opts`.

`path`
: is the path number. (Input)

`size`
: specifies the buffer size. (Input)

`user_opts`
: is a pointer to the options buffer. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_gs_popt()`	
`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT`	*OS-9 Technical Manual*

_os_ss_relea()

Release Device

Syntax

```
#include <sg_codes.h>

#include <types.h>

error_code _os_ss_relea(path_id path);
```

Description

`_os_ss_relea()` releases the device from any `_os_ss_sendsig()`, `_os_ss_dcon()`, or `_os_ss_dcoff()` request made by the calling process.

`path`
: is the path number of the device to release. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_ss_sendsig()`

`_os_ss_dcoff()`

`_os_ss_dcon()`

_os_ss_rename()

Rename File

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_ss_rename(
    path_id path,
    const char *newname);
```

Description

`_os_ss_rename()` changes the file name in the file's associated directory entry to `newname`.

`path`
: is the file's path number. (Input)

`newname`
: is a pointer to the file's new name. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_reset()

Restore Head to Track Zero

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_ss_reset(
    path_id path);
```

Description

For RBF, `_os_ss_reset()` directs the disk head to track zero. It is used for formatting and error recovery. For SBF, `_os_ss_reset()` rewinds the tape.

`path`
  is the path number of the device. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_reten()

Retension Pass on Tape Drive

Syntax

```
#include <sbf.h>
#include <types.h>
error_code _os_ss_reten(path_id path);
```

Description

`_os_ss_reten()` performs a retention pass on the tape drive.

`path`
: is the path number of the tape drive. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_rfm()
Skip Tape Marks

Syntax

```
#include <sbf.h>
#include <types.h>
error_code _os_ss_rfm(
    path_id path,
    int32 marks);
```

Description

`_os_ss_rfm()` skips the number of tape marks specified in marks.

`path`
: is the tape drive's path number. (Input)

`marks`
: specifies the number of tape marks to skip. (Input)

  If marks is negative, the tape is rewound the specified number of marks.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_sendsig()

Send Signal on Data Ready

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_ss_sendsig(
   path_id path,
   signal_code signal);
```

Description

`_os_ss_sendsig()` sets up a signal to send to a process when an interactive device or pipe has data ready. `_os_ss_sendsig()` must be reset each time the signal is sent.

`path`
: specifies the path number of the process receiving the signal. (Input)

`signal`
: specifies the signal to send. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_ss_relea()`

_os_ss_size()

Set File Size

Syntax

```
#include <sg_codes.h>
#include <types.h>
error_code _os_ss_size(
    path_id path,
    u_int32 size);
```

Description

`_os_ss_size()` sets the size of the file associated with `path` to the specified size.

`path`
: is the file's path number. (Input)

`size`
: is the size of the file in bytes. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_skip()

Skip Blocks

Syntax

```
#include <sbf.h>
#include <types.h>
error_code _os_ss_skip(
    path_id path,
    int32 blocks);
```

Description

`_os_ss_skip()` skips the specified number of blocks.

`path`
: is the path number of the tape drive. (Input)

`blocks`
: specifies the number of blocks to skip. (Input)

  If `blocks` is negative, the tape is rewound the specified number of blocks.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_skipend()

Skip to End of Tape

Syntax

```
#include <sbf.h>

#include <types.h

error_code _os_ss_skipend(path_id path);
```

Description

`_os_ss_skipend()` skips the tape to the end of data. This enables you to append data to tapes on cartridge-type tape drives.

`path`
: is the path number of the tape drive. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_ticks()

Wait Specified Number of Ticks for Record Release

Syntax

```
#include <rbf.h>
#include <types.h>
error_code _os_ss_ticks(
    path_id path,
    u_int32 delay);
```

Description

`_os_ss_ticks()` may be used to cause an error (`EOS_LOCK`) to return to the user program if a file lock conflict still exists after the specified number of ticks have elapsed.

`path`
: is the path number. (Input)

`delay`
: specifies the delay interval. (Input)

- A delay of zero (RBF's default) causes sleep until the record is released.
- A delay of one indicates that if the record is not released immediately, an error is returned. If the high order bit is set, the lower 31 bits are converted from 256ths of a second to ticks before sleeping.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_wfm()

Write Tape Marks

Syntax

```
#include <sbf.h>
#include <types.h>
error_code _os_ss_wfm(
    path_id path,
    u_int32 marks);
```

Description

`_os_ss_wfm()` writes the specified number of tape marks.

`path`
: specifies the tape drive's path number. (Input)

`marks`
: specifies the number of tape marks to write. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_ss_wtrack()

Write (Format) Track

Syntax

```
#include <rbf.h>

#include <types.h>

error_code _os_ss_wtrack(
    path_id path,
    const void *trkbuf,
    const void *ilvtbl,
    u_int32 track,
    u_int32 head,
    u_int32 interleave);
```

Description

`_os_ss_wtrack()` causes a format track operation (used with most floppy disks) to occur. For hard or floppy disks with a "format entire disk" command, this formats the entire media only when the track number and side number are both zero.

`path`
: is the path number. (Input)

`trkbuf`
: is a pointer to the track buffer. (Input)

`ilvtbl`
: is a pointer to the interleave table. (Input)

  The interleave table contains byte entries of LBNs ordered to match the requested interleave offset.

`track`
: is the track number. (Input)

`head`
: is the side number. (Input)

`interleave`
: is the interleave value. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT`	*OS-9 Technical Manual*

_os_strap()

Set Error Trap Handler

Syntax

```
#include <settrap.h>
#include <types.h>
#include <regs.h>
error_code _os_strap(
    u_int32 *excpt_stack,
    strap *init_tbl);
```

Description

`_os_strap()` enables user programs to catch "process local" program exceptions, such as illegal instruction or divide-by-zero. If a user routine is not provided and one of these exceptions occurs, the program is aborted. An initialization table for a PowerPC platform might appear as follows:

```
strap errtab[] = {
    { STRAP_DATA, errtrap},
    { STRAP_INSTR, errtrap},
    { ~0, NULL}
};
```

The previous example is for the PowerPC platform. The `STRAP_DATA` and `STRAP_INSTR` macros are defined only for PowerPC, not necessarily for other platforms. When a user's exception routine is executed, it is called as if it had the following prototype:

```
void errtrap(
u_int32 vector_err, /* vector error number for exception */
u_int32 badpc,      /* PC where exception occurred */
u_int32 badaddr,    /* address that caused the exception */
...);               /* original register contents */
```

The variable arguments contain the previous values of registers that were modified between the exception and the call to the exception handler. Generally, the variable arguments contain the previous stack pointer and the previous values of the first three parameter registers.

The following sections provide details about the variable arguments for the various processors.

- **ARMv4 and ARMv4BE**

```
va_arg(vp, u_int32);    /* exception stack pointer */
va_arg(vp, u_int32);    /* exception r7 */
va_arg(vp, u_int32);    /* exception r8 */
```

```
va_arg(vp, u_int32);    /* exception r9 */
```

- **MIPS3000 and MIPS32**

```
va_arg(vp, u_int32);    /* exception stack pointer */
va_arg(vp, u_int32);    /* exception a0 */
va_arg(vp, u_int32);    /* exception a1 */
va_arg(vp, u_int32);    /* exception a2 */
```

- **MIPS64**

```
va_arg(vp, u_int64);    /* exception stack pointer */
va_arg(vp, u_int64);    /* exception a0 */
va_arg(vp, u_int64);    /* exception a1 */
va_arg(vp, u_int64);    /* exception a2 */
```

- **PowerPC**

```
va_arg(vp, u_int32);    /* exception stack pointer */
va_arg(vp, u_int32);    /* exception r3 */
va_arg(vp, u_int32);    /* exception r4 */
va_arg(vp, u_int32);    /* exception r5 */
```

- **SH-3 and SH-4**

```
va_arg(vp, u_int32);    /* exception stack pointer */
va_arg(vp, u_int32);    /* exception r4 */
va_arg(vp, u_int32);    /* exception r5 */
va_arg(vp, u_int32);    /* exception r6 */
```

- **SH-5m**

```
va_arg(vp, u_int64);    /* exception stack pointer */
va_arg(vp, u_int64);    /* exception r2 */
va_arg(vp, u_int64);    /* exception r3 */
va_arg(vp, u_int64);    /* exception r4 */
```

- **x86/Pentium**

```
va_arg(vp, u_int32);    /* exception stack pointer */
va_arg(vp, u_int32);    /* exception %eax */
```

`excpt_stack`
: is a pointer to the stack to use if an exception occurs. (Input)

  If `excpt_stack` is zero, `_os_strap()` uses the stack at the time of the exception.

`init_tbl`
: is a pointer to the service request initialization table. (Input)

PowerPC Users:
When catching the STRAP_FPU exception on PowerPC processors with hardware floating-point an additional variable argument is passed. The first variable argument is a copy of the PowerPC `fpscr` register at the time of the trapped floating-point exception.

You can disable an error exception handler by calling `_os_strap()` with an initialization table that specifies zero as the address of the routine(s) to remove.

- On OS-9 for 68K, the binding for this call performs conversions which allow compatibility with OS-9. If speed is a consideration, refer to `_os9_strap()`.
- Beware of exceptions in exception handling routines. They are usually not re-entrant.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$STrap`	*OS-9 for 68K Technical Manual*
`F_STRAP`	*OS-9 Technical Manual*

_os9_strap()

Set Error Trap Handler

Syntax

```
#include <settrap.h>
#include <regs.h>
#include <types.h>
error_code _os9_strap(
   u_int32 *excpt_stack,
   os9strap *init_tbl);
```

Description

`_os9_strap()` enables user programs to catch “process local” program exceptions such as illegal instructions and divide by zeroes.

`excpt_stack`

is a pointer to the stack to use if an exception occurs. (Input)

If `excpt_stack` is zero, `_os9_strap()` uses the current stack.

`init_tbl`

is a pointer to the service request initialization table. (Input)

The first field of the `init_tbl` should be the vector `OFFSET` of the exception vector on which to install the handler. The second field is the `OFFSET` from the next entry in `init_tbl` to the exception handling function for this vector. `init_tbl` may look like:

```
void ovferror();
void chkerror();
extern void os9_init_tbl();

os9strap *init_tbl = (os9strap *)os9_init_tbl;

_asm("os9strap_init_tbl: dc.w %0,
      ovferror-*-4", T_TRAPV << 2);
_asm(" dc.w %0, chkerror-*-4", T_CHK << 2);
_asm(" dc.w -1, -1");
```

To access the contents of the initialization table, `os9strap_init_tbl` in this example, you must define `os9_init_tbl` as if it were a function. For example, `os9strap *os9_init_tbl` would not generate PC-relative references, while `extern void os9_init_tbl()` forces the compiler to generate references into the code area. If a user routine is not provided and one of these exceptions occur, the program is aborted. You can disable an error exception handler by calling `_os9_strap()` with an initialization table that specifies zero as the offset to the routine(s) to remove.

Beware of exceptions in exception handling routines. They are usually not re-entrant.

Attributes

Operating System:	OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`F$STrap` *OS-9 for 68K Technical Manual*

_os_suspend()

Suspend Process

Syntax

```
#include <process.h>

#include <types.h>

error_code _os_suspend(process_id proc_id);
```

Description

`_os_suspend()` temporarily suspends a process. A super user (group ID zero) may suspend any process. A non-super user gets an `E_PERMIT` message returned.

`_os_suspend()` is currently not supported on OS-9 for 68K.

`proc_id`
    identifies the target process. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_aproc()`

_os_sysdbg()

Call System Debugger

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_sysdbg(
    void *param1,
    void *param2);
```

Description

`_os_sysdbg()` calls the system level debugger, if one exists.

When the system level debugger is active, it runs in system state and effectively stops timesharing. When used in user state, `_os_sysdbg()` can only be called by users in group zero. When used in system state, anyone may use `_os_sysdbg()`. Never use this call when other users are on the system.

You must enable the system debugger before installing breakpoints or attempting to trace instructions. If no system debugger is available, the system is reset. The system debugger handles some of the exception vectors directly. This makes it impossible to use the user debugger when the system debugger is enabled.

`param1` and `param2`
: are parameters passed to the debugger. These are currently not used. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_sysid()

Return System Identification Service Request

Syntax

```
#include <regs.h>
#include <types.h>
error_code _os_sysid(
    u_int32 *oem,
    u_int32 *serial,
    u_int32 *mpu_type,
    u_int32 *os_type,
    u_int32 *fpu_type,
    int32 *time_zone,
    u_int32 *kernel_ver,
    u_int32 *resv2,
    char *sys_ident,
    char *copyright,
    char *author);
```

Description

`_os_sysid()` returns the following information about the system:

Table 2-17. _os_sysid() Return Information

Pointer	Information Stored by _os_sysid()
`oem` (Output)	OEM identification number
`serial` (Output)	Copy serial number
`mpu_type` (Output)	Processor identifier (such as 68020/68030/68040/80386)
`os_type` (Output)	Kernel (OS) MPU configuration
`fpu_type` (Output)	Floating-point processor identifier (such as 68881 and 80387)
`time_zone` (Output)	System time zone in minutes offset from Greenwich Mean Time (GMT)
`kernel_ver` (Output)	The kernel's version number for OS-9 for 68K
`resv2` (Output)	A reserved pointer

Table 2-17. _os_sysid() Return Information (Continued)

Pointer	Information Stored by _os_sysid()
`sys_ident` (Output)	A pointer to an application buffer to copy the system identification message into. The buffer must be at least 80 bytes in length.
`copyright` (Output)	A pointer to an application buffer to copy the copyright message into. The buffer must be at least 80 bytes in length.
`author` (Output)	For OS-9: A pointer to an application buffer to copy the author message for OS-9. The buffer must be at least 80 bytes in length. For OS-9 for 68K: This parameter should be NULL.

On OS-9 for 68K, `time_zone` is always returned as `-1`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_thexit()

Exit a Thread

Syntax

```
#include <threads.h>
```

```
error_code _os_thexit(error_code status);
```

Description

`_os_thexit()` causes the calling thread to exit. If the calling program is not multi-threaded, the EOS_PERMIT error is returned.

If successful, `_os_thexit` does not return to the caller.

Threads created via `pthread_create()` should not use this call. Doing so will result in instability and loss of resources for the process.

`status`
: is the value to be returned to any thread waiting for this thread via an `_os_waitid()` call. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l, mt_os_lib.l`

See Also

`_os_thfork()`

_os_thfork()

Fork a Thread

Syntax

```
#include <threads.h>
error_code _os_thfork(
   thread_t        *thread,
   thread_attr_t   *attr,
   void            **stack_top,
   u_int32         *stack_size,
   void            *func,
   void            *arg,
   void            *data);
```

Description

`_os_thfork()` forks a new thread of control in the current process.

Threads created with `_os_thfork()` or `F_THFORK` are not permitted to use C library calls that have threading issues. Create threads with `pthread_create()`.

`thread`
: is a pointer to a `thread_t` object which is used to return the newly created thread's ID. (Input)

`attr`
: is a pointer to a thread attribute structure. (Input)

  The thread attribute structure is declared in `threads.h`.

`stack_top`
: is a pointer to the top of user stack to be used by this thread—`stack_top` will be the initial stack pointer for the thread. (Input)

`stack_size`
: If the value pointed to by `stack_size` is non-zero, the thread's user stack will be allocated by the system and a pointer to the allocated memory will be returned in the location pointed to by `stack_top`. The size of the actual stack allocated will be returned at `stack_size`.

  If `stack_size` points to zero, the value pointed to by `stack_top` will be used as the thread's stack. (Input/Output)

`func`
: is the address of the initial function to be executed by the forked thread. (Input)

`arg`
: is passed as the only argument to the function specified by `func`. (Input)

`data`
: is the address of thread’s thread-specific data. (Input)

  The pointer to void value pointed to by `data` is maintained on behalf of the thread. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l, mt_os_lib.l`

See Also

`_os_thexit()`

`_os_thread()`

_os_thread()

Set Thread Parameters

Syntax

```
#include <funcs.h>
#include <threads.h>
error_code _os_thread(
    u_int32    code,
    thread_t   thread_id,
    void       *arg);
```

Description

`_os_thread()` sets thread parameters for the thread specified by `thread_id` (input).

Threads created via `pthread_create()` should not use this call. Doing so will result in instability and loss of resources for the process.

`code`

is the subfunction to perform. (Input)

The legal values for `code` are `TH_ORPHAN` to orphan the thread and `TH_TSDATA` to set the thread specific data for the thread. Attempting to orphan an already orphaned thread will result in the error `EOS_THRD_INVLD`.

`arg`

If code is `TH_TSDATA`, `arg` is the thread specific data pointer. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l, mt_os_lib.l`

See Also

`_os_thexit()`

`_os_thfork()`

_os_tlink()

Install User/System State Trap Handling Module

Syntax

```
#include <module.h>
#include <types.h>
error_code _os_tlink(
    u_int32 trap_num,
    const char *mod_name,
    void **lib_exec,
    mh_trap **mod_head,
    void *params,
    u_int32  mem_size);
```

Description

`_os_tlink()` attempts to link or load the specified module. If a trap module already exists for the specified trap number, an error is returned. If static storage is required for the trap handler, it is allocated and initialized.

OS-9 only allows trap handlers to run in system state. OS-9 for 68K allows trap handlers to run in either system state or user state.

`trap_num`
: specifies the user trap number. (Input)

  On OS-9 for 68K valid trap numbers are in the range 1 through 15. On OS-9 valid trap numbers vary from processor to processor, but are generally in the range 0 through 15. See the include file in `/MWOS/OS9000/proc/DEFS` for the macros `TLINK_MIN` and `TLINK_MAX`.

`mod_name`
: is a pointer to the name of the trap module. (Input)

  If `mod_name` is zero or points to a null string, the trap handler is unlinked.

`lib_exec`
: is a pointer to the location where `_os_tlink()` stores the pointer to the trap execution entry point. (Output)

`mod_head`
: is a pointer to the location where `_os_tlink()` stores the pointer to the trap module. (Output)

`params`
: is a pointer to any additional parameters. (Input)

  Currently, this is not implemented.

`mem_size`
: specifies the additional memory size. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_tlinkm()

Install User Trap Handling Module by Module Pointer

Syntax

```
#include <module.h>
#include <types.h>
error_code _os_tlinkm(
    u_int32 trap_num,
    mh_com *mod_head,
    void **lib_exec,
    void *params,
    u_int32 mem_size);
```

Description

`_os_tlinkm()` is passed a pointer to the module to install. If a trap module already exists for the specified trap number, an error is returned. If static storage is required for the trap handler, it is allocated and initialized.

`trap_num`
: specifies the user trap number (`1` through `15`). (Input)

`mod_head`
: is a pointer to the module header. (Input)

`lib_exec`
: is a pointer to the location where `_os_tlinkm()` stores the pointer to the trap execution entry point. (Output)

`params`
: is a pointer to the additional parameters, if necessary. (Input)

`mem_size`
: specifies the additional memory size. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_tranpn()

Translate User Path to System Path

Syntax

```
#include <io.h>
#include <types.h>
error_code _os_tranpn(
    process_id proc_id,
    path_id user_path,
    path_id *sys_path);
```

Description

`_os_tranpn()` translates a user path number to a system path number. System-state processes use this call to access the user paths (standard I/O paths).

`proc_id`
: specifies the process ID. (Input)

`user_path`
: specifies the user path to translate. (Input)

`sys_path`
: is a pointer to the location where `_os_tranpn()` stores the mapped system path. (Output)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_transadd()

Translate Memory Address

Syntax

```
#include <virtual.h>

#include <types.h>

error_code _os_transadd(
    u_int32 *size,
    u_int32 mode,
    void **blk_addr,
    void *reserved);
```

Description

`_os_transadd()` translates an address to or from its external bus address.

`size`

The size of the block to translate is passed at the location pointed to by `size`. (Input/Output)

`_os_transadd()` also stores the size of the block translated at the location pointed to by `size`.

`mode`

specifies the type of translation. (Input)

- If `mode` is zero, the local CPU address is translated to the external bus address.
- If `mode` is one, the external bus address is translated to the local CPU address.

`blk_addr`

The address of the block to translate is passed at the location pointed to by `blk_addr`. (Input/Output)

`_os_transadd()` also stores the block that was translated at the location pointed to by `blk_addr`. `_os_transadd()` is used when the external bus address must be passed to hardware devices, such as DMA-type controllers.

If the specified source block is nonlinear with respect to its destination mapping, `_os_transadd()` returns the maximum number of bytes accessible at the translated address.

`reserved`

is a pointer reserved for future use. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os9_translate()

Translate Memory Address

Syntax

```
#include <memory.h>
#include <types.h>
error_code _os9_translate(
   u_int32 *size,
   u_int32 mode,
   void **blk_addr);
```

Description

`_os9_translate()` translates an address to or from its external bus address. If the specified source block is nonlinear with respect to its destination mapping, `_os9_translate()` returns the maximum number of bytes accessible at the translated address.

`_os9_translate()` is only available if colored memory is enabled.

`size`

The size of the block to translate is passed at the location pointed to by `size`. (Input/Output)

`_os9_translate()` also stores the size of the block translated at the location pointed to by `size`.

`mode`

specifies the type of translation. (Input)

- If `mode` is zero, the local CPU address is translated to the external bus address.
- If `mode` is one, the external bus address is translated to the local CPU address.

`blk_addr`

The address of the block to translate is passed at the location pointed to by `blk_addr`. (Output)

`_os9_translate()` also stores the block that was translated at the location pointed to by `blk_addr`.

`_os9_translate()` is used when the external bus address must be passed to hardware devices, such as DMA-type controllers.

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_uacct()

User Accounting

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_uacct(
    u_int32 acct_code,
    pr_desc *proc_desc);
```

Description

`_os_uacct()` provides a means for users to set up an accounting system. `_os_uacct()` is called by the kernel whenever it forks or exits a process. This provides a mechanism for users to keep track of system operators.

To install a handler for this service request, the `_os_setsvc()` system call must be used to add the user's accounting routine to the system's service request dispatch table. This is usually done in an `OS9P2` module.

You may perform your own system accounting by calling `_os_uacct()` with a user defined `acct_code` identifying the operation to perform. For example, when the kernel forks a process it identifies the operation by passing the `F_FORK` code to the accounting routine.

`acct_code`
: is the operation identifier. `reserved` is a pointer reserved for future use. (Input)

  This is usually a system call function code. Only the lower 16 bits of `acct_code` are used.

`proc_desc`
: is a pointer to the current process descriptor. `reserved` is a pointer reserved for future use. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

_os_unlink()

Unlink Module by Address

Syntax

```
#include <module.h>
#include <types.h>
error_code _os_unlink(mh_com *mod_head);
```

Description

`_os_unlink()` informs the system that the calling process no longer needs the module and decrements the module's link count.

Some modules, such as device drivers in use and all modules included in the bootfile, cannot be unlinked.

`mod_head`
is a pointer to the module header.

`reserved`
`is a pointer reserved for future use. (Input)`

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_unload()`

`F$UnLink`	*OS-9 for 68K Technical Manual*
`F_UNLINK`	*OS-9 Technical Manual*

_os_unload()

Unlink Module by Name

Syntax

```
#include <module.h>
#include <types.h>
error_code _os_unload(
    const char *mod_name,
    u_int32 type_lang);
```

Description

`_os_unload()` locates the module specified by `mod_name` in the module directory and decrements its link count.

`mod_name`
: is a pointer to the module name. (Input)

`type_lang`
: specifies the module's type and language. (Input)

  Only the lower 16 bits of `type_lang` are used.

Library

`os_lib.l`

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

See Also

`_os_unlink()`

`F$UnLoad`	*OS-9 for 68K Technical Manual*
`F_UNLOAD`	*OS-9 Technical Manual*

_os_usema_create()

Create New Usemaphore

Syntax

```
#include <semaphore.h>
#include <types.h>
error_code _os_usema_create(
    usema_id *us_id,
    const char *name,
    u_int32 value,
    u_int32perm,
    u_int32 color);
```

Description

`_os_usema_create()` allows you to create usemaphores dynamically as needed. When a usemaphore is created, an initial value is specified, as well as the permissions and memory color from which to allocate the usemaphore. Subsequent `_os_usema` calls use the returned ID number to refer to the created usemaphore.

A usemaphore and an event (see `_os_ev_create`) may not have the same name.

`us_id`
: is a pointer to the location where _os_usema_create() stores the usemaphore identifier. (Output)

`name`
: is a pointer to the usemaphore name string. (Input)

`value`
: specifies the initial usemaphore value. Only 0 or 1 may be passed. (Input)

`perm`
: specifies the access permissions. (Input)

  Only the lower 16 bits of perm are used.

`color`
: specifies the memory type for the usemaphore structure. (Input)

  Only the lower 16 bits of color are used.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_usema_unlink`

`_os_usema_delete`

`F_EVENT, EV_CREAT | F_USEMA` *OS-9 Technical Manual*

_os_usema_delete()

Delete an Existing Usemaphore

Syntax

```
#include <semaphore.h>
#include <types.h>
error_code _os_usema_delete(const char *name);
```

Description

`_os_usema_delete()` removes a usemaphore from the system usemaphore table, freeing the entry for use by another usemaphore. A usemaphore may not be deleted unless its use count is zero.

`name`
: is a pointer to the usemaphore's name string. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_usema_create`

`_os_usema_unlink`

`F_EVENT, EV_DELET | F_USEMA` *OS-9 Technical Manual*

_os_usema_link()

Link to Existing Usemaphore by Name

Syntax

```
#include <semaphore.h>
#include <types.h>
error_code _os_usema_link(
   usema_id *us_id);
   const char *name,
```

Description

`_os_usema_link()` determines the ID number of an existing usemaphore. Use `_os_usema_unlink()` to unlink from a usemaphore when it is no longer needed. The operating system will automatically unlock, if necessary, and unlink any usemaphores still linked when a process terminates.

`us_id`
: is a pointer to the location where `_os_usema_link()` stores the usemaphore identifier. (Output)

`name`
: is a pointer to the usemaphore name string. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_usema_unlink`

`F_EVENT, EV_LINK | F_USEMA` *OS-9 Technical Manual*

_os_usema_p()

Acquire Ownership of a Usempahore

Syntax

```
#include <semaphore.h>
#include <types.h>
error_code _os_usema_p(
    usema_id us_id,
    signal_code *signal);
```

Description

`_os_usema_p()` waits for the ownership of a usemaphore. If the usemaphore is currently owned by a process this function will block until the owner releases the usemaphore and the caller is granted ownership.

If the specified usemaphore has been automatically unlocked by the operating system and not reset (refer to `_os_usema_reset()`) the error `EOS_USRST` will be returned.

`us_id`
: identifies the usemaphore. (Input)

`signal`
: is a pointer to the location where _os_usema_p() stores the signal code. (Output)

  If a process in the usemaphore queue receives a signal, it is activated even though ownership has not been granted. An error is returned in this case.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_usema_v`

`_os_usema_try_p`

`_os_usema_reset`

`F_EVENT, EV_WAIT | F_USEMA`

_os_usema_reset()

Reset a Usemaphore for Normal Operation

Syntax

```
#include <semaphore.h>
#include <types.h>
error_code _os_usema_reset(usema_id us_id);
```

Description

`_os_usema_reset()` waits for the ownership of a usemaphore and then clears the need for a reset. This is a non-blocking call. If the usemaphore needs to be reset the caller will immediately be granted ownership. If not, the `EOS_USNORST` error will be returned.

A usemaphore would need to be reset after the operating system automatically unlocks a locked usemaphore because the owning process terminated.

Release ownership of the usemaphore with `_os_usema_v()`.

`us_id`
: identifies the usemaphore. (Input)

`signal`
: is a pointer to the location where `_os_usema_p()` stores the signal code. (Output)

  If a process in the usemaphore queue receives a signal, it is activated even though ownership has not been granted. An error is returned in this case.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_usema_p`

`_os_usema_try_p`

`_os_usema_v`

`F_EVENT, EV_RESET | F_USEMA` *OS-9 Technical Manual*

_os_usema_try_p()

Acquire Ownership of a Usempahore Without Blocking

Syntax

```
#include <semaphore.h>
#include <types.h>
error_code _os_usema_tryp(usema_id us_id);
```

Description

`_os_usema_tryp()` tries to acquire the ownership of a usemaphore. If the usemaphore is currently owned by a process this function returns immediately with the error EAGAIN.

If the specified usemaphore has been automatically unlocked by the operating system and not reset (refer to `_os_usema_reset()`) the error `EOS_USRST` will be returned.

`us_id`
: identifies the usemaphore. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_usema_p`

`_os_usema_v`

`_os_usema_reset`

`F_EVENT, EV_TRYWAIT | F_USEMA`

_os_usema_unlink()

Unlink Usemaphore

Syntax

```
#include <semaphore.h>
#include <types.h>
error_code _os_usema_unlink(usema_id us_id);
```

Description

`_os_usema_unlink()` decrements the use count of a usemaphore. When the use count reaches zero, you can delete the usemaphore using `_os_usema_delete()`.

`us_id`
: identifies the usemaphore. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_usema_create`

`_os_usema_link`

`F_EVENT, EV_UNLINK | F_USEMA` *OS-9 Technical Manual*

_os_usema_v()

Release Usemaphore Ownership

Syntax

```
#include <semaphore.h>
#include <types.h>
error_code _os_usema_v(usema_id us_id);
```

Description

`_os_usema_v()` releases ownership of the usemaphore. Then, the usemaphore queue is searched for a process waiting for the usemaphore.

Any usemaphores that are owned by a process at process termination time are automatically released.

`us_id`
: specified the usemaphore to release. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_usema_p`

`F_EVENT, EV_WAIT | F_USEMA` *OS-9 Technical Manual*

_os_vmodul()

Verify Module

Syntax

```
#include <module.h>
#include <types.h>
error_code _os_vmodul(
    mh_com *mod_head,
    mh_com *mod_block,
    u_int32 block_size);
```

Description

`_os_vmodul()` checks the module header parity and CRC bytes of an OS-9 module. If the header values are valid, the module is entered into the module directory. The current module directory is searched for another module with the same name. If a module with the same name and type exists, the module with the highest revision level is retained in the module directory. Ties are broken in favor of the established module.

`mod_head`
: is a pointer to the address of the module. (Input)

`mod_block`
: is a pointer to the memory block containing the module. (Input)

`block_size`
: specifies the size of the memory block containing the module. (Input)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_crc()`

`_os_load()`

_os9_vmodul()

Validate Module

Syntax

```
#include <module.h>
#include <types.h>
error_code _os9_vmodul(
    u_int32 mod_group,
    u_int32 size,
    mh_com *mod_head,
    mod_dir **dir_entry);
```

Description

`_os9_vmodul()` checks the module header parity and CRC bytes of an OS-9 module. If the header values are valid, the module is entered into the module directory, and a pointer to the directory entry is returned. The current module directory is searched for another module with the same name. If a module with the same name and type exists, the module with the highest revision level is retained in the module directory. Ties are broken in favor of the established module.

`mod_group`
: specifies the beginning of the module group (ID). (Input)

`size`
: is the size of the module. (Input)

`mod_head`
: is a pointer to the module. (Input)

`dir_entry`
: is a pointer to the location where `_os9_vmodul()` stores the pointer to the directory entry. (Output)

Attributes

Operating System:	OS-9 for 68K
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_crc()`
`_os_load()`

_os_wait()

Wait for Child Process to Terminate

Syntax

```
#include <process.h>
#include <types.h>
error_code _os_wait(
    process_id *child_id,
    status_code *status);
```

Description

`_os_wait()` deactivates the calling process until a child process terminates by executing an `_os_exit()` system call or is otherwise terminated. The child's ID number and exit status are returned to the parent. If the child process died due to a signal, status contains the signal code.

If a signal is received by a process waiting for children to terminate, the process is activated. In this case, `child_id` contains zero, because no child process has terminated.

`child_id`
: is a pointer to the location where `_os_wait()` stores the process ID of the terminating child. (Output)

`status`
: is a pointer to the location where `_os_wait()` stores the child process' exit status code. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_exit()`

`_os_fork()`

`_os_send()`

`F$Wait`	*OS-9 for 68K Technical Manual*
`F_WAIT`	*OS-9 Technical Manual*

_os_waitid()

Wait for a Specified Process or Thread to Exit

Syntax

```
#include <process.h>
error_code _os_waitid(
process_id   *child_id,
error_code   *status,
signal_code  *signal,
u_int32      wait_flag);
```

Description

`_os_waitid()` has two primary functions:

- waiting for a child process or sibling thread

To specify a wait related activity, `wait_flag` should be 0.

`child_id` — The value pointed by `child_id` specifies the process or thread to wait for. If the value of `child_id` is the ID of a thread, the caller must be a thread in the same process as `child_id`. Otherwise an `EOS_IPRCID` error is returned. (Input)

`status` — If the call is successful, the exit code of `child_id` is returned in the location pointed to by `status`. (Output)

`signal` — If the wait is interrupted by a signal, a value of `EOS_BSIG` is returned by `_os_waitid()` and the value of the signal that caused the interruption is stored in the location pointed to by `signal`. (Output)

- controlling a signal for the death of a child process or sibling thread

`wait_flag` — To specify a signal related activity, `wait_flag` should be non-zero. The valid values for `wait_flag` are `WT_SIGNAL` and `WT_RELEASE`. (Input)

When `wait_flag` is `WT_SIGNAL` it specifies that the caller wants to receive a signal when the process or thread specified by `child_id` terminates. The value of the signal to be sent is pointed to by `signal`. If the process or thread specified by `child_id` has already terminated, the signal is sent immediately.

When `wait_flag` is `WT_RELEASE` it specifies that the caller is no longer interested in getting a signal on the termination of the process or thread specified by `child_id`. The value pointed to by `signal` is irrelevant in this case.

The value pointed to by `status` is not modified when `wait_flag` is non-zero.

`_os_waitid()` returns when `wait_flag` is non-zero; it never blocks, regardless of the state of the child.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l, mt_os_lib.l`

See Also

`_os_exit()`

`_os_thexit()`

`_os_wait()`

_os_waitlk()

Activate Next Process Waiting to Acquire Lock

Syntax

```
#include <lock.h>
#include <types.h>
error_code _os_waitlk(
    lk_desc *lock,
    signal_code *signal);
```

Description

`_os_waitlk()` activates the next process waiting to acquire the lock. The next process in the lock's queue is activated and granted exclusive ownership of the resource lock. If no other process is waiting on the lock, the lock is simply marked free for acquisition. The calling process in either case is suspended and inserted into a waiting queue for the resource based on relative scheduling priority.

`lock`
: is a pointer to the lock on which to wait. (Input)

`signal`
: is a pointer to the location where `_os_waitlk()` stores the received signal. (Output)

  If a process receives a signal while waiting on a lock, the process is activated without gaining ownership of the lock.

  The process returns from the wait lock call with an `EOS_SIGNAL` error code and the signal code is returned through the signal pointer.

  If an `S_WAKEUP` signal is received by a waiting process, the signal code does not register and is zero.

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`lock.l`

See Also

`_os_acqlk()`	`_os_caqlk()`
`_os_crlk()`	`_os_ddlk()`
`_os_dellk()`	`_os_rellk()`
`F_WAITLK`	*OS-9 Technical Manual*

_os_write()

Write Data to File or Device

Syntax

```
#include <modes.h>
#include <types.h>
error_code _os_write(
    path_id path,
    void *buffer,
    u_int32 *count);
```

Description

`_os_write()` outputs bytes to a file or device associated with the specified path number. The path must be opened or created in the write or update access modes.

Data is written to the file or device without processing or editing. If data is written past the present end-of-file, the file is automatically expanded.

If the device is opened in block mode (`S_IBLKMODE`), the `count` parameter passed must be a multiple of the block size of the device, whereas in non-block mode it is interpreted as the number of bytes to read.

On RBF devices, any record that was locked is released.

`path`
: is the specified path number for the file or device. (Input)

`buffer`
: is a pointer to the data buffer. (Output)

`count`
: The number of bytes to write is passed at the location pointed to by count. (Input/Output)

: `_os_write()` also stores the number of bytes written at the location pointed to by count.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_open()` `_os_create()`
`_os9_create()` `_os_writeln()`

_os_writeln()

Write Line of Text with Editing

Syntax

```
#include <modes.h>
#include <types.h>
error_code _os_writeln(
    path_id path,
    void *buffer,
    u_int32 *count);
```

Description

`_os_writeln()` outputs bytes to a file or device associated with the specified path number. The path must have been opened or created in write or update access modes. `_os_writeln()` writes data until it encounters a carriage return character or `count` bytes. Line editing is also activated for character-oriented devices such as terminals and printers.

If the device is opened in block mode (`S_IBLKMODE`), the `count` parameter passed must be a multiple of the block size of the device, whereas in non-block mode it is interpreted as the number of bytes to read.

On RBF devices, any record that was locked is released.

`path`
: is the path number of the file or device. (Input)

`buffer`
: is a pointer to the location where the bytes to be written are placed. (Output)

`countT`
: he number of bytes to write is passed at the location pointed to by `count`. (Input/Output)

  `_os_writeln()` also stores the number of bytes written at the location pointed to by `count`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_open()` `_os9_create()`
`_os_create()` `_os_write()`

_os_yield()

Yield the Processor

Syntax

```
#include <process.h>
error_code _os_yield(void);
```

Description

`_os_yield()` causes the calling process or thread to be placed back into the active queue. The active queue contents are aged and the highest aged process is given control of the processor. In other words, `_os_yield()` causes the operating system to advance to the next executable process or thread. It is possible that the next executable process or thread will be the one that called `_os_yield()`. The status of the process' or thread's signal mask remains unchanged during this system call. `_os_yield()` is much like `_os_sleep()` with a tick count of 1, except that signals are not implicitly unmasked.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`os_lib.l`

See Also

`_os_sleep()`

outc()

Write Character to I/O Address

Syntax

```
#include <regs.h>
#include <types.h>
void outc(
    void *address,
    u_int32 data);
```

Description

`outc()` writes a character to an I/O address on the 80x86 processors or memory address on all other processors.

`data`

specifies the character to write. (Input)

Only the lower 8 bits are used.

`address`

specifies the I/O or memory address. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

See Also

`outl()`

`outw()`

`inc()`

`inl()`

`inw()`

outl()

Write Integer to I/O Address

Syntax

```
#include <regs.h>
#include <types.h>
void outl(
    void *address,
    u_int32 data);
```

Description

`outl()` writes a long value to the I/O address on the 80x86 or the memory address on all other processors.

`data`
: specifies the long value to write. (Input)

`address`
: specifies the I/O or memory address. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

See Also

`outc()`

`outw()`

`inc()`

`inl()`

`inw()`

outw()

Write Word to I/O Address

Syntax

```
#include <regs.h>
#include <types.h>
void outw(
    void *address,
    u_int32 data);
```

Description

`outw()` writes a word to the I/O address on the 80x86 or the memory address on all other processors.

`data`
: specifies the word to write. (Input)

  Only the lower 16 bits are used.

`address`
: specifies the I/O or memory address. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

See Also

`outc()`

`outl()`

`inc()`

`inl()`

`inw()`

_parsepath()

Parse Disk File (RBF) Pathlist

Syntax

```
#include <strings.h>
int _parsepath(const char *string);
```

Description

`_parsepath()` parses a disk file (RBF) pathlist. `_parsepath()` is useful for programs that must determine the validity of a pathlist name without actually creating or opening a file.

`_parsepath()` returns the number of bytes in the valid pathlist. If RBF does not accept the pathlist as valid, `_parsepath()` returns `-1`.

`string`
: is a pointer to the pathlist to parse. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_prsnam()`	
`F$PrsNam`	*OS-9 for 68K Technical Manual*
`F_PRSNAM`	*OS-9 Technical Manual*

pause()
Wait for Signal

Syntax

```
#include <signal.h>
int pause(void);
```

Description

`pause()` suspends a task until a signal is received. `pause()` always returns `-1` unless the received signal caused the process to terminate. In this case, `pause()` never returns.

The thread enabled version of this function contains a cancel point. For more information see *Using OS-9 Threads*.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`kill()`
`_os_sleep()`
`_os9_sleep()`
`sleep()`

`F$Sleep`	*OS-9 for 68K Technical Manual*
`F_SLEEP`	*OS-9 Technical Manual*

pclose()

Close a Pipe from/to a Process

Syntax

```
#include <UNIX/os9def.h>

#include <stdio.h>

int pclose(FILE *stream)
```

Description

`pclose()` closes a pipe from or to a process that was opened by `popen()`. `pclose()` waits for the associated process to terminate and returns the exit status of the command.

`stream`
: is a pointer to the file. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

See Also

`popen()`

perror()

Map Error Number

Syntax

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

```
void perror(const char *chptr);
```

Description

`perror()` maps the error number in `errno` to an error message.

The contents of the error message strings are the same as those returned by `strerror()` with parameter `errno`.

`chptr`

is a pointer to a character. (Input)

If `chptr` is not a null pointer and the character pointed to by `chptr` is not a null character, `perror()` writes a sequence of characters to the standard error stream. The sequence written contains `chptr`, a colon (`:`), a space, and an appropriate error message string followed by a newline character.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`clib.l`

See Also

`strerror()`

pffinit()

Initialize for Float Output (Obsolete)

Syntax

```
int pffinit(void);
```

Description

`pffinit()` was used on the 6809 C compiler to allow `printf()` to perform `float` and `double` conversions. A dummy function named `pffinit()` exists here for 6809/68000 portability.

`pffinit()` is historical and may be removed in a future release.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

pflinit()

Initialize for Longs Output (Obsolete)

Syntax

```
int pflinit(void);
```

Description

`pflinit()` was used on the 6809 C compiler to allow `printf()` to perform `long int` conversions. A dummy function named `pflinit()` exists here for 6809/68000 portability.

`pflinit()` is historical and may be removed in a future release.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

pipe()

Create an Interprocess Communication Channel

Syntax

```
#include <UNIX/os9def.h>

int pipe(unsigned int fd[2]);
```

Description

`pipe()` creates an I/O mechanism called a pipe and returns 2 path numbers, `fd[0]` and `fd[1]`. The standard programming model is that after the pipe has been set up, two (or more) cooperating processes (created by subsequent `_os_exec` calls) passes data through the pipe using `read` and `write` I/O calls.

If an error occurs, the `pipe`() returns `-1` and sets the global variable `errno` to indicate the error.

`fd[0] and fd[1]`
: These paths are open for `read` and `write` access. (Output)

  When the pipe is written, up to 4 KB of data are buffered before the writing process is blocked. Data read from one of the paths accesses data written to either of the paths on a FIFO (first-in-first-out) basis.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

If `pipe()` is called from system-state, `fd[0]` and `fd[1]` will refer to the same system-state path number and the use count on the path will be two.

Library

`unix.l`

See Also

`pclose()`

`popen()`

popen()

Open a Pipe From/To a Process

Syntax

```
#include <UNIX/os9def.h>
#include <stdio.h>
FILE *popen(
    const char *command,
    const char *type);
```

Description

`popen()` opens a pipe from or to a process. The arguments to `popen()` are pointers to null-terminated strings containing, respectively, a shell command line and an I/O mode, either `r` for reading or `w` for writing. `popen()` creates a pipe between the calling process and the command to be executed. The value returned is a stream pointer such that you can write to the standard input of the command, if the I/O mode is `w`, by writing to the file stream. If the I/O mode was `r`, you can read from the standard output of the command by reading from the file stream. A stream opened by `popen()` should be closed with `pclose()` which waits for the associated process to terminate and returns the exit status of the command.

`command`
: is the command written to. (Input)

`type`
: is the character mode. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

See Also

`pclose()`

`pipe()`

`popen()`

pow()

Power Function

Syntax

```
#include <math.h>
double pow(
    double x,
    double y);
```

Description

`pow()` returns `x` (input) raised to the `y` (input) power. A domain error occurs, `EDOM` stored in `errno`, if `x` is negative. A domain error also occurs if both `x` and `y` are zero. A range error, `ERANGE` stored in `errno`, occurs on underflow and overflow. `pow()` returns `HUGE_VAL` for both errors.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

Possible Errors

`EDOM`

`ERANGE`

_prealloc_rand()

Return No Error in Calls to Rand

Syntax

```
#include stdlib.h
error_code _prealloc_rand(void);
```

Description

`_prealloc_rand` can be called to ensure that future calls to `rand` do not return an error.

`_prealloc_rand` returns `SUCCESS` if successful. Otherwise it returns an error number.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe
Re-entrant:	No

Library

`clib.l`

prerr()

Print Error Message

Syntax

```
#include <stdio.h>
int prerr(
    int path,
    int errnum);
```

Description

`prerr()` prints an error message corresponding to an error number on the standard error path.

`preer()` prints a message in the form "`Error #ggg:sss`" where `ggg` is the group number of the error and `sss` is the specific error number within the group. If path is non-zero, the opened error message file is searched for further text related to the error. If more text is available, it is printed.

`path`
: is the path number of the error message file. (Input)

`errnum`
: is the error number. (Input)

It is divided into two numbers.

- OS-9 for 68K: Error numbers are 2 bytes wide. The most significant byte is the error's group number, and the least significant byte is the specific error within that group.
- OS-9: Error numbers are 4 bytes wide. The most significant 2 bytes are the error's group number, and the least significant 2 bytes are the specific error within that group.

Example

```
prerr(0, 216)                                  /* function call */
Error #000:216                                 /* output */
prerr(errmsg_path, 216)                        /* function call */
Error #000:216 (E$PNNF) File not found         /* output line 1 */
The pathlist does not lead to any known file. /* output line 2 */
```

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe

Re-entrant: Yes

Library

`sys_clib.l`

See Also

`_os_perr()`

`F$PErr` *OS-9 for 68K Technical Manual*

_prgname()
Get Module Name

Syntax

```
#include <module.h>
```

```
char *_prgname(void);
```

Description

`_prgname()` returns a pointer to the name of the calling module. Normally, the `argv[0]` string indicates the name of the program as called by the parent process with `os9exec()`. You can use `_prgname()` to determine the actual name of the module as it appears in the module directory.

If the code that calls `_prgname()` is executing in a trap handler, the name of the trap handler module is returned.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_errmsg()`

`os9exec()`

printf()

Formatted Output

Syntax

```
#include <stdio.h>

int printf(const char *format, ...);
```

Description

`printf()` is a standard C library function that performs formatted output to `stdout`. It converts, formats, and prints any parameters as indicated by the control string.

`printf()` returns the number of characters transmitted, or a negative value if an output error occurred.

The `sclib.l` and `sclib.il` libraries contain a smaller version of the `printf()` function. Refer to the *Using Ultra C/C++* manual for more information about the small library functions.

`format`
: is a pointer to a control string. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fprintf()`

`scanf()`

`sprintf()`

_prsnam()

Parse Path Name Segment

Syntax

```
#include <strings.h>
int _prsnam(const char *string);
```

Description

`_prsnam()` parses a path name segment.

`_prsnam()` returns the number of characters in a valid path name segment. If the path name segment is invalid, `-1` is returned. Use `_parsenam()` to determine if a path is a valid disk file (RBF) pathlist.

You can use successive calls to `_prsnam()` to parse a complete path name.

`string`
: is a pointer to the path name segment. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_prsnam()`

`F$PrsNam`	*OS-9 for 68K Technical Manual*
`F_PRSNAM`	*OS-9 Technical Manual*

pthread_attr_destroy()

Free Thread Attribute Object

Syntax

```
#include <pthread.h>

int pthread_attr_destroy(pthread_attr_t *attr);
```

Description

`pthread_attr_destroy()`tells the library that a pthread attribute, `attr`, will no longer be used. The attribute, in effect, becomes uninitialized. If successful, it returns a value of 0; otherwise, an error.

`attr`
is a pointer to an initialized pthread attribute object. (Input)

Example

```
err = pthread_attr_destroy(&attr);

if (err != 0)

   fprintf(stderr, "error destroying attribute - %s\n", strerror(err));
```

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	An invalid `pthread_attr_t` pointer was passed.

See Also

`pthread_attr_init()`

`pthread_create()`

pthread_attr_getdetachstate()

Get Detach State Attribute

Syntax

```
#include <pthread.h>

int pthread_attr_getdetachstate(
          const pthread_attr_t  *attr,
          int                   *detachstate);
```

Description

`pthread_attr_getdetachstate()` gets the detach state attribute, `attr`, in the attribute object. The integer pointed to by `detachstate` (input) will be written with `PTHREAD_CREATE_DETACHED` or `PTHREAD_CREATE_JOINABLE`.

If successful, returns a value of 0; otherwise, returns an error.

`attr`
: is a pointer to an initialized pthread attribute object. (Input)

Example

```
err = pthread_attr_getdetachstate(&attr, &state);

if (err != 0)

   fprintf(stderr, "error getting detach state - %s\n", strerror(err));
```

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	`attr` or `detachstate` is invalid or the object pointed to by `attr` is not properly initialized.

See Also

`pthread_attr_init()`

`pthread_attr_setdetachstate()`

`pthread_create()`

`pthread_detach()`

`pthread_join()`

_pthread_attr_getinitfunction()

Get Initialization Function Attribute

Syntax

```
#include <pthread.h>
int _pthread_attr_getinitfunction(
    const pthread_attr_t *attr,
    int (**initfunc)(void *),
    void **initfunc_arg,
    void **initfunc_gp,
    void **initfunc_cp);
```

Description

`_pthread_attr_getinitfunction()` returns the initialization function pointer and initialization function argument fields from an attribute objects.

`attr`
: is a pointer to an initialized pthread attribute object. (Input)

`initfunc`
: points to a place to store the initialization function pointer. (Output)

`initfunc_arg`
: points to a place to store the initialization function argument. (Output)

`initfunc_gp`
: points to a place to store the initialization function global pointer. (Output)

`initfunc_cp`
: points to a place to store the initialization function constant pointer. (Output)

Refer to `_pthread_attr_setinitfunction()` for more information about these fields.

Example

```
err = _pthread_attr_getinitfunction(&attr, &initfunc, &initfunc_arg, &gp,
&cp);
if (err != 0)
   fprintf(stderr, "error getting initialization function - %s\n",
   strerror(err));
```

Attributes

Operating System:	OS-9
State:	User

Library

`mt_clib.l`

Possible Errors

`EINVAL`	`attr` does not refer to an initialized attributes object. `initfunc` or `initfunc_arg` is invalid.

See Also

`pthread_attr_init()`

`_pthread_attr_setinitfunction()`

`pthread_create()`

_pthread_attr_getpriority()

Get Priority Attribute

Syntax

```
#include <pthread.h>

int _pthread_attr_getpriority(
     const pthread_attr_t  *attr,
     u_int32               *priority);
```

Description

`_pthread_attr_getpriority()` sets the `u_int32` pointed to by `priority` with the current priority setting from the specified pthread attribute object pointed to by `attr`. A value of 0 indicates that threads created with the specified attribute object will adopt the priority of the creating thread. A non-zero value indicates the desired priority for the created thread.

If successful, returns a value of 0; otherwise, returns an error.

`attris`
: a pointer to an initialized pthread attribute object. (Input)

`priority`
: is a pointer to the unsigned interger. (Input)

Attributes

Operating System:	OS-9
State:	User

Library

`mt_clib.l`

Possible Errors

`EINVAL`	`attr` or `priority` is invalid or the object pointed to by `attr` is not properly initialized.

See Also

`pthread_attr_init()`

`_pthread_attr_setpriority()`

`pthread_create()`

Example

```
err = _pthread_attr_getpriority(&attr, &pr);
if (err != 0)
   fprintf(stderr, "error getting priority - %s\n", strerror(err));
```

pthread_attr_getstackaddr()

Get Stack Address Attribute

Syntax

```
#include <pthread.h>
int pthread_attr_getstackaddr(
     const pthread_attr_t  *attr,
      void                  **stackaddr);
```

Description

`pthread_attr_getstackaddr()` gets the thread stack address attribute, `attr` (input), in the attribute object.

`pthread_attr_getstackaddr()` stores the thread stack address attribute value in `stackaddr` (output) if successful.

If successful, returns a value of 0; otherwise, returns an error.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	`attr` or `stackaddr` is invalid or the object pointed to by `attr` is not properly initialized.

See Also

`pthread_attr_init()`
`pthread_attr_setstackaddr()`
`pthread_create()`

Example

```
err = pthread_attr_getstackaddr(&attr, &stack);
if (err != 0)
   fprintf(stderr, "error getting stack address - %s\n", strerror(err));
printf("Highest stack address is 0x%x\n", stack);
```

pthread_attr_getstacksize()
Get Stack Size Attribute

Syntax

```
#include <pthread.h>
int pthread_attr_getstacksize(
     const pthread_attr_t  *attr,
     size_t                *stacksize);
```

Description

`pthread_attr_getstacksize()` gets the thread stack size attribute, `attr` (input), in the attribute object.

`pthread_attr_getstacksize()` stores the thread stack size attribute value in `stacksize` (output) if successful.

If successful, returns a value of 0; otherwise, returns an error.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	`attr` or `stacksize` is invalid or the object pointed to by `attr` is not properly initialized.

See Also

`pthread_attr_init()`

`pthread_attr_setstacksize()`

`pthread_create()`

Example

```
err = pthread_attr_getstacksize(&attr, &size);
if (err != 0)
   fprintf(stderr, "error getting stack size - %s\n", strerror(err));
printf("Stack size will be %u\n", size);
```

pthread_attr_init()

Allocate Thread Creation Attribute Object

Syntax

```
#include <pthread.h>
```

```
int pthread_attr_init(pthread_attr_t *attr);
```

Description

`pthread_attr_init()` sets default values into the pthread creation attribute object. The default values for a thread creation attribute object are shown in Table 2-18:

Table 2-18. Default values for thread creation attribute

Attribute	Default Value
Stack Size	`PTHREAD_STACK_MIN`
Stack Address	`NULL (system allocated stack)`
Detach State	`PTHREAD_CREATE_JOINABLE`
Priority	`0 (priority of creator)`
Initialization Function	`NULL (none)`

If successful, returns a value of 0; otherwise, returns an error.

Attributes

Operating System: OS-9

State: User

Compatibility: POSIX

Library

`mt_clib.l`

Possible Errors

`ENOMEM` Insufficient memory exists to initialize the attribute.

`EINVAL` `attr` is invalid.

See Also

`pthread_create()`

Example

```
err = pthread_attr_init(&attr);
if (err != 0)
   fprintf(stderr, "error initializing attribute - %s\n", strerror(err));
```

pthread_attr_setdetachstate()

Set Detached State Attribute

Syntax

```
#include <pthread.h>
int pthread_attr_setdetachstate(
    pthread_attr_t  *attr,
     int             detachstate);
```

Description

`pthread_attr_setdetachstate()` sets the detach state attribute of the specified attribute object. Valid values for detachstate are `PTHREAD_CREATE_DETACHED` or `PTHREAD_CREATE_JOINABLE`.

Threads created as joinable retain information upon exit so that status can be returned when `pthread_join()` is used, unless `pthread_detach()` is used to detach the thread. Threads created as detached automatically free all resources upon exit and cannot be used with `pthread_join()`. These type of threads are forked as "orphan" OS-9 threads. If successful, this function returns a value of 0; otherwise, returns an error.

`attr`
    is a pointer to an initialized pthread attribute object. (Output)

`detachstate`
    is the detach state attribute of the specified attribute object. (Input)

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	`attr` or `detachstate` is not valid.

See Also

`pthread_attr_init()`
`pthread_attr_getdetachstate()`
`pthread_create()`
`pthread_detach()`
`pthread_join()`

Example

```
err = pthread_attr_setdetachstate(&attr, PTHREAD_CREATE_DETACHED);
if (err != 0)
   fprintf(stderr, "error setting to detached state - %s\n",
strerror(err));
```

_pthread_attr_setinitfunction()

Set Initialization Function Attribute

Syntax

```
#include <pthread.h>

int _pthread_attr_setinitfunction(
    const pthread_attr_t *attr,
    int (*initfunc)(void *),
    void *initfunc_arg,
    void *gp,
    void *cp);
```

Description

`_pthread_attr_setinitfunction()` sets the initialization function address, argument, global data and constant pointer fields of an attribute object.

The initialization function has the following prototype:

```
int initfunc(void *initfunc_arg);
```

The value of the argument is the value of the `initfunc_arg` parameter in the thread's creation attributes object. If the initialization function returns a non-zero value, that value is converted to a pointer to void and passed to `pthread_exit()`, thus terminating the created thread without ever calling the intended start function.

The initialization function is called in the context of the created thread before the call to `pthread_create()` returns to its caller. The function may perform application specific thread initialization as necessary. The function could be useful in eliminating any race conditions that may exist between the creating thread and created thread since it is known that the initialization code will run in the created thread prior to the return from `pthread_create()`.

Although `pthread_self()` will function correctly, the value it returns should not be communicated to any other threads. The created thread has, technically, not finished its initialization, thus it is not ready to handle all thread operations. The initialization function should not interact with any other threads.

The initialization function runs at the priority of the creating thread, instead of the priority specified for the created thread. That is, if a high priority thread is creating a low priority thread with an initialization function, the initialization function will execute at high priority in the context of the low priority thread.

`attr`
: is a pointer to an initialized pthread attribute object. (Input)

`initfunc`
: points to the initialization function. (Input)

`initfunc_arg`
: is the argument to pass as the initialization functions sole argument. (Input)

`gp`
: specifies the global data pointer that should be in place when calling `initfunc`. (Input)

`cp`
: specifies the constant pointer that should be in place when calling `inifunc`. (Input)

If a constant pointer is not applicable for a particular processor or the code is compiled in such a way that a constant pointer is not needed, the value of `cp` may be `NULL`. Passing `NULL` as the `initfunc` parameter disables the calling of an initialization function. Passing `NULL` as the `initfunc_arg` parameter simply specifies that the value of the initialization function parameter should be `NULL`.

Attributes

Operating System:	OS-9
State:	User

Library

`mt_clib.l`

Possible Errors

`EINVAL`	`attr` does not refer to an initialized attributes object.

See Also

`pthread_attr_init()`

`_pthread_attr_getinitfunction()`

`pthread_create()`

`pthread_exit()`

`get_static()`

`get_const()`

Example

```
err = _pthread_attr_setinitfunction(&attr, thread_startup, &sema);
if (err != 0)
    fprintf(stderr, "error setting initialization function - %s\n",
    strerror(err));
```

_pthread_attr_setpriority()

Set Priority Attribute

Syntax

```
#include <pthread.h>
int _pthread_attr_setpriority(
     pthread_attr_t  *attr,
     u_int32      priority);
```

Description

`_pthread_attr_setpriority()` sets the priority attribute of the pthread attribute object pointed to by `attr` to `priority`. A priority of 0 indicates that created threads should adopt the priority of the creating thread. A non-zero value specifies the desired priority for the created thread.

`attr`
: is a pointer to an initialized pthread attribute object. (Input)

`priority`
: is a pointer to the unsigned interger. (Input)

If successful, returns a value of 0; otherwise, returns an error.

Attributes

Operating System:	OS-9
State:	User

Library

`mt_clib.l`

Possible Errors

`EINVAL`	If `attr` is invalid or the object pointed to by `attr` is not properly initialized or the value of priority is out of range for a thread priority (0 to 65535).

See Also

`pthread_attr_init()`
`_pthread_attr_getpriority()`
`pthread_create()`
`_pthread_setpr()`

Example

```
err = _pthread_attr_setpriority(&attr, 255);
if (err != 0)
   fprintf(stderr, "error setting priority - %s\n", strerror(err));
```

pthread_attr_setstackaddr()

Set Stack Address Attribute

Syntax

```
#include <pthread.h>

int pthread_attr_setstackaddr(
     pthread_attr_t  *attr,
              void          *stackaddr);
```

Description

`pthread_attr_setstackaddr()` allows a thread to specify a particular pre-allocated thread stack. The address specified is the desired stack pointer for the created thread. The specified stack must be at least `PTHREAD_STACK_MIN` in size.

There is a matrix of possibilities for the two functions `pthread_attr_setstacksize()` and `pthread_attr_setstackaddr()`. Either one can be called independent of the other one being called. The behavior depends upon the following matrix, shown in Table 2-19.

Table 2-19. Function Behavior

Setstackaddr()	Setstacksize()	Resultant behavior
Not called	Not called	A system-allocated stack, of size PTHREAD_STACK_MIN, will be given to created threads.
Called	Not called	The specified stack address will be passed to created threads. The size will be assumed to be PTHREAD_STACK_MIN.
Not called	Called	A system-allocated stack of the size specified will be passed to created threads.
Called	Called	The specified stack address will be passed to created threads. The size will be assumed to be the size set by pthread_attr_setstacksize().

Be aware of the following requirements when setting the stack address explicitly:

- The address passed to this function will be passed directly to threads created with this attribute object. Make sure that the top of the stack is passed (the highest RAM address of the stack).
- Do not create more than one thread with a given stack address.
- The stack should be "pre-loaded" with a NULL link pointer to ensure proper stack back-tracing.

If successful, returns a value of 0; otherwise, returns an error.

`attr`
: is a pointer to an initialized pthread attribute object. (Input)

`stackaddr`
: is a pointer to the pre-allocated thread stack. (Input)

The `stackaddr` parameter is rounded down to an eight-byte boundary. To get the actual stack address used for created threads with a given attribute object. Use `pthread_attr_getstackaddr()` to get the actual address passed to the next created thread.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

EINVAL	`attr` is invalid or `attr` is not properly initialized.

See Also

`pthread_attr_init()`

`pthread_attr_getstackaddr()`

`pthread_create()`

Example

```
stack = malloc(PTHREAD_STACK_MIN);
if (stack == NULL)
   fprintf(stderr, "error allocating stack - %s\n", strerror(errno));
memset(stack, 0, PTHREAD_STACK_MIN);
err = pthread_attr_setstackaddr(&attr, stack + stacksize);
if (err != 0)
   fprintf(stderr, "error setting stack address - %s\n", strerror(err));
```

pthread_attr_setstacksize()

Set Stack Size Attribute

Syntax

```
#include <pthread.h>
int pthread_attr_setstacksize(
     pthread_attr_t  *attr,
    size_t          stacksize);
```

Description

`pthread_attr_setstacksize()` sets the stack size that will be allocated for threads that are created with the specified attribute object.

The `stacksize` parameter is rounded down to an eight-byte boundary. To get the actual stack size used for created threads with a given attribute object. Use `pthread_attr_getstacksize()` to get the actual stack size attribute used to create threads.

`pthread_attr_setstacksize()` and `pthread_attr_setstackaddr()` can be called independently of one another. The behavior depends upon the following matrix:.

Table 2-20. Function Behavior

Setstackaddr()	Setstacksize()	Resultant behavior
Not called	Not called	A system-allocated stack, of size PTHREAD_STACK_MIN, will be given to created threads.
Called	Not called	The specified stack address will be passed to created threads. The size will be assumed to be PTHREAD_STACK_MIN.
Not called	Called	A system-allocated stack of the size specified will be passed to created threads.
Called	Called	The specified stack address will be passed to created threads. The size will be assumed to be the size set by pthread_attr_setstacksize().

If successful, returns a value of 0; otherwise, returns an error.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	`attr` is invalid, `attr` is not properly initialized or `stacksize` is less than `PTHREAD_STACK_MIN`.

See Also

`pthread_attr_init()`

`pthread_attr_getstacksize()`

`pthread_create()`

Example

```
err = pthread_attr_setstacksize(&attr, 4096);
if (err != 0)
    fprintf(stderr, “error setting stack size - %s\n”, strerror(err));
```

pthread_cancel()

Cancel Target Thread

Syntax

```
#include <pthread.h>
int pthread_cancel(pthread_t thread);
```

Description

`pthread_cancel()` cancels the target thread unless it is not currently cancelable. If the thread is not cancelable, the request is held pending until it reaches a cancellation point. The call to `pthread_cancel()` returns immediately regardless of the cancelability of the target thread. If the specified thread has asynchronous cancels enabled it will terminate immediately without doing any sort of cleanup.

When a thread processes a deferred cancel the cleanup routines are called, thread specific data destructors are called, and the thread is terminated with the exit status `PTHREAD_CANCELED`.

Cancelling an asynchronous cancel type thread is guaranteed to cause a loss of resources. For example, the memory allocated to implement thread safety for C library functions will be lost. Use deferred cancellation whenever possible. In addition, cancelling an asynchronous cancel type thread that is in a queue waiting for a resource will most likely cause the process to exit with an exception.

`thread`
: is the target thread. (Input)

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`ESRCH`	No thread could be found corresponding to that specified by the given thread ID.

See Also

`pthread_cond_timedwait()`
`pthread_cond_wait()`
`pthread_exit()`
`pthread_join()`
`pthread_setcancelstate()`
`pthread_setcanceltype()`

Example

```
err = pthread_cancel(worker);
if (err != 0)
   fprintf(stderr, "error cancelling worker - %s\n", strerror(err));
```

pthread_cleanup_pop()

Pop Cleanup Routine

Syntax

```
#include <pthread.h>
void pthread_cleanup_pop(int execute);
```

Description

`pthread_cleanup_pop()` removes the routine at the top of the cancellation cleanup stack of the calling thread and invokes the popped thread if `execute` (input) is nonzero.

`pthread_cleanup_pop()` and `pthread_cleanup_push()` have to be in the same lexical scope.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

None

See Also

`pthread_cancel()`

`pthread_cleanup_push()`

`pthread_setcancelstate()`

`pthread_setcanceltype()`

Example

```
pthread_cleanup_pop(1);     /* pop and call top cleanup function */
```

pthread_cleanup_push()

Push Cleanup Routine

Syntax

```
#include <pthread.h>
void pthread_cleanup_push(
     void (*routine)(void *),
     void  *arg);
```

Description

`pthread_cleanup_push()` is similar to the ANSI `atexit()` function. It allows a thread to push a series of routines that should be called if the thread is terminated by `pthread_testcancel()` or `pthread_exit()`. The routines are called in the reverse order that they were pushed onto the cleanup stack. That is, the most recently pushed routine is called first, followed by the next most recent, and so on.

Each `pthread_cleanup_push()` invocation must have an associated `pthread_cleanup_pop()` invocation in the same lexical scope. This is strictly enforced by having the `pthread_cleanup_push()` macro begin with an open brace ({) and the `pthread_cleanup_pop()` macro end with a close brace (}).

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

None

See Also

`pthread_cancel()`
`pthread_cleanup_pop()`
`pthread_setcancelstate()`
`pthread_setcanceltype()`

Example

```
err = pthread_mutex_lock(mutx);
if (err != 0)
    fprintf(stderr, "error locking mutex - %s\n", strerror(err));
pthread_cleanup_push(pthread_mutex_unlock, mutx);
err = pthread_cond_wait(condvar, mutx);   /* cancellation point */
if (err != 0)
    fprintf(stderr, "error during cond_wait - %s\n", strerror(err));
pthread_cleanup_pop(1);   /* unlock mutx */
```

pthread_cond_broadcast()

Release Threads Waiting for Condition Variable

Syntax

```
#include <pthread.h>
```

```
int pthread_cond_broadcast(pthread_cond_t *cond);
```

Description

`pthread_cond_broadcast()` releases every thread waiting on the specified condition variable.

If more than one thread is blocked on a condition variable, the OS-9 scheduler determines the order in which threads are activated. When each thread is unblocked it returns from its call to `pthread_cond_wait()` or `pthread_cond_timedwait()`. The thread owns the mutex with which it called `pthread_cond_wait()` or `pthread_cond_timedwait()`. The thread(s) that are unblocked contend for the mutex in the normal fashion, as if each had called `pthread_mutex_lock()`.

`pthread_cond_broadcast()` may be called by a thread whether or not that thread currently owns the mutex that threads calling `pthread_cond_wait()` or `pthread_cond_timedwait()` have associated with the condition variable during their waits. However, if predictable scheduling behavior is required, then that mutex should be locked by the thread calling `pthread_cond_broadcast()`.

`pthread_cond_broadcast()` has no effect if there are no threads currently blocked on `cond`.

If successful, returns a value of 0; otherwise, returns an error.

`cond`
    Input

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value `cond` does not refer to an initialized condition variable.

See Also

`pthread_cond_init()`
`pthread_cond_timedwait()`
`pthread_cond_wait()`
`pthread_cond_signal()`

Example

```
err = pthread_cond_broadcast(cond);
if (err != 0)
   fprintf(stderr, “failed to signal readers - %s\n”, strerror(err));
err = pthread_mutex_unlock(data_lock);
if (err != 0)
   fprintf(stderr, “failed to unlock data lock - %s\n”, strerror(err));
```

pthread_cond_destroy()

Free Condition Variable Object

Syntax

```
#include <pthread.h>

int pthread_cond_destroy(pthread_cond_t *cond);
```

Description

The function `pthread_cond_destroy()` destroys the given condition variable specified by `cond`; the object becomes, in effect, uninitialized.

If successful, returns a value of 0; otherwise, returns an error.

`cond`
: is a pointer to the given condition variable. (Input)

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EBUSY`	An attempt to destroy the object referenced by `cond` while it is in use by another thread. For example, while being used in a `pthread_cond_wait()` or a `pthread_cond_timedwait()`.
`EINVAL`	The value specified by `cond` is invalid.

See Also

`pthread_cond_broadcast()`

`pthread_cond_init()`

`pthread_cond_signal()`

`pthread_cond_timedwait()`

`pthread_cond_wait()`

Example

```
err = pthread_cond_destroy(&cond);
if (err != 0)
    fprintf(stderr, “failed to destroy condvar - %s\n”, strerror(err));
```

pthread_cond_init()

Allocate Condition Variable Object

Syntax

```
#include <pthread.h>

int pthread_cond_init(

     pthread_cond_t            *cond,

     const pthread_condattr_t  *attr);
```

Description

The function `pthread_cond_init()` initializes the condition variable referenced by `cond` with attributes referenced by `attr`. If `attr` is `NULL`, the default condition variable attributes are used; the effect is the same as passing the address of a default condition variable attributes object. Upon successful initialization, the state of the condition variable becomes initialized.

If successful, returns a value of 0; otherwise, returns an error.

`attr`
: is a pointer to an initialized pthread attribute object. (Input)

`cond`
: is a pointer to the condition variable. (Input)

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EAGAIN`	The system lacked the necessary resources (other than memory) to initialize another condition variable.
`ENOMEM`	Insufficient memory exists to initialize the condition variable.
`EBUSY`	An attempt to reinitialize the object referenced by `cond` (a previously initialized, but not yet destroyed, condition variable) has been detected.
`EINVAL`	The value specified by `cond` or `attr` is invalid.

See Also

pthread_cond_broadcast()

pthread_cond_destroy()

pthread_cond_signal()

pthread_cond_timedwait()

pthread_cond_wait()

pthread_condattr_init()

Example

```
err = pthread_cond_init(&cond, NULL);
if (err != 0)
    fprintf(stderr, “failed to initialize condvar - %s\n”, strerror(err));
```

pthread_cond_signal()

Release Thread Waiting for Condition Variable

Syntax

```
#include <pthread.h>

int pthread_cond_signal(pthread_cond_t *cond);
```

Description

`pthread_cond_signal()` releases one thread waiting on the specified condition variable.

When the thread is unblocked it returns from its call to `pthread_cond_wait()` or `pthread_cond_timedwait()`. The thread owns the mutex with which it called `pthread_cond_wait()` or `pthread_cond_timedwait()`. The thread that is unblocked contends for the mutex in the normal fashion, as if it had called `pthread_mutex_lock()`.

`pthread_cond_signal()` may be called by a thread whether or not that thread currently owns the mutex that threads calling `pthread_cond_wait()` or `pthread_cond_timedwait()` have associated with the condition variable during their waits. However, if predictable scheduling behavior is required, then that mutex should be locked by the thread calling `pthread_cond_signal()`.

`pthread_cond_signal()` has no effect if there are no threads currently blocked on `cond`.

If successful, returns a value of 0; otherwise, returns an error.

`cond`
: is a pointer to the condition variable. (Input)

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value `cond` does not refer to an initialized condition variable.

See Also

pthread_cond_init()

pthread_cond_timedwait()

pthread_cond_wait()

pthread_cond_broadcast()

Example

```
err = pthread_cond_signal(cond);
if (err != 0)
   fprintf(stderr, “failed to signal worker - %s\n”, strerror(err));
err = pthread_mutex_unlock(work_que_lock);
if (err != 0)
   fprintf(stderr, “failed to unlock work queue - %s\n”, strerror(err));
```

pthread_cond_timedwait()

Wait on Condition Variable for Specified Interval

Syntax

```
#include <pthread.h>

int pthread_cond_timedwait(
     pthread_cond_t         *cond,
     pthread_mutex_t        *mutex,
    const struct timespec  *abstime);
```

Description

`pthread_cond_timedwait()` is used to block on a condition variable until an absolute time is reached. It must be called with `mutex` locked by the calling thread or `EINVAL` will be returned.

`mutex`is a pointer to the mutex. (Input)

This function releases the mutex and causes the calling thread to block on the condition variable `cond`. If another thread is able to acquire the mutex after the about-to-block thread has released it, then a subsequent call to `pthread_cond_signal()` or `pthread_cond_broadcast()` in that thread behaves as if it were issued after the about-to-block thread has blocked.

Upon return, the mutex is locked and is owned by the calling thread. When using condition variables, there is always a boolean predicate involving shared variables associated with each condition wait that is true if the thread should proceed. Spurious wakeups from the `pthread_cond_timedwait()` may occur. Since the return from `pthread_cond_timedwait()` does not imply anything about the value of this predicate, the predicate should be re-evaluated upon each return.

The effect of using more than one mutex for concurrent `pthread_cond_wait()` or `pthread_cond_timedwait()` operations on the same condition variable will result in `EINVAL` errors being returned. That is, a condition variable becomes bound to a unique mutex when a thread waits on the condition variable, and this dynamic binding ends when the last concurrent wait returns.

A condition wait is a cancellation point. When the cancelability enable state of a thread is set to `PTHREAD_CANCEL_DEFERRED`, a side effect of acting upon a cancellation request while in a condition wait is that the mutex is re-acquired before calling the first cancellation cleanup handler. The effect is as if the thread were unblocked, allowed to execute up to the point of returning from the call to `pthread_cond_timedwait()`, but at that point notices the cancellation request and instead of returning to the caller of `pthread_cond_timedwait()`, starts the thread cancellation activities, which includes calling cancellation cleanup handlers.

A thread that has been unblocked because it has been canceled while blocked in a call to `pthread_cond_timedwait()` does not consume any condition signal that may be directed concurrently at the condition variable if there are other threads blocked on the condition variable.

The `timespec` pointed to by `abstime` specifies an absolute time in GMT that the call should return if the thread is not awakened by a `pthread_cond_signal()` or `pthread_cond_broadcast()`.

`abstime`is a pointer to the absolute time. (Input)

The Microware Pthread implementation supports the concept of interruption as it relates to condition variable waits. If a thread has a pending interruption or is interrupted while blocked, `pthread_cond_timedwait()` will return `EINTR`. The mutex will be re-acquired prior to return.

If successful, returns a value of 0; otherwise, returns an error.

This function contains a cancel point.

`cond`
: is a pointer to the condition variable. (Input)

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`ETIMEDOUT`	The time specified by `abstime` to `pthread_cond_timedwait()` has passed.
`EINVAL`	The value specified by `cond`, `mutex`, or `abstime` is invalid. Different mutexes are supplied for concurrent `pthread_cond_wait()` or `pthread_cond_timedwait()` operations on the same condition variable. The mutex is not owned by the current thread at the time of the call.
`EINTR`	`_pthread_interrupt()` was called with this thread as the target prior to or during this call.

See Also

`pthread_cond_broadcast()`

`pthread_cond_signal()`

`pthread_cond_wait()`

Example

```
err = _os_getime(&tspec->tv_sec, &ticks);
if (err != SUCCESS)
    fprintf(stderr, “error getting GMT - %s\n”, strerror(err));
tspec->tv_sec += 5; /* give up after 5 seconds */
tspec->tv_nsec = 0;
err = pthread_cond_timedwait(cond, mutx, tspec);
switch (err) {
case EINTR:
    fputs(“timed wait interrupted\n”, stderr);
    break;
case ETIMEDOUT:
    fputs(“timed wait timed out\n”, stderr);
    break;
default:
    fprintf(stderr, “error on timed wait - %s\n”, strerror(err));
    break;
}
```

pthread_cond_wait()

Wait on Condition Variable

Syntax

```
#include <pthread.h>

int pthread_cond_wait(
     pthread_cond_t   *cond,
    pthread_mutex_t  *mutex);
```

Description

`pthread_cond_wait()` is used to block on a condition variable. It must be called with `mutex` locked by the calling thread or `EINVAL` will be returned.

`mutex`is a pointer to the mutex. (Input)

This function releases the mutex and causes the calling thread to block on the condition variable `cond`. If another thread is able to acquire the mutex after the about-to-block thread has released it, then a subsequent call to `pthread_cond_signal()` or `pthread_cond_broadcast()` in that thread behaves as if it were issued after the about-to-block thread has blocked.

Upon return, the mutex is locked and is owned by the calling thread. When using condition variables, there is always a boolean predicate involving shared variables associated with each condition wait that is true if the thread should proceed. Spurious wakeups from the `pthread_cond_wait()` may occur. Since the return from `pthread_cond_wait()` does not imply anything about the value of this predicate, the predicate should be re-evaluated upon each return.

The effect of using more than one mutex for concurrent `pthread_cond_wait()` or `pthread_cond_timedwait()` operations on the same condition variable will result in `EINVAL` errors being returned. That is, a condition variable becomes bound to a unique mutex when a thread waits on the condition variable, and this dynamic binding ends when the last concurrent wait returns.

A condition wait is a cancellation point. When the cancelability enable state of a thread is set to `PTHREAD_CANCEL_DEFERRED`, a side effect of acting upon a cancellation request while in a condition wait is that the mutex is re-acquired before calling the first cancellation cleanup handler. The effect is as if the thread were unblocked, allowed to execute up to the point of returning from the call to `pthread_cond_wait()`, but at that point notices the cancellation request and instead of returning to the caller of `pthread_cond_wait()`, starts the thread cancellation activities, which includes calling cancellation cleanup handlers.

A thread that has been unblocked because it has been canceled while blocked in a call to `pthread_cond_wait()` does not consume any condition signal that may be directed concurrently at the condition variable if there are other threads blocked on the condition variable.

The Microware Pthread implementation supports the concept of interruption as it relates to condition variable waits. If a thread has a pending interruption or is interrupted while blocked, `pthread_cond_wait()` will return `EINTR`. The mutex will be re-acquired prior to return.

If successful, returns a value of 0; otherwise, returns an error.

This function contains a cancel point.

`cond`
is a pointer to the condition variable. (Input)

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value specified by `cond` or `mutex` is invalid. Different mutexes are supplied for concurrent `pthread_cond_wait()` or `pthread_cond_timedwait()` operations on the same condition variable. The mutex is not owned by the current thread at the time of the call.
`EINTR`	`_pthread_interrupt()` was called with this thread as the target prior to or during this call.

See Also

`pthread_cond_broadcast()`

`pthread_cond_signal()`

`pthread_cond_timedwait()`

Example

```
err = pthread_cond_wait(cond, mutx);
if (err != 0)
   fprintf(stderr, “failed to wait on condvar\n”, strerror(err));
```

pthread_condattr_destroy()

Free Condition Variable Attributes Object

Syntax

```
#include <pthread.h>
int pthread_condattr_destroy(
       pthread_condattr_t *attr);
```

Description

`pthread_condattr_destroy()` destroys a condition variable attributes object; the object becomes, in effect, uninitialized.

If successful, returns a value of 0; otherwise, returns an error.

`attr`
: is a pointer to an initialized pthread attribute object. (Input)

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value specified by `attr` is invalid.

See Also

`pthread_cond_init()`

`pthread_condattr_init()`

Example

```
err = pthread_condattr_destroy(attr);
if (err != 0)
   fprintf(stderr, "failed to destory condattr - %s\n", strerror(err));
```

pthread_condattr_getpshared()

Get Condition Variable Process-Shared Attribute

Syntax

```
#include <pthread.h>

int pthread_condattr_getpshared(

     const pthread_condattr_t  *attr,

     int                       *pshared);
```

Description

`pthread_condattr_getpshared()` obtains the value of the process-shared attribute from the attributes object referenced by `attr`.

If successful, returns 0 and stores the value of the process-shared attribute of `attr` into the object referenced by the `pshared` parameter. Otherwise, an error number is returned.

`attr`
: is a pointer to an initialized pthread attribute object. (Input)

`pshared`
: is a pointer to the process-shared attribute. (Output)

This facility is not currently supported in Microware's Pthreads implementation. The process-shared attribute can be changed, but both values behave like `PTHREAD_PROCESS_PRIVATE`. `_POSIX_THREAD_PROCESS_SHARED` is not currently defined.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value specified by attr is invalid.

See Also

`pthread_condattr_init()`

`pthread_condattr_setpshared()`

Example

```
err = pthread_condattr_getpshared(attr, &pshare);
if (err != 0)
   fprintf(stderr, “failed to get pshared attribute - %s\n”,
strerror(err));
```

pthread_condattr_init()

Allocate Condition Variable Attributes Object

Syntax

```
#include <pthread.h>
```

```
int pthread_condattr_init(pthread_condattr_t *attr);
```

Description

`pthread_condattr_init()` initializes a condition variable attributes object `attr` with the default value for all of the attributes.

If successful, returns a value of 0; otherwise, returns an error.

`attr`

is a pointer to an initialized pthread attribute object. (Output)

The default values of the attributes are shown in Table 2-21.

Table 2-21. Default Attribute Values

Attribute	Default Value
Process-shared	`PTHREAD_PROCESS_PRIVATE`

Attributes

Operating System: OS-9

State: User

Compatibility: POSIX

Library

`mt_clib.l`

Possible Errors

`ENOMEM` Insufficient memory exists to initialize the condition variable attributes object.

`EINVAL` `attr` is an invalid value.

See Also

`pthread_cond_init()`

`pthread_condattr_destroy()`

Example

```
err = pthread_condattr_init(&condattr);
if (err != 0)
   fprintf(stderr, "failed to init condattr - %s\n", strerror(err));
```

pthread_condattr_setpshared()

Set Condition Variable Process-Shared Attribute

Syntax

```
#include <pthread.h>

int pthread_condattr_setpshared(
     pthread_condattr_t *attr,
     int                 pshared);
```

Description

`pthread_condattr_setpshared()` sets the process-shared attribute in an initialized attributes object referenced by `attr`. Valid values for pshared are `PTHREAD_PROCESS_SHARED` or `PTHREAD_PROCESS_PRIVATE`.

If successful, returns a value of 0; otherwise, returns an error.

`attr`
: is a pointer to an initialized pthread attribute object. (Input)

`pshared`
: is a pointer to the process-shared attribute. (Input)

This facility is not currently supported in the Microware Pthreads implementation. The process-shared attribute can be changed, but `PTHREAD_PROCESS_SHARED` behaves exactly like `PTHREAD_PROCESS_PRIVATE`. `_POSIX_THREAD_PROCESS_SHARED` is not currently defined.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value specified by `attr` is invalid. The new value specified for the attribute is outside the range of legal values for that attribute.

See Also

`pthread_condattr_init()`

`pthread_condattr_getpshared()`

Example

```
err = pthread_condattr_setpshared(&condattr, PTHREAD_PROCESS_PRIVATE);
if (err != 0)
    fprintf(stderr, “failed to set to private - %s\n”, strerror(err));
```

pthread_create()

Create New Thread

Syntax

```
#include <pthread.h>

int pthread_create(
     pthread_t              *thread,
     const pthread_attr_t   *attr,
     void                   *(*start_routine) (void *),
     void                   *arg);
```

Description

`pthread_create()` is used to create a new thread, with attributes specified by `attr`, within a process. If `attr` is `NULL`, the default attributes are used. If the attributes specified by `attr` are modified later, the attributes of the thread are not affected. Upon successful completion, `pthread_create()` stores the ID of the created thread in the location referenced by `thread`.

The thread starts by executing `start_routine` with `arg` as its sole argument. If the `start_routine` returns, the effect is as if there was an implicit call to `pthread_exit()` using the return value of `start_routine` as the exit status.

If `pthread_create()` fails, no new thread is created, and the contents of the location referenced by `thread` are undefined.

The pthread `attr` structure is used when threads are created.

If successful, returns a value of 0; otherwise, returns an error.

`attr`
: is a pointer to an initialized pthread attribute object. (Input)

`thread`
: is a pointer to the target thread. (Output)

`start_routine`
: is a pointer to the start thread routine. (Input)

  The thread in which `main()` was originally invoked differs from this. When this thread returns from `main()`, the effect is as if there was an implicit call to `exit()` using the return value of `main()` as the exit status.

`arg`
: is the sole argument for execution. (Input)

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EAGAIN`	The system lacked the necessary resources to create another thread, or the system-imposed limit on the total number of threads in a process `PTHREAD_THREADS_MAX` would be exceeded.
`EINVAL`	The value specified by `attr` is invalid.

See Also

`_os_thfork()`

`pthread_exit()`

`pthread_join()`

`pthread_detach()`

Example

```
err = pthread_create(&tid, &worker_attr, worker_loop, NULL);
if (err != 0)
   fprintf(stderr, "error creating worker - %s\n", strerror(err));
```

pthread_detach()

Orphan Target Thread

Syntax

```
#include <pthread.h>
```

```
int pthread_detach(pthread_t thread);
```

Description

`pthread_detach()` orphans the designated thread. Any thread within the caller's process can be detached unless it is already in detached state.

The `pthread_detach()` function is used to indicate that storage for the thread can be reclaimed when that thread terminates. If thread has not terminated, `pthread_detach()` does not cause it to terminate. Multiple `pthread_detach()` calls on the same target thread result in `EINVAL` being returned.

If successful, returns a value of 0; otherwise, returns an error.

`thread`
: is the target thread. (Input)

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value specified by `thread` does not refer to a thread that can be joined.
`ESRCH`	No thread could be found corresponding to that specified by the given thread ID.

See Also

`pthread_join()`

Example

```
err = pthread_detach(io_thread);
if (err != 0)
   fprintf(stderr, "error detaching I/O thread - %s\n", strerror(err));
```

pthread_equal()
Compare Thread Identifiers

Syntax

```
#include <pthread.h>
```

```
int pthread_equal(pthread_t t1, pthread_t t2);
```

Description

`pthread_equal()` tests whether two thread IDs are the same.

`pthread_equal()` returns a nonzero value if the two thread IDs are equal; otherwise 0 is returned.

`t1 and t2`
: are two thread IDs. (Input)

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

None

See Also

`pthread_self()`

Example

```
if (pthread_equal(worker[0], dead))
   fputs("worker #0 died", stderr);
```

pthread_exit()

Terminate Thread

Syntax

```
#include <pthread.h>

void pthread_exit(void *value_ptr);
```

Description

`pthread_exit()` terminates the calling thread. If any thread is waiting on a join on this thread, they are released and passed `value_ptr` as the exit status.

`pthread_exit()` terminates the calling thread and makes the value `value_ptr` available to any successful join with the terminating thread. Any cancellation cleanup handlers that have been pushed and not yet popped, shall be popped in the reverse order that they were pushed and then executed. After all cancellation cleanup handlers have been executed, if the thread has any thread-specific data, appropriate destructor functions are called in an unspecified order. Thread termination does not release any application visible process resources (e.g. allocated memory, open paths, etc.). Nor does it perform any process level cleanup actions like calling any `atexit()` routines that may exist.

An implicit call to `pthread_exit()` is made when a thread other than the thread in which `main()` was first invoked returns from the start routine that was used to create it. The return value of the function serves as the exit status of the thread.

`pthread_exit()` returns immediately without doing anything if called from a cancellation cleanup handler or destructor function that was invoked as a result of either an implicit or explicit call to `pthread_exit()`.

After a thread has terminated, the result of access to local (auto) variables of the thread is undefined. Thus, references to local variables of the exiting thread should not be used for the `pthread_exit()` `value_ptr` parameter value.

The process exits with an exit status of 0 after the last thread has been terminated. The behavior is as if the implementation called `exit()` with a zero argument at the time of thread termination.

Calling `pthread_exit` from the thread in which main was first invoked does not necessarily cause the process to exit. The process will continue to run until all threads have terminated or an exit call is made.

`value_ptr`
: is a pointer to the value. (Input)

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

None

See Also

`exit()`

`pthread_create()`

`pthread_join()`

`pthread_detach()`

Example

```
pthread_exit((void *)SUCCESS);
```

pthread_getspecific()

Get Thread-Specific Data Pointer

Syntax

```
#include <pthread.h>
```

```
void *pthread_getspecific(pthread_key_t key);
```

Description

`pthread_getspecific()` returns the value currently bound to the specified key on behalf of the calling thread.

`pthread_getspecific()` returns the thread-specific data value associated with the given key. If no thread-specific data value is currently associated with key, then the value `NULL` is returned.

`t key`
: is the key associated with the calling thread. (Input)

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

None

See Also

`pthread_key_create()`

`pthread_setspecific()`

Example

```
thread_data = pthread_getspecific(thread_data_key);
if (thread_data == NULL) {
    thread_data = malloc(sizeof(thread_data_t));
    if (thread_data == NULL)
        fprintf(stderr, "memory allocation error - %s\n", strerror(errno));
    pthread_setspecific(thread_data_key, thread_data);
}
```

_pthread_getstatus()

Get Thread Status Information

Syntax

```
#include <pthread.h>
int _pthread_getstatus(
     pthread_t           thread,
     _pthread_status_t   *status);
```

Description

`_pthread_getstatus()` returns various pieces of information related to the target `thread` in the structure pointed to by `status`.

If successful, returns a value of 0; otherwise, returns an error.

`thread`
is the target thread. (Input)

`status`
is a pointer to the status. (Output)

The following table describes the fields of the `_pthread_status_t` structure:

Table 2-22. _pthread_status_t Structure Fields

Type	Name	Description
`u_int32` (bit masks follow)	status	Bits for various boolean pieces of information:
`_PT_DETACHED`		
0 = joinable thread 1 = detached thread		
`_PT_EXIT`		
0 = thread has terminated 1 = thread has not yet terminated		
`_PT_CSTATE`		
0 = cancels enabled 1 = cancels disabled		
`_PT_CTYPE`		
0 = deferred cancels 1 = asynchronous cancels		
`_PT_CPENDING`		

Table 2-22. _pthread_status_t Structure Fields (Continued)

Type	Name	Description
0 = no cancel request pending 1 = cancel request pending		
_PT_SSTATE		
0 = suspendable 1 = unsuspendable		
_PT_SPENDING		
0 = no suspend request pending 1 = suspend request pending		
_PT_SFLAG		
0 = not suspended 1 = suspended		
_PT_BOOSTED		
0 = not priority boosted 1 = priority boosted		
_PT_IPENDING		
0 = no interruption pending 1 = interruption pending		
thread_t	tid	OS-9 thread identifier
thread_t	creator	OS-9 thread identifier of thread's creator
void *	stack	stack base (highest address)
size_t	stack_size	Stack size in bytes
u_int16	priority	Thread's priority
u_int16	bpriority	Thread's boosted priority
u_int32 [2]	resv	Reserved space for future additional status information

Attributes

Operating System: OS-9

State: User

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The passed thread or status pointer is NULL.
`ESRCH`	The specified target thread is not valid.

Example

```
err = _pthread_getstatus(child, &stats);
if (err != 0)
   fprintf(stderr, "failed to get status for child - %s", strerror(err));
printf("child's OS-9 thread ID is %u\n", stats.tid);
```

_pthread_global_slot()

Read or Write Global Variables

Syntax

```
u_int32       *_pthread_global_slot(
              int32 slot)
```

Description

This function is used when reading or writing global versions of "core" C run-time variables. `_mainid`, the process ID of a thread's host process, is the only example of such a variable.

`_pthread_global_slot()` is used to get the address of the global version of `_mainid`.

`_pthread_global_slot()` returns the address of the storage for a specific slot number. This makes it equally easy to read or write the variable. In addition, `_pthread_global_slot()` automatically saves and restores any modified registers except the return value. This makes it easier to call from assembly language.

A module's global data pointer and `_pthread` value must be valid prior to calling `_pthread_global_slot()`

`slot`

is the slot number. (Input)

Slot numbers are defined in `MWOS/SRC/DEFS/pthread.h`. Once a slot number has been assigned to a variable, it will not change in a subsequent release.

Attributes

Operating System:	OS-9
State:	User

Library

`mt_clib.l`

_pthread_interrupt()

Interrupt Target Thread

Syntax

```
#include <pthread.h>
int _pthread_interrupt(pthread_t thread);
```

Description

`_pthread_interrupt()` interrupts any `pthread_cond_wait()` or `pthread_cond_timedwait()` being done by the specified thread. If the thread is not currently blocked in `pthread_cond_wait()` or `pthread_cond_timedwait()`, `_pthread_interrupt()` makes the interruption pending.

`_pthread_interrupt()` is implemented as if the target thread can atomically check for a pending interrupt and then block in `pthread_cond_timedwait()` or `pthread_cond_wait()` if none is pending. That is, there is no window between when a thread checks for a pending interrupt and when the thread actually blocks where an interruption request could be missed.

If successful, returns a value of 0; otherwise, returns an error.

`thread`
: is the target thread. (Input)

Attributes

Operating System:	OS-9
State:	User

Library

`mt_clib.l`

Possible Errors

`EINVAL`	`thread` is invalid.
`ESRCH`	`thread` is not a valid thread.

See Also

`pthread_cond_timedwait()`
`pthread_cond_wait()`
`_pthread_getstatus()`
`_pthread_interrupt_clear()`

Example

```
err = _pthread_interrupt(wait_thread);
if (err != 0)
   fprintf(stderr, "failed to interrupt waiter - %s\n", strerror(err));
```

_pthread_interrupt_clear()

Clear Interrupt Request for Target Thread

Syntax

```
#include <pthread.h>

int _pthread_interrupt_clear(
    pthread_t    thread,
    int          *old_status);
```

Description

`_pthread_interrupt_clear()` clears any pending interrupt for the specified thread. This function might be useful if other interruptible operations are defined for a particular application. Refer to `_pthread_getstatus()` for more information on determining if a particular thread has an interruption pending.

If successful, returns a value of 0; otherwise, returns an error.

`thread`
: is the target thread. (Input)

`old_status`
: The value of the interruption status for the target thread is returned at the integer pointed to by `old_status`. (Output)

  If the old status is not required, `NULL` may be passed for `old_status`.

Attributes

Operating System:	OS-9
State:	User

Library

`mt_clib.l`

Possible Errors

`EINVAL`	`thread` is invalid.
`ESRCH`	`thread` is not a valid thread.

See Also

`pthread_cond_timedwait()`
`_pthread_interrupt()`
`pthread_cond_wait()`
`_pthread_getstatus()`

Example

```
err = _pthread_interrupt_clear(pthread_self());

if (err != 0)

    fprintf(stderr, "failed to clear interruption - %s\n", strerror(err));
```

pthread_join()

Wait for Target Thread to Terminate

Syntax

```
#include <pthread.h>
int pthread_join(
    pthread_t thread,
    void **value_ptr);
```

Description

The `pthread_join()` function suspends execution of the calling thread until the target thread terminates, unless the target thread has already terminated. On return from a successful `pthread_join()` call with a non-NULL `value_ptr` (output) argument, the value passed to `pthread_exit()` by the terminating `thread` (input) is stored in the location referenced by `value_ptr`.

When a `pthread_join()` returns successfully, the target thread has been terminated. Multiple simultaneous calls to `pthread_join()` specifying the same target thread results in one thread successfully getting the exit status and the remainder getting `EOS_NOCHLD` as the result of `pthread_join()`.

Exited but remaining unjoined threads count against the maximum number of threads a process may have, `PTHREAD_THREADS_MAX`.

If successful, returns a value of 0; otherwise, returns an error.

This function contains a cancel point.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value specified by `thread` does not refer to a thread that can be joined.
`ESRCH`	No thread could be found corresponding to that specified by the given thread ID.
`EDEADLK`	A deadlock was detected, or the value of `thread` specifies the calling thread.

See Also

pthread_create()

pthread_detach()

pthread_exit()

Example

```
err = pthread_join(child, &status);
if (err != 0)
   fprintf(stderr, “error waiting for child - %s\n”, strerror(err));
printf(“Child’s exit status was %u\n”, status);
```

_pthread_local_slot

Read or Write Thread-Specific Variables

Syntax

```
u_int32  *_pthread_local_slot(
         int32 slot)
```

Description

This function is used when reading or writing thread-specific versions of "core" C run-time variables. `errno` is an example of a local slot. For threaded applications, there exists one `errno` per thread. `_pthread_local_slot()` is used to get the address of the calling thread's version of `errno`.

`_pthread_local_slot()` returns the address of the storage for a specific slot number. This makes it equally easy to read or write the variable. In addition, `_pthread_local_slot()` automatically saves and restores any modified registers except the return value. This makes it easier to call from assembly language.

This might be used in the dispatcher during function exit to copy the version of `errno` generated by the code within a subroutine module back to the application's version of `errno`.

A module's global data pointer and `_pthread` value must be valid prior to calling `_pthread_local_slot()`.

`slot`

is the slot number. (Input)

Slot numbers are defined in `MWOS/SRC/DEFS/pthread.h`. Once a slot number has been assigned to a variable, it will not change in a subsequent release.

Attributes

Operating System:	OS
State:	User

Library

`mt_clib.l`

pthread_key_create()

Create Thread-Specific Data Key

Syntax

```
#include <pthread.h>
int pthread_key_create(
         pthread_key_t  *key,
    void          (*destructor) (void *));
```

Description

`pthread_key_create()` creates a thread-specific data key visible to all threads in the process. Key values provided by `pthread_key_create()` are opaque objects used to locate thread-specific data. Although the same key value may be used by different threads, the values bound to the key by `pthread_setspecific()` are maintained on a per-thread basis and persist for the life of the calling thread.

If successful, `pthread_key_create()` stores the newly created key value at `*key` and returns 0. Otherwise, an error number is returned.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EAGAIN`	The system lacked the necessary resources to create another thread-specific data key, or the limit on the total number of keys per process, `PTHREAD_KEYS_MAX`, has been exceeded.
`EINVAL`	The key value is invalid.
`ENOMEM`	Insufficient memory exists to create the key.

See Also

`pthread_getspecific()`
`pthread_key_delete()`
`pthread_setspecific()`

Example

```
err = pthread_key_create(&thread_data_key, free_thread_data);
if (err != 0)
   fprintf(stderr, "failed to create key - %s\n", strerror(err));
```

pthread_key_delete()

Delete Thread-Specific Data Key

Syntax

```
#include <pthread.h>

int pthread_key_delete(pthread_key_t key);
```

Description

`pthread_key_delete()` deletes a thread-specific data `key` (input) previously returned by `pthread_key_create()`. The thread-specific data values associated with key need not be `NULL` at the time `pthread_key_delete()` is called. It is the responsibility of the application to free any application storage or perform any cleanup actions for data structures related to the deleted key or associated thread-specific data in any threads; this cleanup can be done either before or after `pthread_key_delete()` is called.

If successful, returns a value of 0; otherwise, returns an error.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The key value is invalid.

See Also

`pthread_key_create()`

`pthread_getspecific()`

`pthread_setspecific()`

Example

```
err = pthread_key_delete(thread_data_key);
if (err != 0)
    fprintf(stderr, "error deleting key - %s\n", strerror(err));
```

pthread_mutex_destroy()

Free Mutex Object

Syntax

```
#include <pthread.h>
```

```
int pthread_mutex_destroy(pthread_mutex_t *mutex);
```

Description

`pthread_mutex_destroy()` destroys the mutex object referenced by `mutex` (input); the mutex object becomes, in effect, uninitialized. If successful, returns a value of 0; otherwise, returns an error.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EBUSY`	Attempt to destroy the object referenced by `mutex` while it is locked or referenced. For example, while being used in a `pthread_cond_wait()` or `pthread_cond_timedwait()` by another thread.
`EINVAL`	The value specified by `mutex` is invalid.

See Also

`pthread_mutex_init()`

Example

```
err = pthread_mutex_destroy(mutx);
if (err != 0)
    fprintf(stderr, "error destroying mutex - %s\n", strerror(err));
```

pthread_mutex_getprioceiling()

Get Mutex Priority Ceiling

Syntax

```
#include <pthread.h>

int pthread_mutex_getprioceiling(
     const pthread_mutex_t      *mutex,
     int                        *prioceiling);
```

Description

`pthread_mutex_getprioceiling()` obtains the value of the priority ceiling value from the mutex object referenced by `mutex` (input).

The value stored at `prioceiling` (output) will be the current value of the priority ceiling for the mutex. Valid priority ceilings are in the range 0 to 65535 (0xffff).

If successful, returns 0 and stores the value of the priority ceiling of `mutex` into the integer referenced by the `prioceiling` parameter. Otherwise, returns an error number.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value specified by `mutex` is invalid.

See Also

`pthread_mutexattr_init()`

`pthread_mutex_setprioceiling()`

Example

```
err = pthread_mutex_getprioceiling(mutex, &pc);
if (err != 0)
   fprintf(stderr, "error getting priority ceiling - %s\n",
strerror(err));
```

pthread_mutex_init()

Allocate Mutex Object

Syntax

```
#include <pthread.h>
int pthread_mutex_init(
     pthread_mutex_t            *mutex,
     const pthread_mutexattr_t  *attr);
```

Description

The `pthread_mutex_init()` function initializes the mutex referenced by `mutex` with attributes specified by `attr`.

If successful, returns a value of 0; otherwise, returns an error.

`mutex`
: is a pointer to the mutex. (Input)

`attr`
: is a pointer to an initialized pthread attribute object. (Input)

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EAGAIN`	The system lacked the necessary resources (other than memory) to initialize another mutex.
`EBUSY`	An attempt to reinitialize the object referenced by `mutex` (a previously initialized, but not yet destroyed, mutex).
`EINVAL`	The value specified by `attr` or `mutex` is invalid.

See Also

`pthread_mutex_lock()`
`pthread_mutex_unlock()`
`pthread_mutex_trylock()`
`pthread_mutex_destroy()`

Example

```
err = pthread_mutex_init(&glob_mutex, NULL);
if (err != 0)
   fprintf(stderr, "error initializing mutex - %s\n", strerror(err));
```

pthread_mutex_lock()

Lock Mutex Object

Syntax

```
#include <pthread.h>
int pthread_mutex_lock(pthread_mutex_t *mutex);
```

Description

The mutex object referenced by `mutex` (input) is locked by calling `pthread_mutex_lock()`. If the mutex is already locked, the calling thread blocks until the mutex becomes available. This operation returns with the mutex object referenced by `mutex` in the locked state with the calling thread as its owner. An attempt by the current owner of a mutex to relock the mutex results in an `EDEADLK` error.

If a signal is delivered to a thread waiting for a mutex, upon return from the signal handler the thread resumes waiting for the mutex as if it was not interrupted. If priority inheritance is enabled for the specified mutex and a thread with a lower priority already owns the mutex then the owning thread's priority will be raised to the level of calling thread.

After the lock is acquired, if priority protection is enabled for the specified mutex and the specified ceiling priority is greater than the thread's current priority the thread's priority will be raised.

If successful, returns a value of 0; otherwise, returns an error.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value specified by `mutex` does not refer to an initialized mutex object.
`EDEADLK`	The current thread already owns the mutex.

See Also

`pthread_mutex_trylock()`　　`pthread_mutex_unlock()`

Example

```
err = pthread_mutex_lock(&glob_mutex);
if (err != 0)
   fprintf(stderr, "error locking mutex - %s\n", strerror(err));
```

pthread_mutex_setprioceiling()

Set Mutex Priority Ceiling

Syntax

```
#include <pthread.h>
int pthread_mutex_setprioceiling(
     pthread_mutex_t      *attr,
     int                  ceiling);
```

Description

`pthread_mutex_setprioceiling()` is used to set the priority ceiling value in an initialized mutex object referenced by `mutex`.

If successful, returns a value of 0; otherwise, returns an error.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value specified by `mutex` is invalid. The new value specified for the attribute is outside the range of legal values for that attribute.

See Also

`pthread_mutexattr_init()`

`pthread_mutex_getprioceiling()`

Example

```
err = pthread_mutex_setprioceiling(mutex, 255);
if (err != 0)
   fprintf(stderr, "error setting priority ceiling - %s\n",
strerror(err));
```

pthread_mutex_trylock()

Lock Mutex Object (Non-Blocking)

Syntax

```
#include <pthread.h>
```

```
int pthread_mutex_trylock(pthread_mutex_t *mutex);
```

Description

`pthread_mutex_trylock()` is a non-blocking mutex lock operation. If `mutex` (input) is currently unowned, the calling thread is made the owner. If `mutex` is currently owned (by any thread, including the calling thread), `EBUSY` is returned.

Returns 0 if a lock on the mutex object referenced by `mutex` is acquired; otherwise, returns an error number.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EBUSY`	The mutex could not be acquired because it was already locked.
`EINVAL`	The value specified by `mutex` does not refer to an initialized mutex object.

See Also

`pthread_mutex_lock()`

`pthread_mutex_unlock()`

Example

```
err = pthread_mutex_trylock(&glob_mutex);
if (err != 0 && err != EBUSY)
   fprintf(stderr, "error trying to lock glob_mutex - %s\n",
strerror(err));
```

pthread_mutex_unlock()

Unlock Mutex Object

Syntax

```
#include <pthread.h>

int pthread_mutex_unlock(pthread_mutex_t *mutex);
```

Description

`pthread_mutex_unlock()` is called by the owner of the mutex object referenced by `mutex` (input) to release it. A `pthread_mutex_unlock()` call by a thread that is not the owner of the mutex results in an `EPERM` error. Calling `pthread_mutex_unlock()` when the mutex object is unlocked also results in an `EPERM` error.

If there are threads blocked on the mutex object referenced by `mutex` when `pthread_mutex_unlock()` is called, the mutex becomes available, and is given to the next waiting thread.

If successful, returns a value of 0; otherwise, returns an error.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value specified by `mutex` does not refer to an initialized mutex object.
`EPERM`	The current thread does not own the mutex.

See Also

`pthread_mutex_lock()`

`pthread_mutex_trylock()`

Example

```
err = pthread_mutex_unlock(&glob_mutex);
if (err != 0)
    fprintf(stderr, "error unlocking glob_mutex - %s\n", strerror(err));
```

pthread_mutexattr_destroy()

Free Mutex Attributes Object

Syntax

```
#include <pthread.h>
int pthread_mutexattr_destroy(
   pthread_mutexattr_t *attr);
```

Description

`pthread_mutexattr_destroy()` destroys a mutex attributes object; the object becomes, in effect, uninitialized.

If successful, returns a value of 0; otherwise, returns an error.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value specified by `attr` is invalid.

See Also

`pthread_mutex_init()`

`pthread_mutexattr_init()`

Example

```
err = pthread_mutexattr_destroy(mutex_attr);
if (err != 0)
   fprintf(stderr, "error destroying attr - %s\n", strerror(err));
```

pthread_mutexattr_getprioceiling()

Get Priority Ceiling Attribute

Syntax

```
#include <pthread.h>
int pthread_mutexattr_getprioceiling(
     const pthread_mutexattr_t  *attr,
     int                        *prioceiling);
```

Description

`pthread_mutexattr_getprioceiling()` obtains the value of the priority ceiling attribute from the mutex attributes object referenced by `attr` (input).

The value stored at `prioceiling` (output) will be the current value of the priority ceiling attribute. Valid priority ceilings are in the range 0 to 65535 (0xffff).

If successful, returns 0 and stores the value of the priority ceiling attribute of `attr` into the integer referenced by the `prioceiling` parameter. Otherwise, returns an error number.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value specified by `attr` is invalid.

See Also

`pthread_mutexattr_init()`

`pthread_mutexattr_setprioceiling()`

Example

```
err = pthread_mutexattr_getprioceiling(mutex_attr, &pc);
if (err != 0)
   fprintf(stderr, "error getting priority ceiling - %s\n",
strerror(err));
```

pthread_mutexattr_getprotocol()

Get Protocol Attribute

Syntax

```
#include <pthread.h>

int pthread_mutexattr_getprotocol(
     const pthread_mutexattr_t  *attr,
     int                        *protocol);
```

Description

`pthread_mutexattr_getprotocol()` obtains the value of the protocol attribute from the mutex attributes object referenced by `attr` (input).

The value stored at `protocol` will be one of `PTHREAD_PRIO_NONE`, `PTHREAD_PRIO_INHERIT`, or `PTHREAD_PRIO_PROTECT`.

If successful, returns 0 and stores the value of the protocol attribute of `attr` into the integer referenced by the `protocol` (output) parameter. Otherwise, returns an error number.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value specified by `attr` is invalid.

See Also

`pthread_mutexattr_init()`

`pthread_mutexattr_setprotocol()`

Example

```
err = pthread_mutexattr_getprotocol(mutex_attr, &prot);
if (err != 0)
   fprintf(stderr, "error getting protocol - %s\n", strerror(err));
```

pthread_mutexattr_getpshared()

Get Mutex Process-Shared Attribute

Syntax

```
#include <pthread.h>

int pthread_mutexattr_getpshared(
     const pthread_mutexattr_t  *attr,
     int                        *pshared);
```

Description

`pthread_mutexattr_getpshared()` obtains the value of the process-shared attribute from the attributes object referenced by `attr` (input).

The value stored at `pshared` will be either `PTHREAD_PROCESS_SHARED` or `PTHREAD_PROCESS_PRIVATE`.

If successful, returns 0 and stores the value of the process-shared attribute of `attr` into the object referenced by the `pshared` (output) parameter. Otherwise, returns an error number.

This facility is not currently supported in Microware's Pthreads implementation. The process-shared attribute can be changed, but both values behave like `PTHREAD_PROCESS_PRIVATE`. `_POSIX_THREAD_PROCESS_SHARED` is not currently defined.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value specified by `attr` is invalid.

See Also

`pthread_mutexattr_init()`

`pthread_mutexattr_setpshared()`

Example

```
err = pthread_mutexattr_getpshared(mutex_attr, &pshared);
if (err != 0)
   fprintf(stderr, "error getting pshared - %s\n", strerror(err));
```

pthread_mutexattr_init()

Allocate Mutex Attributes Object

Syntax

```
#include <pthread.h>
int pthread_mutexattr_init(
    pthread_mutexattr_t *attr);
```

Description

`pthread_mutexattr_init()` initializes a mutex attributes object `attr` with a default value for all of the attributes.

Returns 0 if successful or an error code if unsuccessful.

`attr`

is a pointer to an initialized pthread attribute object. (Input)

The default values for the attributes are shown in Table 2-23.

Table 2-23. Default Attribute Values for Mutex

Attribute	Default Value
Process-shared	PTHREAD_PROCESS_PRIVATE
Protocol	PTHREAD_PRIO_NONE
Priority Ceiling	<none>

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

EINVAL	The key value is invalid.
ENOMEM	Insufficient memory exists to initialize the mutex attributes object.

See Also

`pthread_mutex_init()` `pthread_mutexattr_destroy()`

Example

```
err = pthread_mutexattr_init(mutex_attr);
if (err != 0)
    fprintf(stderr, "error initializing attr - %s\n", strerror(err));
```

pthread_mutexattr_setprioceiling()

Set Priority Ceiling Attribute

Syntax

```
#include <pthread.h>

int pthread_mutexattr_setprioceiling(
     pthread_mutexattr_t  *attr,
     int                  ceiling);
```

Description

`pthread_mutexattr_setprioceiling()` is used to set the priority ceiling attribute in an initialized attributes object referenced by `attr` (input).

`ceiling` (output) must be a valid OS-9 priority value; it must be in the range 0 to 65535 (0xffff).

If successful, returns a value of 0; otherwise, returns an error.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value specified by `attr` is invalid. The new value specified for the attribute is outside the range of legal values for that attribute.

See Also

`pthread_mutexattr_init()`

`pthread_mutexattr_getprioceiling()`

Example

```
err = pthread_mutexattr_setprioceiling(mutex_attr, 255);
if (err != 0)
   fprintf(stderr, "error setting priority ceiling - %s\n",
strerror(err));
```

pthread_mutexattr_setprotocol()

Set Protocol Attribute

Syntax

```
#include <pthread.h>
int pthread_mutexattr_setprotocol(
     pthread_mutexattr_t  *attr,
     int                  protocol);
```

Description

`pthread_mutexattr_setprotocol()` is used to set the protocol attribute in an initialized attributes object referenced by `attr` (input).

`protocol` (output) must be either `PTHREAD_PRIO_NONE`, `PTHREAD_PRIO_INHERIT`, or `PTHREAD_PRIO_PROTECT`,.

If successful, returns a value of 0; otherwise, returns an error.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value specified by `attr` is invalid. The new value specified for the attribute is outside the range of legal values for that attribute.

See Also

`pthread_mutexattr_init()`

`pthread_mutexattr_getprotocol()`

Example

```
err = pthread_mutexattr_setprotocol(mutex_attr, param);
if (err != 0)
   fprintf(stderr, "error setting protocol attr - %s\n", strerror(err));
```

pthread_mutexattr_setpshared()

Set Mutex Process-Shared Attribute

Syntax

```
#include <pthread.h>
int pthread_mutexattr_setpshared(
     pthread_mutexattr_t  *attr,
     int                  pshared);
```

Description

`pthread_mutexattr_setpshared()` is used to set the process-shared attribute in an initialized attributes object referenced by `attr` (input).

`pshared` (input) must be either `PTHREAD_PROCESS_SHARED` or `PTHREAD_PROCESS_PRIVATE`.

If successful, returns a value of 0; otherwise, returns an error.

This facility is not currently supported in Microware's Pthreads implementation. The process-shared attribute can be changed, but both values behave like `PTHREAD_PROCESS_PRIVATE`. `_POSIX_THREAD_PROCESS_SHARED` is not currently defined.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The value specified by `attr` is invalid. The new value specified for the attribute is outside the range of legal values for that attribute.

See Also

`pthread_mutexattr_init()`

`pthread_mutexattr_getpshared()`

Example

```
err = pthread_mutexattr_setpshared(mutex_attr, PTHREAD_PROCESS_PRIVATE);
if (err != 0)
   fprintf(stderr, "error setting pshared attr - %s\n", strerror(err));
```

pthread_once()

Execute Routine Once per Process

Syntax

```
#include <pthread.h>

int pthread_once(
     pthread_once_t  *once_control,
     void            (*init_routine) (void));
```

Description

The first call to `pthread_once()` by any thread in a process with a given `once_control` (input) calls the `init_routine()` with no arguments. Subsequent calls of `pthread_once()` (input) with the same `once_control` will not call the `init_routine()`. On return from `pthread_once()` by any thread, it is guaranteed that `init_routine()` has completed. The `once_control` parameter is used to determine whether the associated initialization routine has been called.

`pthread_once()` is not a cancellation point. However, if `init_routine()` is a cancellation point and is canceled, the effect on `once_control` is as if `pthread_once()` was never called.

The behavior of `pthread_once()` is undefined if `once_control` has automatic storage duration or is not initialized by `PTHREAD_ONCE_INIT`.

If successful, returns a value of 0; otherwise, returns an error.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	once is an invalid pointer to a `pthread_once_t` object. `once` does not point to an initialized object. `init_routine` is an invalid address.

Example

```
err = pthread_once(get_key_once, create_data_key);

if (err != 0)

   fprintf(stderr, "error creating data key - %s\n", strerror(err));
```

_pthread_resume()

Decrement Suspension Counter

Syntax

```
#include <LIB/pthread.h>
int _pthread_resume(
   pthread_t thread,
   int *status);
```

Description

`_pthread_resume()` decrements the suspension counter for the specified target thread. The suspension status of the target thread is returned at the `int` pointed to by status. The `int` is as follows:

- 0 if the target thread was not suspended
- 1 if the target thread went from suspended to not suspended
- > 1 if the target thread remained suspended

A suspension counter is used to support multiple suspension requests with the same target thread. An equal number of resume requests must be made for the thread to continue execution.

If successful, returns a value of 0; otherwise, returns an error.

`thread`
: is the target thread. (Input)

`status`
: is a pointer to the suspension status of the target thread. (Output)

Attributes

Operating System:	OS-9
State:	User

Library

`mt_clib.l`

Possible Errors

`EINVAL`	`thread` or `status` is NULL.
`ESRCH`	`thread` is not a valid thread.

See Also

`_pthread_setsuspendable()`
`_pthread_setunsuspendable()`
`_pthread_suspend()`

Example

```
err = _pthread_resume(worker, &level);
if (err != 0)
   fprintf(stderr, “error resuming worker - %s\n”, strerror(err));
```

pthread_self()

Get Thread Identifier

Syntax

```
#include <pthread.h>
pthread_t pthread_self(void);
```

Description

`pthread_self()` returns the calling thread's thread ID.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

None

See Also

`pthread_equal()`

Example

```
if (pthread_self() == worker[0])
    fputs(“thread is worker #0\n”, stdout);
```

pthread_setcancelstate()

Set Cancel State

Syntax

```
#include <pthread.h>
int pthread_setcancelstate(
    int state,
    int *oldstate);
```

Description

`pthread_setcancelstate()` sets a thread's cancel state. `state` (input) can be either `PTHREAD_CANCEL_ENABLE` or `PTHREAD_CANCEL_DISABLE`. The previous value of the thread's cancel state is returned at `oldstate` (output).

Any cancel requests made against a thread while its state is `PTHREAD_CANCEL_DISABLE` will be held pending until the state is changed to `PTHREAD_CANCEL_ENABLE`.

If successful, returns a value of 0; otherwise, returns an error.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	`state` is neither `PTHREAD_CANCEL_ENABLE` nor `PTHREAD_CANCEL_DISABLE`. `oldstate` is an invalid address.

See Also

`pthread_setcanceltype()`

`pthread_cancel()`

`pthread_cleanup_push()`

`pthread_cleanup_pop()`

`pthread_testcancel()`

Example

```
err = pthread_setcancelstate(PTHREAD_CANCEL_DISABLE, &oldstate);
if (err != 0)
    fprintf(stderr, "error setting cancel state - %s\n", strerror(err));
```

pthread_setcanceltype()

Set Cancel Type

Syntax

```
#include <pthread.h>
int pthread_setcanceltype(
   int type,
   int *oldtype);
```

Description

`pthread_setcanceltype()` sets a thread's cancel type. `type` (input) can be either `PTHREAD_CANCEL_DEFERRED` or `PTHREAD_CANCEL_ASYNCHRONOUS`. The previous value of the thread's cancel type is returned at `oldtype` (output).

When a thread's cancel type is `PTHREAD_CANCEL_DEFERRED` cancel requests against it wait to take effect until the next call to `pthread_testcancel()`. When a thread's cancel type is `PTHREAD_CANCEL_ASYNCHRONOUS` cancel requests are acted upon when they are made. That is, when a thread calls `pthread_cancel()` with a target thread that has cancellation enabled and asynchronous, the target thread will immediately cancel.

If successful, returns a value of 0; otherwise, returns an error.

Cancelling an asynchronous cancel type thread is guaranteed to cause a loss of resources. For example, the memory allocated to implement thread safety for C library functions will be lost. Use deferred cancellation whenever possible.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`EINVAL`	`type` is neither `PTHREAD_CANCEL_DEFERRED` nor `PTHREAD_CANCEL_ASYNCHRONOUS`.

See Also

`pthread_setcancelstate()`
`pthread_cleanup_push()`
`pthread_testcancel()`
`pthread_cancel()`
`pthread_cleanup_pop()`

Example

```
err = pthread_setcanceltype(PTHREAD_CANCEL_DEFERRED, &oldtype);
if (err != 0)
   fprintf(stderr, "error setting cancel type - %s\n", strerror(err));
```

_pthread_setpr()

Set Priority for Target Thread

Syntax

```
#include <pthread.h>
int _pthread_setpr(
   pthread_t thread,
   u_int32 priority);
```

Description

`_pthread_setpr()` sets the OS-9 priority of `thread` (input) to `priority` (input). This call must be used by threaded applications instead of `_os_setpr()` to ensure that priority inversion avoidance is properly supported for mutexes. Calling `_os_setpr()` directly results in undefined behavior as it relates to priority inversion.

Use `_pthread_getstatus()` to determine the priority of a thread.

If successful, returns a value of 0; otherwise, returns an error.

Attributes

Operating System:	OS-9
State:	User

Library

`mt_clib.l`

Possible Errors

`EINVAL`	`thread` is invalid. `priority` is out of range. Valid range of `priority` is 0-65538.
`ESRCH`	`thread` is an invalid thread ID.

See Also

`_pthread_getstatus()`

`pthread_mutex_destroy()`

`pthread_mutex_destroy()`

`_pthread_attr_setpriority()`

`_pthread_attr_getpriority()`

Example

```
err = _pthread_setpr(reactor_shutdown, HIGH_PRIORITY);
if (err != 0)
   fprintf(stderr, "failed to set priority - %s", strerror(err));
```

_pthread_setsignalrange()

Set Range of Signal Values

Syntax

```
#include <pthread.h>
int _pthread_setsignalrange(
     signal_code  low,
     signal_code  high);
```

Description

`_pthread_setsignalrange()` is used to specify the set of signal values that the Pthread library uses internally. Using this function will cause the Pthread library to use signals in the range `low` to `(high - 1)`.

Use this function if your application uses the same set of signal values as the Pthread library. By default, the Pthread library will use signals in the range 40,000 to 49,999 inclusive.

A minimum of 1000 signal values must be specified. The Pthreads library uses about 5 signals per thread as well as 1 per timed condition variable wait.

The new set of signals may not overlap the current set of signal values. This is to ensure integrity of any already allocated signal numbers.

`_pthread_setsignalrange()` returns `0` if successful or an error code if not.

`low and high`
: are the low and high ranges of signals used in the Pthread library. (Input)

Attributes

Operating System:	OS-9
State:	User

Library

`mt_clib.l`

Possible Errors

`EINVAL`	If less than 1000 signal values are in the range or `high` is less than `low` or the specified range overlaps with the signal range currently in use.

Example

```
err = _pthread_setsignalrange(2000, 3500);
if (err != SUCCESS)
   fprintf(stderr, "error setting signal range - %s\n", strerror(err));
```

pthread_setspecific()

Set Thread-Specific Data Pointer

Syntax

```
#include <pthread.h>
int pthread_setspecific(
    pthread_key_t key,
    const void *value);
```

Description

`pthread_setspecific()` function associates a thread-specific value with a `key` (input) obtained via a previous call to `pthread_key_create()`. Different threads may bind different values to the same key. These values are typically pointers to blocks of dynamically allocated memory that have been reserved for use by the calling thread. `value` is an input.

If successful, returns a value of 0; otherwise, returns an error.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

`ENOMEM`	Insufficient memory exists to associate the value with the key.
`EINVAL`	The key value is invalid.

See Also

`pthread_key_create()`

`pthread_getspecific()`

Example

```
err = pthread_setspecific(thread_data_key, thread_data);
if (err != 0)
   fprintf(stderr, "error setting thread data - %s\n", strerror(err));
```

_pthread_setsuspendable()

Decrement Suspendability Counter

Syntax

```
#include <pthread.h>
int _pthread_setsuspendable(void);
```

Description

`_pthread_setsuspendable()` decrements the suspendability counter for the calling thread. When this counter is at 0, the thread is suspendable.

This call would be used by applications that contain thread suspension and resource locking. Before taking a common lock a thread would set itself unsuspendable. This prevents the thread from holding a common lock while it is in the suspended state. Holding a common lock while suspended could cause deadlock for the remaining unsuspended threads. After unlocking the common lock the thread would call this function to return itself to the suspendable state.

Calling this function from a suspendable thread yields no change in state.

Attributes

Operating System:	OS-9
State:	User

Library

`mt_clib.l`

Possible Errors

None

See Also

`_pthread_resume()`

`_pthread_setunsuspendable()`

`_pthread_suspend()`

Example

The following example illustrates how to execute a semaphore protected critical section. Using the mechanisms shown below, a thread calling `_pthread_suspend()` can be assured that `glob_lock` will not be claimed by the suspended thread.

```
_pthread_setunsuspendable();

ec = _os_sema_p(&glob_lock);
if (ec != SUCCESS) {
    fprintf(stderr, "failed to get semaphore\n");
    pthread_exit((void *)ec);
}

/* critical section code */

ec = _os_sema_v(&glob_lock);
if (ec != SUCCESS) {
    fprintf(stderr, "failed to release semaphore\n");
    pthread_exit((void *)ec);
}

_pthread_setsuspendable();
```

_pthread_setunsuspendable()

Increment Suspendability Counter

Syntax

```
#include <pthread.h>
```

```
int _pthread_setunsuspendable(void);
```

Description

`_pthread_setunsuspendable()` increments the suspendability counter for the calling thread. When this counter is greater than 0, the thread is unsuspendable. This call does not return until the unsuspendable state is achieved.

This call is used by applications that contain thread suspension and resource locking. Before taking a common lock a thread would use this call to set itself unsuspendable. This prevents the thread from holding a common lock while it is in the suspended state. After unlocking the common lock the thread would call `_pthread_setsuspendable()` to return itself to the normal suspendable state.

Calling this function from a unsuspendable thread simply increases the suspendability counter. It is expected that each `_pthread_setunsuspendable()` call has a matching `_pthread_setsuspendable()` call.

Calling this function more than `0xffffffff` times without any intervening `_pthread_setsuspendable()` calls results in undefined behavior. Fewer `_pthread_setsuspendable()` calls than `_pthread_setunsuspendable()` calls will be required to return to the normal suspendable state.

Attributes

Operating System:	OS-9
State:	User

Library

`mt_clib.l`

Possible Errors

Errors from memory allocation and getting a process descriptor if called when signals are masked.

See Also

`_pthread_resume()`

`_pthread_setsuspendable()`

`_pthread_suspend()`

Example

Refer to the example provided for `_pthread_setunsuspendable()`.

_pthread_suspend()

Increment Suspension Counter

Syntax

```
#include <pthread.h>
int _pthread_suspend(
    pthread_t thread,
    unsigned int *count);
```

Description

`_pthread_suspend()` increments the suspension counter for the target thread specified by `thread` (input). The target thread's suspension counter prior to the suspension request is returned at the unsigned integer pointed to by `count` (output). A counter is used to support multiple suspension requests on the same target thread. An equal number of resume requests must be made before the target thread will resume execution.

This call does not return until the target thread has been successfully suspended. That is, if the target thread has set itself unsuspendable then this call will poll until the target sets itself back to suspendable.

Refer to the section on Thread Suspension for more information on what services are guaranteed while threads are suspended.

Returns 0 if the thread's suspension counter was successfully incremented or an error number if not.

Attributes

Operating System:	OS-9
State:	User

Library

`mt_clib.l`

Possible Errors

`EINVAL`	The specified thread or count pointer is `NULL`.
`ESRCH`	The specified thread is invalid or has terminated.
`EDEADLK`	The specified thread is the calling thread and there is only one thread in the process.

See Also

`_pthread_resume()`
`_pthread_setsuspendable()`
`_pthread_setunsuspendable()`

Example

```
err = _pthread_suspend(child, &count);
if (err != 0) {
    fprintf(stderr, "failed to suspend child\n");
    pthread_exit((void *)err);
}

/* do some activity with child suspended */

err = _pthread_resume(child, &status);
if (err != 0) {
    fprintf(stderr, "failed to resume child\n");
    pthread_exit((void *)err);
}
```

pthread_testcancel()

Test for Pending Cancel

Syntax

```
#include <pthread.h>
```

```
void pthread_testcancel(void);
```

Description

`pthread_testcancel()` checks for a pending, deferred cancel request. If there is one, cancellation cleanup handlers are called in the reverse order in which they were pushed, thread specific data destructors are called in an unspecified order, and the thread is terminated with `PTHREAD_CANCELED` as its status. If the cancel state of the thread is `PTHREAD_CANCEL_DISABLE`, this call has no effect.

`pthread_testcancel()` does not return if a cancel is pending.

Attributes

Operating System:	OS-9
State:	User
Compatibility:	POSIX

Library

`mt_clib.l`

Possible Errors

None

See Also

`pthread_cancel()`

`pthread_setcancelstate()`

`pthread_setcanceltype()`

Example

```
pthread_testcancel();
```

putc(), putchar()

Put Next Character to File, Standard Out

Syntax

```
#include <stdio.h>
int putc(
    int chr,
    FILE *stream);
    int putchar(int chr);
```

Description

`putc()` converts a character to an `unsigned char`. It writes the character to the output stream at the position indicated by the associated file position indicator for the stream, if defined, and advances the indicator appropriately. If the stream cannot support positioning requests or if the stream was opened with append mode, the character is appended to the output stream.

If it is implemented as a macro, it may evaluate the stream more than once. Therefore, the parameter should never be an expression with side effects.

`putc()` returns the character written. If a write error occurs, the error indicator for the stream is set and `putc()` returns `EOF`.

`putchar()` is similar to `putc()` with the second parameter `stdout`.

`chr`
: is the character to write. (Input)

  Only the lower 16 bits of `chr` are used.

`stream`
: is a pointer to the C I/O `FILE` structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fopen()`
`fputc()`
`getc(), getchar()`

putenv()

Change or Add Value to Environment

Syntax

```
#include <UNIX/os9def.h>

int putenv(const char *string)
```

Description

`putenv()` sets the value of an environment variable.

`putenv()` manipulates the environment pointed to by `_environ`, and can be used in conjunction with `getenv()`. However, `envp` (the third argument to main) is not changed. This routine uses `malloc` to enlarge the environment.

`putenv()` returns non-zero if it was unable to obtain enough space using `malloc` for an expanded environment, otherwise zero.

`string`

is in the form "`name=value`" where `name` is the name of the environment variable to set and `value` is the new value for the environment variable. (Input)

If the variable named exists, its value is changed to `value`. If the variable name does not exist, a new environment list entry is created and set to the value passed. `putenv()` makes a copy of `string` so subsequent modifications to `string` do not affect the environment.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

puts()

Output String to File

Syntax

```
#include <stdio.h>
int puts(const char *strptr);
```

Description

`puts()` writes `strptr` to the stream pointed to by `stdout` and adds a newline character to the output. The terminating null character is not written.

`puts()` returns `EOF` if an error occurs. Otherwise, it returns a non-negative value.

`strptr`
: is a pointer to a string to write to `stdout`. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fgets()`

`gets()`

putw()
Output Word to File

Syntax

```
#include <stdio.h>
int putw(
    int num,
    FILE *stream);
```

Description

`putw()` writes an integer, converted to a word, to a file. `putw()` neither assumes nor causes any special alignment in the file.

`putw()`, like `getw()`, is machine-dependent because the size of the integer it outputs varies with the integer size of the machine on which it resides. This compiler defines `int` values as 4-byte quantities, but `putw()` actually outputs 2 bytes.

If successful, `putw()` returns the value it has written. Otherwise, it returns `-1`.

`num`
: is the integer to write to the structure `FILE`. (Input)

`stream`
: is a pointer to the file. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`getw()`

qsort()
Quick Sort

Syntax

```
#include <stdlib.h>
void qsort(
    void *base,
    size_t nmemb,
    size_t size,
    int (*compar)
      (const void *, const void *));
```

Description

`qsort()` sorts an array.

`base`
: is a pointer to the initial array element. (Input)

`nmemb`
: is the number of elements in the array. (Input)

`size`
: is the size of each array element. (Input)

`compar`
: is a pointer to a comparison function. (Output)

The contents of the array are sorted into ascending order according to `compar`. `compar` is called with two parameters that point to the objects being compared. `compar` returns an integer that is:

- Negative, if the first parameter is less than the second.
- Zero, if the first parameter is equal to the second.
- Positive, if the first parameter is greater than the second.

If two elements compare as equal, their order in the sorted array is unspecified. `qsort()` returns no value.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

raise()

Send Signal To Program

Syntax

```
#include <signal.h>
int raise(int sig);
```

Description

`raise()` sends a signal to the executing program.

`sig`
: specifies the signal to send. (Input)

`raise()` returns zero if successful. Otherwise, it returns a non-zero value.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

rand()

Return Random Integer

Syntax

```
#include <stdlib.h>

int rand(void);
```

Description

`rand()` computes a sequence of pseudo-random integers in the range zero to `RAND_MAX` and returns a pseudo-random integer.

`rand()` uses the following algorithm:

```
static unsigned long int next = 1;

int rand(void)      * RAND_MAX assumed to be 32767

{

   next = next * 1103515245 + 12345;

   return (unsigned int) (next/65536) % 32768;

}
```

`next` contains the current internal value for calculating pseudo-random numbers. Because the value of `next` is divided by 65536 before returning the value, this algorithm avoids the common problem of non-random, low-order bits.

By storing the value in an `int`, this algorithm also allows the period of the sequence to be greater than `RAND_MAX`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

read()

Read Bytes from Path

Syntax

```
#include <modes.h>
int read(
    int path,
    char *buffer,
    unsigned count);
```

Description

`read()` reads bytes from a path.

`read()` essentially performs a raw `read`; that is, the `read` is performed without translating characters. The characters are passed to the program as read.

`read()` returns the number of bytes actually read (`0` indicates the end of the file). If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

End-of-file is returned as zero bytes being read, not an error indication.

The thread enabled version of this function contains a cancel point. For more information see *Using OS-9 Threads*.

`path`

specifies the path number of the path from which to read. (Input)

The path number is an integer indicating one of the standard path numbers (0, 1, or 2) or a path number returned from a successful call to `open()`, `creat()`, `create()`, or `dup()`.

`buffer`

is a pointer to a space with at least `count` bytes of memory into which `read()` puts the data read from the path. (Output)

`count`

is the minimum buffer size. (Input)

It is guaranteed that at most, `count` bytes are read, but often less are read, either because the path serves a terminal and input stops at the end of a line or the end-of-file has been reached.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`creat()`

`create()`

`dup()`

`open()`

`read()`

`readln()`

`I$Read`	*OS-9 for 68K Technical Manual*
`I_READ`	*OS-9 Technical Manual*

readdir()

Return Pointer

Syntax

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

```
struct direct *readdir(DIR *dirp);
```

Description

`readdir()` returns a pointer to a structure containing the next directory entry.

`readdir()` returns `NULL` upon reaching the end of the directory or detecting an invalid `seekdir()` operation.

`dirp`
: is a pointer to the directory. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`sys_clib.l`

See Also

`closedir()`

`opendir()`

`rewinddir()`

`seekdir()`

`telldir()`

readln()

Read Bytes from Path

Syntax

```
#include <modes.h>
int readln(
    int path,
    char *buffer,
    unsigned count);
```

Description

`readln()` reads bytes from a path.

`readln()` causes line-editing, such as echoing, to take place and returns once a `\n` is read in the input or the number of bytes requested has been read. `readln()` is the preferred call for reading from the terminal.

`readln()` returns the number of bytes actually read (`0` indicating end of file). If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

End-of-file is returned as zero bytes being read, not an error indication.

The thread enabled version of this function contains a cancel point. For more information see *Using OS-9 Threads*.

`path`

specifies the path number of the file from which to read. (Input)

The path number is an integer indicating one of the standard path numbers (`0`, `1`, or `2`) or a path number returned from a successful call to `open()`, `creat()`, `create()`, or `dup()`.

`buffer`

is a pointer to a space with at least `count` bytes of memory into which `read()` puts the data read from the path. (Output)

`count`

is the minimum buffer size. (Input)

It is guaranteed that at most, `count` bytes are read. Often less are read, either because the path serves a terminal and input stops at the end of a line or the end-of-file has been reached.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`creat()`

`create()`

`dup()`

`open()`

`_os_readln()`

`read()`

`I$ReadLn`	*OS-9 for 68K Technical Manual*
`I_READLN`	*OS-9 Technical Manual*

readv()

Read Input

Syntax

```
#include <UNIX/os9def.h>
int readv(
   unsigned int fd,
   struct iovec *iov,
   unsigned int iovcnt);
```

Description

`readv()` reads input, the same action as `read()`. The difference is that `readv()` scatters the input data into the `iovcnt` buffers specified by the members of the `iov` array:

```
 iov[0], iov[1], ...iov[iovcnt-1].
```

If `iovcnt` is zero, the value of the `iov_len` member in an `iovec` structure is less than zero, or all the `iov_len` members of the `iovec` structures are zero, `readv()` returns `-1` and sets the global variable `errno`.

For `readv()`, the `iovec` structure is defined as:

```
struct iovec{
     caddr_t iov_base;
     int iov_len
};
```

Each `iovec` entry specifies the base address and length of an area in memory where data should be placed. `readv()` always fills an area completely before proceeding to the next.

Upon successful completion, `readv()` returns the number of bytes actually read and placed in the buffers.

`fd`	Input
`iov`	Output
`iovcnt`	Input

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

realloc()

Resize Block of Memory

Syntax

```
#include <stdlib.h>
void *realloc(
    void *ptr,
    size_t size);
```

Description

`realloc()` changes the size of a memory block. The contents of the object are unchanged up to the lesser of the new and old sizes. If the new size is larger, the value of the newly allocated portion of the object is indeterminate.

`realloc()` returns either a null pointer or a pointer to the possibly moved allocated space.

`ptr`

is a pointer to the old block of memory. (Input)

If `ptr` is a null pointer, `realloc()` behaves like `malloc()` for the specified size. Otherwise, if `ptr` does not match a pointer earlier returned by `calloc()`, `malloc()`, or `realloc()`, or if the space has been deallocated by a call to `free()`, `_lfree()`, `realloc()`, or `_lrealloc()`, the behavior is undefined.

If the space cannot be allocated, `ptr` is unchanged.

`size`

is the size of the new block of memory. (Input)

If `size` is zero and `ptr` is not a null pointer, the object `ptr` points to is freed.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`calloc()`
`_lcalloc()`
`_lrealloc()`
`realloc()`
`free()`
`_lfree()`
`malloc()`

regcomp()

Regular Expression Handler

Syntax

```
#include <UNIX/regexp.h>
regexp *regcomp(const char *str);
```

Description

`regcomp()` returns a pointer to the compiled regular expression. Otherwise a string containing an error message is returned. If an error occurs, the function `regerror()` is called with a character string for the error and `NULL` is returned.

When the compiled regular expression is no longer needed, it can be passed to `free()`.

`strregcomp()`
: compiles a string (`str`) into an internal form suitable for pattern matching with `regex()`. `regex()` matches a compiled regular expression against a string. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`regerror()`

`regex()`, `regexec()`

regerror()

Regular Expression Error Handler

Syntax

```
#include <UNIX/regexp.h>

void regerror (const char *msg);
```

Description

If printing a message is inappropriate for the application using regular expressions, the programmer may define a `regerror()` function to override the `unix.l` version.

`msgregerror()`
: is called by the functions `regex()` and `regcomp()` when various errors occur. `regerror()` prints the string `"regexp: "` and the string pointed to by `msg`. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`regcomp()`

`regex()`, `regexec()`

regex(), regexec()

Regular Expression Handler

Syntax

```
#include <UNIX/regexp.h>
int regex(
    regexp *re,
    char const *str);
```

Description

`regex()` returns one if the strings match and zero if the strings don't match. If an error occurs, `regerror()` is called with the appropriate error message and zero is returned to indicate the strings did not match.

`re` and `strregex()`
: compare a string (`str`) with a compiled regular expression (`re`). (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`regcomp()`

`regerror()`

remove()

Remove File

Syntax

```
#include <stdio.h>

int remove(const char *filename);
```

Description

`remove()` deletes a file. Subsequent attempts to open a file using that name fail, unless the file is recreated.

`remove()` returns zero if the operation succeeds. Otherwise, it returns a non-zero value.

`filename`
: is a pointer to the file to delete. (Input)

  If the file is open, `remove()` returns `-1` with `errno` set to `EOS_SHARE`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

rename()

Rename File

Syntax

```
#include <stdio.h>
int rename(
    const char *old,
    const char *new);
```

Description

`rename()` renames a file.

The file named `old` is no longer accessible by that name. If a file named `new` exists prior to the call to `rename()`, it is overwritten.

`rename()` returns zero if the operation succeeds. Otherwise, it returns a non-zero value and the file name does not change.

`old`
: is a pointer to the name of an existing file. (Input)

`new`
: is a pointer to the new name for the file. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

rewind()

Return File Pointer to Zero

Syntax

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

```
void rewind(FILE *stream);
```

Description

`rewind()` sets the file position indicator for the stream pointed to by `stream` to the beginning of the file. It is equivalent to the following except that the error indicator for the stream is also cleared:

```
(void)fseek(stream, 0L, SEEK_SET)
```

```
;
```

`stream`
is a pointer to the C I/O `file` structure. (Input)

`rewind()` returns no value.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fseek()`

rewinddir()

Reset Position of Directory Stream

Syntax

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

```
void rewinddir(DIR *dirp);
```

Description

`rewinddir()` resets the position of the named directory stream to the beginning of the directory.

`dirp`
    is a pointer to the directory stream. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`closedir()`

`opendir()`

`readdir()`

`seekdir()`

`telldir()`

rindex()

Search for Character in String

Syntax

```
#include <strings.h>
char *rindex(
    const char *ptr,
    int ch);
```

Description

`rindex()` returns a pointer to the last occurrence of a character in a string. If the character is not found, `rindex()` returns `NULL`.

`ptr`

is a pointer to the string to search. (Input)

`ch`

is the character for which to search. (Input)

Only the lower 8 bits of `ch` are used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`index()`

Example

The following example code fragment looks for a period (`.`) in the string and sets `ptr` to point to it. The search starts from the end of the string and progresses to the front of the string. Note that `ch` is a character, not a pointer to a character:

```
func()
{
   char *ptr,*string;
   if((ptr = rindex(string,'.')) {
       process(ptr);
   } else {
       printf("No '.' found!\n");
   }
}
```

sbrk()

Extend Data Memory Segment

Syntax

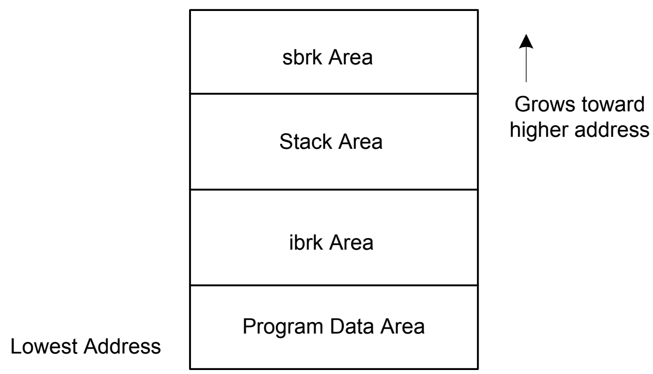
```
#include <stdlib.h>

char *sbrk(unsigned size);
```

Description

`sbrk()` allocates memory from the top of the data area upwards.

Figure 2-10. sbrk() Memory Allocation Table



`sbrk()` grants memory requests by calling the `F$MEM` (for OS-9 for 68K) or the `F_MEM` (for OS-9) system call. This method resizes the data area to a larger size. The new memory granted is contiguous with the end of the previous data memory.

On systems without an MMU, `sbrk()` fails quickly because it may keep growing in size until the data area reaches other allocated memory. At this point, it is impossible to increase in size and an error is returned. A program may increase its data size by only 20K, even if 200K is available elsewhere.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`size`
: specifies the size of the memory block. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`sys_clib.l`

See Also

`_os_mem()`
`_os_srqmem()`

`F$Mem`	*OS-9 for 68K Technical Manual*
`F_MEM`	*OS-9Technical Manual*

scanf()

Input Strings Conversion

Syntax

```
#include <stdio.h>

int scanf(const char *format, ...);
```

Description

`scanf()` reads input from `stdin`.

`scanf()` returns `EOF` if an input failure occurs before any conversion. Otherwise, `scanf()` returns the number of input items assigned, which can be fewer than provided for, or zero in the event of an early matching failure.

The `sclib.l` and `sclib.il` libraries contain a smaller version of the `scanf()` function. Refer to the *Using Ultra C/C++* manual for more information about the small library functions.

`format`
: is a pointer to the control string. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fscanf()`

`sscanf()`

sched_yield()

Yield Processor

Syntax

```
#include <sched.h>
```

```
int sched_yield(void);
```

Description

`sched_yield()` gives up a thread's timeslice, allowing the kernel to reschedule the active threads. If there are other active threads at the same priority as the calling thread, one of them will be given the processor. The standard aging process occurs at every `sched_yield()` call.

`sched_yield()` works much like `_os_sleep()` with a `ticks` value of 1, except that it does not implicitly unmask signals.

If successful, 0 is returned, otherwise an error number is returned.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_sleep()`

`tsleep()`

Example

```
while (not_ready)
   sched_yield();/* allow other threads to run */
```

seekdir()

Set Position of Next Readdir

Syntax

```
#include <dir.h>
void seekdir(
    DIR *dirp,
    long loc);
```

Description

`seekdir()` sets the position of the next `readdir()` operation on the directory stream to `loc`.

Values returned by `telldir()` are valid only for the lifetime of the associated `dirp` pointer. If the directory is closed and then reopened, the `telldir()` value may no longer be valid. It is safe to use a previous `telldir()` value immediately after a call to `opendir()` and before any calls to `readdir()`.

`dirp`
: is a pointer to the directory. (Input)

`loc`
: is the location for the next `readdir()` operation. (Input)

  `loc` is a specific position in the directory stream returned by a previous call to `telldir()`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`closedir()`

`opendir()`

`readdir()`

`rewinddir()`

`telldir()`

select()

Synchronous I/O Multiplexing

Syntax

```
#include <UNIX/os9types.h>
#include <types.h>
int select (
    unsigned int width,
    fd_set *readfds,
    fd_set *writefds,
    fd_set *exceptfds,
    struct timeval *timeout);
```

Description

`select()` examines the path sets whose addresses are passed in `readfds`, `writefds`, and `exceptfds` to see if some of their paths are ready for reading, ready for writing, or have an exceptional condition pending.

`select()` returns a non-negative value on success. A positive value indicates the number of ready paths in the path sets. Zero indicates that the time limit referred to by `timeout` has expired. On failure, `select()` returns -1, sets `errno` to indicate the error, and the path sets are not changed.

User applications using `select()` can not use the `_os_intercept()` function.

No paths in the `exceptfds` are ever returned since OS-9 for 68K does not support the concept of "exceptional condition."

`width`
: is the number of bits to be checked in each bit mask that represent a path. The paths from `0` through `width-1` in the descriptor sets are examined. `width` is in the range `1-FD_SETSIZE`. The total number of ready paths in all the sets is returned. The macros `FD_SET`, `FD_CLR`, `FD-ISSET`, and `FD_ZERO` have been defined in `os9types.h` to manipulate these `fd_set` structures.

`timeout`
: If `timeout` is not a NULL pointer, it specifies a maximum interval to wait for the selection to complete. If `timeout` is a NULL pointer, the `select` blocks indefinitely. To effect a poll, the `timeout` argument should be a non-NULL pointer, pointing to a zero-valued `timeval` structure.

`readfds, writefds, exceptfds`
: Any `readfds`, `writefds`, and `exceptfds` may be given as NULL pointers if no paths are of interest. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

set<name>()

Set Value of SPR, DCR, PREG, or TB

Syntax

```
#include <getset.h>

#include <types.h>

void _set_<name>(u_int32 val);
```

Description

The `_set_<name>()` class of functions can be used to set the value of Special Purpose Registers (SPRs), Device Control Registers (DCRs), Processor Registers (PREG), and Time-Based Registers (TBs).

All functions are provided. It is the programmer's responsibility to avoid using system-state only registers from user-state and accessing registers that do not exist on the target processor. All registers are accessible from system-state. Only those noted are available from user-state. Attempting to use system state registers from user state causes unpredictable results.

For information on which `_get<name>()` functions are available for your processor, refer to the `getset.h` header file in the following location:

```
MWOS\OS9000\<PROCESSOR>\DEFS\getset.h
```

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

See Also

`_get_<name>()`

setbuf()

Fix File Buffer

Syntax

```
#include <stdio.h>

void setbuf(
    FILE *stream,
    char *buf);
```

Description

`setbuf()` sets up buffering for an I/O stream. It may be used only after the stream has been associated with an open file and before any other operation is performed on the stream. It is similar to `setvbuf()` called with `_IOFBF` for `mode` and `BUFSIZ` for `size`, or, if `buf` is a null pointer, with `_IONBF` for `mode`.

`stream`
: is a pointer to the C I/O `FILE` structure. (Input)

`buf`
: is a pointer to the file's buffer. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fopen()`

`getc()`, `getchar()`

`putc()`, `putchar()`

`setvbuf()`

_setcrc()

Re-Validate Module CRC

Syntax

```
#include <module.h>

int _setcrc(mh_com *module);
```

Description

`_setcrc()` updates the header parity and CRC of a module in memory. The module must have the correct size and sync bytes; other parts of the module are not checked. If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

Although `_os_setcrc()` and `_setcrc()` functions do update the header and CRC of a module in memory, the copy of the module header in the module directory is not affected. Therefore, you have an invalid module directory entry for the memory module with the new CRC and an error 236 results if links to the module are attempted.

`module`
is a pointer to the module to update. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_setcrc()`

`F$SetCRC`	*OS-9 for 68K Technical Manual*
`F_SETCRC`	*OS-9 Technical Manual*

setenv()

Insert or Reset Environment Variable Name

Syntax

```
#include <stdlib.h>
int setenv(
        const char *name,
        const char *value,
        int overwrite);
```

Description

The `setenv()` function inserts or resets the environment variable name in the current environment list. If the variable name does not exist in the list, it is inserted with the given value. If the variable does exist, the argument overwrite is tested; if overwrite is zero, the variable is not reset, otherwise it is reset to the given value.

`setenv()` and returns zero if successful; otherwise the global variable errno is set to indicate the error and a -1 is returned.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

set_excpt_base()

Set Exception Table Base Address

Syntax

```
#include <regs.h>
void set_excpt_base(
   u_int32   *dsreg);
```

Description

`set_excpt_base()` sets the exception table base address. It is a system state only system call.

`set_excpt_base()` is supported only on the 80x86 family of processors version of the compiler.

`dsreg`
is a pointer to the base address of the exception table. (Input)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

set_gdtr()

Set Global Descriptor Pointer

Syntax

```
#include <regs.h>
void set_gdtr(
    u_int32 *base);
```

Description

`set_gdtr()` sets the global descriptor pointer. It is a system state only system call.

`set_gdtr()` is supported only on the 80x86 family of processors version of the compiler.

`base`
is a pointer to the global descriptor. (Input)

Attributes

Operating System:	OS-9
State:	System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

setgid()

Set Global Descriptor Pointer

Syntax

```
#include <UNIX/os9def.h>

int setgid(
   unsigned int gid);
```

Description

`setgid()` sets the user's group identification of the current process as specified by `gid` (input). `setgid()` returns `-1` on error and sets the global variable `errno` to indicate the error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

setime()

Set System Time

Syntax

```
#include <time.h>
```

```
int setime(struct sgtbuf *timebuf);
```

Description

`setime()` sets the system time from a time buffer. The time units are defined in the `time.h` header file. This function uses the year 1900 as a base, and the year passed to the function must be an offset of 1900. For example, to use the `setime()` function and set to the year 2011, you need to pass `111` in the year member of the `tm` structure. If successful, `setime()` returns a pointer to a buffer. Otherwise, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

Only super users may set the time.

`timebuf`

is a pointer to the time buffer. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`getime()`

`_os_setime()`

`_os9_setime()`

`F$STime`	*OS-9 for 68K Technical Manual*
`F_STIME`	*OS-9Technical Manual*

setitimer()

Set a Timer to Specified Value

Syntax

```
#include <UNIX/os9time.h>
int setitimer(
            int which,
            const struct itimerval *value,
            struct itimerval *ovalue);
```

Description

The `setitimer()` call sets a timer to the specified value (returning the previous value of the timer if ovalue is non-nil). A timer value is defined by the itimerval structure:

```
struct itimerval {
  struct  timeval it_interval;    /* timer interval */
  struct  timeval it_value;       /* current value */
};
```

The first parameter must be `ITIMER_REAL`; the third must be NULL.

If it_value is non-zero, it indicates the time to the next timer expiration. If `it_interval` is non-zero, it specifies a value to be used in reloading `it_value` when the timer expires. If it_interval is non-zero, it must be the same value as it_value. Setting `it_value` to 0 disables a timer. Setting `it_interval` to 0 causes a timer to be disabled after its next expiration (assuming `it_value` is non-zero).

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`_os_alarm_cycle()`

`_os_alarm_set()`

`_os_alarm_delete()`

setjmp()

Non-Local Goto

Syntax

```
#include <setjmp.h>
int setjmp(jmp_buf env);
```

Description

`setjmp()` is a macro which saves its calling environment in its `env` parameter for later use by a call to `longjmp()`.

If the return is from a direct call, `setjmp()` returns zero.

If the return is from a call to `longjmp()`, `setjmp()` returns a non-zero value.

`setjmp()` may only be used as follows:

- The entire expression of an expression statement. This may be cast to `void`. For example:

  `(void) setjmp(env);`

- The entire controlling expression of a selection or iteration statement. For example:

  `while(setjmp(env))`

- One expression of a relational or equality operator with the operand an integral constant expression, with the resulting expression being the entire controlling expression of a selection or iteration statement. For example:

  `while(1<=setjmp(env))`

- The operand of the unary operator (`!`) with the resulting expression being the entire controlling expression of a selection or iteration statement. For example:

  `while(!setjmp(env))`

`env`

is a program environment structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`longjmp()`

setlocale()

Locale Control

Syntax

```
#include <locale.h>
char *setlocale(
    int category,
    const char *locale);
```

Description

`setlocale()` selects the appropriate portion of the program's locale as specified by `category` and `locale`. You can use `setlocale()` to change or query the program's entire current locale or portions of it.

Currently, the C locale is fully supported.

If `locale` (input) is `C`, the minimal environment for C translation is specified.

If `locale` is "", the value of the corresponding environment variable, `LC_TIME` for category `LC_TIME`, and so forth, is checked for validity. If the environment variable contains a valid locale string, `locale` is set accordingly. If it does not contain a valid string, `setlocale()` behaves as if passed an invalid locale string.

If the environment variable is not set or is set to the empty string, the existence and validity of the environment variable `LANG` is checked and `locale` is set from these. If `LANG` does not exist, `locale` is set to `C`.

At program startup, the equivalent of the following is executed:

```
setlocale(LC_ALL, "C");
```

If `locale` is a pointer to a string and the selection can be honored, `setlocale()` returns a pointer to the string associated with the specified category for the new locale. If the selection cannot be honored, `setlocale()` returns a null pointer and the program's locale is not changed.

A null pointer for `locale()` causes `setlocale()` to return a pointer to the string associated with the category for the program's current locale; the program's locale is not changed.

The pointer to the string returned by `setlocale()` is such that a subsequent call with that string value and its associated category restores that part of the program's locale. The program does not modify the string, but it may be overwritten by a subsequent call to `setlocale()`.

`category`
can be one of the values shown in Table 2-24. (Input)

Table 2-24. setlocale() Category Values

Name	Description
`LC_ALL`	Names the program's entire locale. The other values for `category` name only a portion of the program's locale.
`LC_COLLATE`	Affects the behavior of `strcoll()` and `strxfrm()`
`LC_CTYPE`	Affects the behavior of the character handling functions and the multibyte functions
`LC_MONETARY`	Affects the monetary formatting information returned by `localeconv()`
`LC_NUMERIC`	Affects the decimal point character for the formatted I/O functions and the string conversion functions, as well as the non-monetary formatting information returned by `localeconv()`
`LC_TIME`	Affects the behavior of `strftime()`

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`atof()`
`atoi()`
`atol()`
`fprintf()`
`fscanf()`
`isalnum()`
`isalpha()`
`iscntrl()`
`isdigit()`
`isgraph()`
`islower()`
`isprint()`
`ispunct()`
`isspace()`
`isupper()`
`isxdigit()`
`_issjis1()`
`_issjis2()`
`_isjis_kana()`
`mblen()`
`mbstowcs()`
`mbtowc()`
`printf()`
`scanf()`
`sprintf()`
`sscanf()`
`vfprintf()`
`vprintf()`
`vsprintf()`
`wctomb()`
`wcstombs()`
`strtod()`
`strtoll()`
`strtoul()`
`strcoll()`
`strftime()`
`strxfrm()`

setpr()

Set Process Priority

Syntax

```
#include <process.h>
int setpr(
    int pid,
    int prior);
```

Description

`setpr()` sets the priority of a process. The lowest priority is zero; the highest is 65535.

If an error occurs, such as the process not having the same user ID as the caller, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`pid`
: is the process ID. (Input)

`prior`
: specifies the priority. (Input)

  Only the lower 16 bits of `prior` are used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

setpwent()

Reset Password File

Syntax

```
#include <UNIX/pwd.h>
int setpwent(void);
```

Description

`setpwent()` has the effect of rewinding the password file to allow for repeated searches.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`endpwent()`

`fgetpwent()`

`getpwent()`

`getpwnam()`

`getpwuid()`

setstat()

Set File Status

Syntax

```
#include <sg_codes.h>
#include <sgstat.h>
int setstat(
    int code,
    int path,
    char *buffer); /* code = 0* /
int setstat(
    int code,
    int path,
    long size);   /* code = 2* /
```

Description

`setstat()` sets the path options or the file size of the file open on `path`.

If `code` is 0, the buffer is copied to the path descriptor options section. The `sgstat.h` header file contains the definitions for the path options.

If `code` is 2, `size` should be an `int` specifying the new file size. Only the lower 16 bits of `code` are used.

If an error occurs, both forms of the call return `-1` and place the appropriate error code in the global variable `errno`.

This call exists for 6809 portability. The `_os_ss` functions are the preferred versions of these function calls.

`path`
: is the path number of the open file. (Input)

`buffer`
: is a pointer to the buffer containing the path descriptor options. (Input)

`size`
: is the size of the new file. (Input)

Attributes

Operating System:	OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

getstat()	_os_ss_attr()
_os9_ss_close()	_os_ss_dcon()
_os_ss_dcoff()	_os_ss_dsrts()
_os_ss_enrts()	_os_ss_erase()
_os_ss_fd()	_os_ss_lock()
_os_ss_popt()	_os_ss_relea()
_os_ss_reset()	_os_ss_rfm()
_os_ss_sendsig()	_os_ss_size()
_os_ss_skip()	_os_ss_ticks()
_os_ss_wfm()	_os_ss_wtrack()
_os9_ss_open()	
I$SetStt	*OS-9 for 68K Technical Manual*

_setsys()

Set/Examine System Global Variables

Syntax

```
#include <sysglob.h>
int _setsys(
    int glob,
    int size[,
    int value]);
```

OS-9 for 68K Users:

Include `setsys.h` in addition to `sysglob.h`.

For C++ Programmers:

The parameters for this function are *not* optional in C++. You must specify each; if you do not, a compliation error will occur.

Description

`_setsys()` changes or examines a system global variable. These variables are defined in `sys.l`. The same values are defined in the `setsys.h` header file for C program use. These variables begin with a `D_` prefix.

`_setsys()` returns the value of the variable on an examination request. On a change request, `_setsys()` returns the value of the variable before the change.

If the examine or change request fails, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

Use `_getsys()` to examine variables without the possibility of accidental change.

`glob`
: is the offset to the intended variable. (Input)

  Only the lower 16 bits of `glob` are used.

`size`
: is the size of the variable. (Input)

  `size | 0x80000000` is used to examine the variable.

`value`
: is an optional parameter used only when changing a variable. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_getsys()`

`_os_getsys()`

`_os_setsys()`

`F$SetSys`	*OS-9 for 68K Technical Manual*
`F_SetSys`	*OS-9 Technical Manual*

setuid()
Set User ID

Syntax

```
#include <process.h>
int setuid(int uid);
```

Description

`setuid()` sets the group/user ID of the process to `uid`. The following restrictions govern the use of `setuid()`:

- User number `0.0` may change his/her ID to anything without restriction.
- A primary module owned by user `0.0` may change the process' user ID to anything without restriction.
- Any primary module may change the process' user ID to match the module's owner.

If the call fails, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`uid`
: is the user identification. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`getuid()`

setvbuf()

Set Up Buffer for I/O Stream

Syntax

```
#include <stdio.h>

int setvbuf(
    FILE *stream,
    char *buf,
    int mode,
    size_t size);
```

Description

`setvbuf()` sets up buffering for an I/O stream. It may be used only after the `stream` has been associated with an open file and before any other operation is performed on the stream.

`setvbuf()` returns zero if successful. If an invalid value is given for mode or if the request cannot be honored, `setvbuf()` returns a non-zero value.

`stream`

is a pointer to the C I/O `FILE` structure. (Input)

`buf`

is a pointer to a buffer. (Input)

If `buf` is not a null pointer, the library may use the array it points to instead of a buffer allocated by `setvbuf()`.

`mode`

determines how `stream` is buffered. (Input)

Table 2-25. setvbug() Parameter Mode Values

Mode	Description
`_IOFBF`	I/O is fully buffered
`_IOLBF`	I/O is line buffered
`_IONBF`	I/O is unbuffered

`size`

specifies the array size. (Input)

The contents of the array at any time are indeterminate.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

sigmask()

Control Process' Signal Handling

Syntax

```
#include <signal.h>
```

```
int sigmask(int level);
```

Description

`sigmask()` controls the process' signal mask. A signal mask is an internal variable in each process descriptor which determines the signal handling for the process.

The process' signal level is not decremented below zero.

If a signal is received by a process whose signal mask is zero, normal program flow is interrupted and the signal is processed by executing the program's intercept routine.

If a signal is received by a process whose signal mask is non-zero, the signal is placed in a queue of signals waiting to be processed. The queued signals become active only when the process' signal mask becomes zero.

Regardless of the signal mask value, a process wakes up from event waits and I/O operation when signals arrive, but the signal handling routine is not executed until the signals are unmasked.

The process' signal mask is automatically incremented while the intercept routine is executing. This prevents the intercept routine from being accidentally re-entered if a new signal arrives. The process may use `sigmask()` within its intercept routine to allow re-entrant signals or to force the signal mask to remain non-zero when normal program execution resumes.

When a process makes an `F$Sleep` or `F$Wait` (for OS-9 for 68K) or `F_SLEEP` or `F_WAIT` (for OS-9) system call, its signal mask is automatically cleared. If any signals are pending, the process returns to the intercept routine without sleeping.

The `S_KILL` and `S_WAKE` signals ignore the state of the signal mask and are never queued. `S_KILL` terminates the receiving process, and `S_WAKE` ensures that the receiving process is active.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`. If errors do not occur, `sigmask()` returns zero.

I/O operations using the `cio` library should not be performed by both the main program and the intercept routine.

If an intercept routine is exited with `longjmp()`, the signal mask is still set to one. Generally, the destination of the long jump should unmask signals immediately.

OS-9 for 68K: The depth to which signals may be queued is limited only by available memory.

OS-9: There is a set limit.

`level`

specifies the signal level. (Input)

- `0` specifies clear
- `1` specifies increment
- `-1` specifies decrement

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_intercept()`

`_os_send()`

`_os_sigmask()`

`F$SigMask`	*OS-9 for 68K Technical Manual*
`F_SIGMASK`	*OS-9 Technical Manual*

signal()

Specify Signal Handling

Syntax

```
#include <signal.h>

void (*signal(int sig, void (*func)(int)))(int);
```

Description

`signal()` chooses one of three ways in which receipt of the signal number `sig` is handled.

- If `func` is `SIG_DFL`, default handling for that signal occurs.
- If `func` is `SIG_IGN`, the signal is ignored.
- Otherwise, `func` is a pointer to a function to call when that signal occurs. Such a function is called a signal handler.

When a signal occurs, signals are masked and `signal(sig, SIG_DFL)` is executed. Then, the specified type of handling is executed. Signals are blocked for the duration of the signal handler, unless the program takes some action that unmasks the signal.

There are times in which a thread receives a signal it is not expecting. When this occurs, the thread forwards the signal to an arbitrary thread that is expecting it.

A program will not receive an abort or quit signal from the keyboard (usually `^C` and `^E`) unless the program performs output to the terminal. This is because the operating system sends the abort/quit signals to the last process to perform I/O to the terminal. If you run the program from the shell and type `^E` before the program performs I/O to the terminal, the shell receives the signal and kills the running program. If a program requires immediate control of the terminal, perform some I/O to one of the standard paths such as printing a program banner or getting the terminal options with `_gs_opt()`.

For each signal recognized by `signal()`, the default handling is program termination (with an exit status related to the exception or the signal number for non-exception related signals) and the program startup condition is `SIG_DFL`.

The default handling is reset on all signals.

Default Handling

If you specify default handling, the process terminates and the termination status is set to the signal number that occurred. This occurs if no `signal()` has been called for the signal or `signal()` was called with `SIG_DFL` as `func`. If the program has used `intercept()`the signal handler assigned to the call is called and execution resumes at the point of interruption instead of terminating.

Do not use `_os_intercept()` with `signal()`.

Ignore Handling

If a signal occurs that is to be ignored, the program resumes at the point of interruption.

If the occurring signal is exception-related, the process terminates with the appropriate vector as the exit status. Effectively, exception-related signals cannot be ignored.

Available Signals

The set of signals for the signal function varies with the operating system and the processor. A set of signals is also available regardless of the operating system.

ANSI "Core" Signals

Table 2-26. ANSI Core Signals

Signal	Description
`SIGABRT`	Abnormal termination, such as initiated by `abort()`.
`SIGFPE`	An erroneous arithmetic operation, such as zero divide or an operation resulting in overflow. This signal is generated on processor-specific conditions.
`SIGILL`	Detection of an invalid function image, such as illegal instruction. This signal is generated on processor-specific conditions.
`SIGINT`	Receipt of an interactive attention signal generated by a `<control>C` on OS-9 for 68K and OS-9.
`SIGSEGV`	An invalid access to storage. This signal is generated on processor-specific conditions.
`SIGTERM`	A termination request sent to the program.

OS-9 for 68K/OS-9 "Core" Signals

Table 2-27. OS-9 for 68K and OS-9 Core Signals

Signal	Description
`SIGKILL`	A death request sent to the program. This signal cannot be ignored or handled.
`SIGWAKE`	A wakeup request sent to the program. If a process is active when this signal arrives, it is ignored. Otherwise, the process is activated, but the signal handling function is not called.
`SIGQUIT`	Receipt of an interactive abort signal generated by a `<control>E` on OS-9 for 68K and OS-9.
`SIGHUP`	Modem hangup signal. This signal is sent to a process when a modem connection is lost.
`SIGALRM`	Not automatically sent. Programs could use this signal for an alarm call.
`SIGPIPE`	Not automatically sent.

Table 2-27. OS-9 for 68K and OS-9 Core Signals (Continued)

Signal	Description
SIGUSR1	Condition is user defined.
SIGUSR2	Condition is user defined.

680x0: OS-9 for 68K, OS-9

Table 2-28. OS-9 for 68K and OS-9 Core Signals for 680x0

Signal	Description
SIGADDR	Address error
SIGCHK	CHK instruction
SIGTRAPV	TRAPV instruction
SIGPRIV	Privilege violation
SIGTRACE	Trace exception
SIG1010	1010 line-A exception
SIG1111	1111 line-F exception

680x0: OS-9

Table 2-29. OS-9 Core Signals for 680x0

Signal	Description
SIGCOPRCV	Coprocessor protocol violation
SIGFMTERR	Format error
SIGUNIRQ	Uninitialized interrupt

80x86: OS-9

Table 2-30. OS-9 Core Signals for 80x86

Signal	Description
SIGGPROT	General protection
SIGSTACK	Stack exception
SIGSEGNP	Segment not present
SIGINVTSS	Invalid TSS
SIGDBLFLT	Double fault
SIGBNDCHK	Boundary check
SIGBRKPT	Breakpoint
SIGNMI	Non-maskable interrupt
SIGDBG	Debug exception

PowerPC: OS-9

Table 2-31. OS-9 Core Signals for PowerPC

Signal	Description
SIGALIGN	Alignment
SIGCHECK	Machine check
SIGINST	Instruction access
SIGPRIV	Privilege violation

Function Handling

If a signal which has an associated function occurs, the equivalent of `(*func)(sig)` is executed. `func` may terminate by executing a `return` statement or by calling `abort()`, `exit()`, or `longjmp()`. If `func` executes a `return` statement and `sig` was exception-related, the program exits with the appropriate vector for a status. Otherwise, the program resumes execution at the point it was interrupted.

Asynchronous Signals

Signals that occur by means other than `abort()` or `raise()` are called asynchronous. Signal handlers dealing with asynchronous signals should be careful about the following:

Calling any function in the library (except `signal()` with the occurring signal) that may be working with static storage structures.

Calling any function that is not re-entrant.

Modifying any static storage structure other than a variable of type `volatile sig_atomic_t`.

If the `signal()` call can be honored, it returns `func` for the most recent call to `signal()` for the specified signal `sig`. Otherwise, `SIG_ERR` is returned and a positive value is stored in `errno`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`abort()` `exit()`
`intercept()` `_os_intercept()`
`raise()`

sin()
Sine Function

Syntax

```
#include <math.h>
double sin(double x);
```

Description

`sin()` returns the sine of `x` (input) as a double float. `x` is in radians.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

sinh()
Hyperbolic Sine Function

Syntax

```
#include <math.h>
double sinh(double x);
```

Description

`sinh()` returns the hyperbolic sine of `x` (input) as a double float. `x` is in radians. A range error occurs, `ERANGE` stored in `errno`, if the magnitude of `x` is too large. In this case, the appropriately signed `HUGE_VAL` is returned.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

Possible Error

`ERANGE`

sl_add(), sl_find(), sl_free(), sl_init()

Manipulate Stringlists

Syntax

```
#include <UNIX/stringlist.h>
StringList * sl_init();
int sl_add(
        StringList *sl,
        char *item);
void sl_free(
          StringList *sl,
          int freeall);
char * sl_find(
            StringList *sl,
            char *item);
```

Description

The stringlist functions manipulate stringlists, which are lists of strings that extend automatically if necessary. The StringList structure has the following definition:

```
typedef struct _stringlist {
  char    **sl_str;
  size_t    sl_max;
  size_t    sl_cur;
} StringList;
```

`sl_str`
: is a pointer to the base of the array containing the list.

`sl_max`
: is the size of `sl_str`.

`sl_cur`
: is the offset in `sl_str` of the current element.

The following stringlist manipulation functions are available:

`sl_init()`
: Create a stringlist. Returns a pointer to a StringList, or NULL in case of failure.

`sl_free()`
: Releases memory occupied by `sl` and the `sl->sl_str` array. If `freeall` is non-zero, then each of the items within `sl->sl_str` is released as well.

`sl_add()`
: Add item to `sl->sl_str` at `sl->sl_cur`, extending the size of `sl->sl_str`. Returns zero upon success, -1 upon failure.

`sl_find()`
: Find item in `sl`, returning NULL if it is not found.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`free()`

`malloc()`

sleep()

Suspend Execution for Specified Time

Syntax

```
#include <signal.h>
int sleep(unsigned seconds);
```

Description

`sleep()` suspends the calling process for the specified time. A sleep time of zero seconds sleeps indefinitely. `sleep()` returns the number of ticks remaining to sleep if awakened prematurely by a signal.

The thread enabled version of this function contains a cancel point. For more information see *Using OS-9 Threads*.

`seconds`
: specifies the length of time for the process to sleep. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_sleep()`

`_os9_sleep()`

`F$Sleep`	*OS-9 for 68K Technical Manual*
`F_SLEEP`	*OS-9 Technical Manual*

_sliblink()

Link to Subroutine Module

Syntax

```
#include <module.h>
mh_com *_sliblink(
    int slib_num,
    const char *slib_name);
```

Description

`_sliblink()` links or loads the named module. Then, it places the subroutine module's execution entry pointer and static storage data pointer in the global arrays `_sublibs` and `_submems`, respectively. You can use `_subcall()` to make subsequent calls the subroutine library.

For more information on creating, installing, and calling subroutine library modules, refer to the *OS-9 Technical Manual*.

You can remove a subroutine module by passing a null pointer for the name of the module and specifying the subroutine number. A process can link to a maximum 16 subroutine libraries, numbered from 0 to 15.

`slib_num`
specifies the subroutine number. (Input)

`slib_name`
is a pointer to the subroutine name string. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

See Also

`_subcall()`

`F_SLINK` *OS-9 Technical Manual*

snprintf()

Write to str

Syntax

```
#include <stdio.h>
int snprintf(
          char *str,
          size_t size,
          const char *format, ...);
```

Description

`snprintf()` writes to the character string `str`. The function writes to the at most `size` -1 of the characters printed into the output string (the size'th character then gets the terminating `\0'); if the return value is greater than or equal to the size argument, the string was too short and some of the printed characters were discarded. If size is zero, nothing is written and str may be a NULL pointer.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`sprintf()`

`memcpy()`

`memset()`

sprintf()

Formatted Output

Syntax

```
#include <stdio.h>
int sprintf(
    char *str,
    const char *format, ...);
```

Description

`sprintf()` is a standard C library function that performs formatted output to the array specified by `str`. `sprintf()` converts, formats, and prints any parameters as indicated by the control string. A null character is written at the end of the characters written; it is not counted as part of the returned sum. If copying takes place between overlapping objects, the behavior is undefined.

`sprintf()` returns the number of characters written in the array, not counting the terminating null character.

The `sclib.l` and `sclib.il` libraries contain a smaller version of the `sprintf()` function. Refer to the *Using Ultra C/C++* manual for more information about the small library functions.

`str`
: is a pointer to an array into which to write the generated output. (Output)

`format`
: is a pointer to a control string. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`printf()`

`fprintf()`

sqrt()

Square Root Function

Syntax

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

```
double sqrt(double x);
```

Description

`sqrt()` returns the square root of `x` (input). `x` must not be negative. If the parameter is negative, `sqrt()` sets a domain error `EDOM` in `errno` and returns `HUGE_VAL`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

Possible Error

`EDOM`

srand()

Set Seed for Random Number Generator

Syntax

```
#include <stdlib.h>
```

```
void srand(unsigned int seed);
```

Description

`srand()` uses the parameter as a seed for a new sequence of pseudo-random numbers to be returned by subsequent calls to `rand()`. If `srand()` is then called with the same seed value, the sequence of pseudo-random numbers is repeated. If `rand()` is called before any calls to `srand()` have been made, the same sequence is generated as when `srand()` is first called with a seed value of one.

`seed`
: is used as a seed for a new sequence of pseudo-random numbers. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`rand()`

srqcmem()

Allocate Colored Memory

Syntax

```
#include <memory.h>
char *srqcmem(
    int bytecnt,
    int memtype);
```

Description

`srqcmem()` is a direct hook to the `F$SRqCMem` (for OS-9 for 68K) or `_os_srqmem()` (for OS-9000) system call.

`srqcmem()` is identical to `_srqmem()` with the exception of the additional color parameter.

If successful, a pointer to the memory granted is returned. The returned pointer always begins on an even byte boundary. If the request was not granted, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`bytecnt`
: is rounded to a system-defined block size. (Input)

  The size of the allocated block is stored in the global integer variable `_srqcsiz`. If `bytecnt` is `0xffffffff`, the largest contiguous block of free memory in the system is allocated.

`memtype`
: indicates the specific type of memory to allocate. (Input)

  If `memtype` is `MEM_ANY`, any available system memory may be allocated.

`memory.h`
: contains definitions of the memory types that you may specify:

Table 2-32. srqcmem() Memory Types

Memory Type	Description
`SYSRAM or MEM_SYS`	System RAM memory
`VIDEO1`	Video memory for plane A
`VIDEO2`	Video memory for plane B
`MEM_ANY`	No memory type specified

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`free()`

`malloc()`

`_os_srqmem()`

`_os9_srqmem()`

`_os_srtmem()`

`F$SRqCMem`	*OS-9 for 68K Technical Manual*
`F_SRQMEM`	*OS-9 Technical Manual*

_srqmem()

System Memory Request

Syntax

```
#include <memory.h>
char *_srqmem(unsigned size);
```

Description

`_srqmem()` and the complementary function `_srtmem()` are provided to request and return system memory when tight control over memory allocation is required.

`_srqmem()` is a direct hook into the `F$SRqMem` (for OS-9 for 68K) or `F_SRQMEM` (for OS-9) system call.

If successful, a pointer to the memory granted is returned. If the request was not granted, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

The returned pointer always begins on an even byte boundary. Care should be taken to preserve the value of the pointer if the memory is to be returned with `_srtmem()` or `_os_srtmem()`.

`size`
: specifies the number of bytes to request. (Input)

  The specified `size` is rounded to a system-defined block size. A `size` of `0xffffffff` obtains the largest contiguous block of free memory in the system. The global unsigned variable `_srqsiz` may be examined to determine the actual size of the allocated block.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_srqmem()`

`_os9_srqmem()`

`_os_srtmem()`

`F$SRqMem`	*OS-9 for 68K Technical Manual*
`F_SRQMEM`	*OS-9 Technical Manual*

_srtmem()

System Memory Return

Syntax

```
#include <memory.h>
int _srtmem(
    unsigned size,
    char *ptr);
```

Description

`_srtmem()` is a direct hook into the `F$SRtMem` (OS-9 for 68K) or `_os_srtmem()` (OS-9) system call. It is used to return memory granted by `_srqmem()` or `_os_srqmem()`. `size` and `ptr` must the same as those returned by `_srqmem()` or `_os_srqmem()`. If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`size`
: specifies the number of bytes to return. (Input)

`ptr`
: is a pointer to the memory to return. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_srqmem()`
`_os9_srqmem()`
`_os_srtmem()`

`F$SRtMem`	*OS-9 for 68K Technical Manual*
`F_SRTMEM`	*OS-9 Technical Manual*

_ss_attr()

Set File Attributes

Syntax

```
#include <sg_codes.h>
int _ss_attr(
    int path,
    int attr);
```

Description

`_ss_attr()` changes a disk file's attributes. `_os_gs_fd()` determines the current attributes of a file. Only the owner of the file or the super user can change a file's attributes.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`_ss_attr()` is effective even if the owner or super user does not have write permission to the path. You cannot set the `directory` bit of a non-directory file or clear the `directory` bit of a directory that is not empty.

`path`
: is the path number of a disk file. (Input)

`attr`
: specifies the file attributes to set. (Input)

  Only the lower 16 bits of `attr` are used.

  The attributes selected in `attr` are set in the file open on `path`. The `modes.h` header file defines the valid mode values.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_gs_fd()`
`_os_ss_attr()`
`_os_ss_fd()`

`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT, SS_ATTR`	*OS-9 Technical Manual*

sscanf()

Input Strings Conversion

Syntax

```
#include <stdio.h>
int sscanf(
    const char *input,
    const char *format, ...);
```

Description

`sscanf()` reads input from the string specified by `input`. Reaching the end of the string is equivalent to encountering end-of-file for `fscanf()`. If copying takes place between overlapping objects, the behavior is undefined.

`sscanf()` returns `EOF` if an input failure occurs before any conversion. Otherwise, `sscanf()` returns the number of input items assigned. This can be fewer than provided for or zero, in the event of an early matching failure.

The `sclib.l` and `sclib.il` libraries contain a smaller version of the `sscanf()` function. Refer to the *Using Ultra* C/C++ manual for more information about the small library functions.

`input`
: is a pointer to the input string. (Input)

`format`
: is a pointer to the control string. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`scanf()`

`fscanf()`

`printf()`

_ss_dcoff()

Send Data Carrier Lost Signal to Process

Syntax

```
#include <scf.h>
int _ss_dcoff(
    int path,
    int sigcode);
```

Description

`_ss_dcoff()` sends a signal to the calling process when the "data carrier detect line" associated with the device is lost.

`Only the lower 16 bits of sigcode are used on OS-9 for 68K.`
If `_ss_dcoff()` cannot register the signal, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`path`
is the path number of the device. (Input)

`sigcode`
is the signal code to send. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ss_dcoff()`

`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT, SS_DCOFF`	*OS-9 Technical Manual*

_ss_dcon()

Send Data Carrier Present Signal to Process

Syntax

```
#include <scf.h>
int _ss_dcon(
    int path,
    int sigcode);
```

Description

`_ss_dcon()` sends a signal to the calling process when the "data carrier detect line" associated with the device is present.

If `_ss_dcon()` cannot register the signal, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`path`
: is the path number of the device. (Input)

`sigcode`
: is the signal code to send. (Input)

Only the lower 16 bits of `sigcode` are used on OS-9 for 68K.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ss_dcon()`

`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT, SS_DCON`	*OS-9 Technical Manual*

_ss_dsrts()

Disable RTS Line

Syntax

```
#include <scf.h>
```

```
int _ss_dsrts(int path);
```

Description

`_ss_dsrts()` disables the RTS line for an open device.

If `_ss_dsrts()` cannot disable the RTS line, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`path`
: is the path number of the device. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ss_dsrts()`

`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT, SS_DSRTS`	*OS-9 Technical Manual*

_ss_enrts()

Enable RTS Line

Syntax

```
#include <scf.h>
```

```
int _ss_enrts(int path);
```

Description

`_ss_enrts()` enables the RTS line for an open device.

If `_ss_enrts()` cannot enable the RTS line, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`path`
: is the path number of the device. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ss_enrts()`

`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT, SS_ENRTS`	*OS-9 Technical Manual*

_ss_lock()
Lock Out Record

Syntax

```
#include <rbf.h>
int _ss_lock(
    int path,
    unsigned locksize);
```

Description

`_ss_lock()` locks out a section of the file open on `path` from the current file position up to the number of bytes specified by `locksize`.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

Refer to your operating system technical manual for information on RBF record locking.

`path`
: is the path number of the file. (Input)

`locksize`
: specifies the number of bytes in the file to lock. (Input)

If `locksize` is zero, all locks (record-lock, EOF lock, and file lock) are removed.

If `locksize` is `0xffffffff`, the entire file is locked out regardless of the file pointer's location. This is a special type of file lock that remains in effect until released by `_ss_lock(path,0)`, a read or write of zero bytes, or the file is closed.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ss_lock()`	
`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT, SS_LOCK`	*OS-9 Technical Manual*

_ss_opt()

Set Path Options

Syntax

```
#include <sg_codes.h>
#include <sgstat.h>
int _ss_opt(
    int path,
    struct sgbuf *buffer);
```

Description

`_ss_opt()` copies a buffer into the options section of the path descriptor open on `path`.

Generally, a program gets the options with `_gs_opt()`, changes the appropriate values, and updates the path options with `_ss_opt()`. The structure `sgbuf` declared in the `sgstat.h` header file provides a convenient means to access the individual option values.

If the path was invalid, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

It is common practice to preserve a copy of the original options so the program can restore them before exiting. The option changes take effect on the currently open path (and any paths created with `I$Dup` or `I_DUP` to the same).

If you use `_ss_popt()` on OS-9, you must use the OS-9 for 68K header file. `_ss_luopt()` is provided on OS-9 solely for compatibility with OS-9. If the OS-9 for 68K header file is unavailable, change the source code to use `I_SETSTAT, SS_PATHOPT` or `I_SETSTAT, SS_LUOPT`.

`path`
: specifies the path number of the path descriptor. (Input)

`buffer`
: is a pointer to a buffer containing the path descriptor information. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_gs_popt()`
`_os_ss_popt()`

`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT`	*OS-9 Technical Manual*
`tmode`	*Using OS-9 for 68K* or *Using OS-9*

_ss_pfd()

Put File Descriptor Sector

Syntax

```
#include <rbf.h>
#include <direct.h>
int _ss_pfd(
    int path,
    struct fd *buffer);
```

Description

`_ss_pfd()` copies certain fields from the file descriptor information pointed to by `buffer` into the file descriptor sector of the file open on `path`. The buffer is usually obtained from `_gs_gfd()`. Only the owner ID, the modification date, and creation date fields are changed.

The structure `fd` declared in the `direct.h` header file provides a convenient means to access the file descriptor information.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

The buffer must be at least 32 bytes long or unanticipated data could be written into the file descriptor sector. Only the super user can change the owner ID field. You cannot change the file attributes with this call. Instead, use `_ss_attr()`.

You must use the OS-9 for 68K `direct.h` header file. This call is provided on OS-9 in order to provide compatibility with OS-9 for 68K. For faster speed, use `_os_ss_fd`.

`path`
is the path number of the file. (Input)

`buffer`
is a pointer to the buffer containing the file descriptor information. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_gs_fd()`
`_os_ss_fd()`

`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT`	*OS-9 Technical Manual*

_ss_rel()

Release Device

Syntax

```
#include <sg_codes.h>
int _ss_rel(int path);
```

Description

`_ss_rel()` cancels the signal to send from a device on data ready.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

The signal request is also cancelled when the issuing process dies or closes the path to the device. This feature exists only on SCF and PIPEMAN devices.

`path`
: is the device's path number. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ss_relea()`

`_os_ss_sendsig()`

`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT, SS_RELEASE`	*OS-9 Technical Manual*

_ss_rest()

Restore Device

Syntax

```
#include <sg_codes.h>
```

```
int _ss_rest(int path);
```

Description

`_ss_rest()` causes an RBF device to restore the disk head to track zero. It is usually used for disk formatting and error recovery.

If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`path`
: is the device's path number. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ss_reset()`

`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT, SS_RESET`	*OS-9 Technical Manual*

_ss_size()
Set Current File Size

Syntax

```
#include <sg_codes.h>
int _ss_size(
    int path,
    int size);
```

Description

`_ss_size()` changes the size of an open file. This call is effective only on RBF devices. The size change is immediate. If the file size is decreased, the freed sectors are returned to the system. If the file size is increased, sectors with undefined contents are added to the file.

If the path is invalid or the device is not an RBF device, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`path`
: is the file's path number. (Input)

`size`
: specifies the new file size in bytes. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ss_size()`

`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT, SS_SIZE`	*OS-9 Technical Manual*

_ss_ssig()

Send Signal on Data Ready

Syntax

```
#include <sg_codes.h>
int _ss_ssig(
    int path,
    int sigcode);
```

Description

`_ss_ssig()` sets up a signal to be sent to the calling process when an interactive device has data ready. This feature exists only on SCF devices and pipes. When data is received on the device indicated by `path`, a signal is sent to the calling process.

`_ss_ssig()` must be called each time the signal is sent if it is to be used again.

The device is considered busy and returns an error if any read requests arrive before the signal is sent. Write requests to the device are allowed while in this state.

If an error occurs, `-1` is returned and the appropriate error value is placed in the global variable `errno`.

`path`
: is the device's path number. (Input)

`sigcode`
: specifies the signal code to send. (Input)

  Only the lower 16 bits of `sigcode` are used on OS-9 for 68K.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ss_relea()`

`_os_ss_sendsig()`

`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT, SS_SENDSIG`	*OS-9 Technical Manual*

_ss_tiks()
Wait for Record Release

Syntax

```
#include <rbf.h>
int _ss_tiks(
    int path,
    int tickcnt);
```

Description

If a read or write request is issued for a part of a file that is locked out by another user, RBF normally sleeps indefinitely until the conflict is removed. This feature exists only on RBF devices. `_ss_tiks()` may be used to return the error `EOS_LOCK` to the program if the conflict still exists after a specified number of ticks have elapsed.

If an error occurs, `-1` is returned and the appropriate error value is placed in the global variable `errno`.

`path`
: specifies the file's path number. (Input)

`tickcnt`
: specifies the number of ticks to wait if a record-lock conflict occurs while the file is open on `path`. (Input)

  - A `tickcnt` of zero (RBF's default) causes a sleep until the record is released.
  - A `tickcnt` of one returns an error if the record is not released immediately.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ss_ticks()`

`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT, SS_TICKS`	*OS-9 Technical Manual*

_ss_wtrk()

Write Track

Syntax

```
#include <rbf.h>
int _ss_wtrk(
    int path,
    int trkno,
    int siden,
    int ilvf,
    const char *trkbuf,
    const char *ilvptr);
```

Description

`_ss_wtrk()` performs a write-track operation on a disk drive. It is essentially a direct hook into the driver's write-track entry point.

If an error occurs, `-1` is returned and the appropriate error value is placed in the global variable `errno`.

This feature exists only on RBF devices. You can obtain additional information on actual use of this call by examining the `format` utility and/or a device driver.

`path`
: is the path on which the device is open. (Input)

`trkno`
: is the track number on which to write. (Input)

`siden`
: is the side of the track to write. (Input)

`ilvf`
: is the interleave factor. (Input)

`trkbuf`
: is a pointer to the track buffer image.(Input)

`ilvptr`
: is a pointer to the interleave table. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_ss_wtrack()`	
`I$SetStt`	*OS-9 for 68K Technical Manual*
`I_SETSTAT, SS_WTRACK`	*OS-9 Technical Manual*
`format`	*Using OS-9 for 68K* or *Using OS-9*

stacksiz(), _stacksiz()

Get Size of Stack Used

Syntax

```
#include <stdlib.h>

int stacksiz(void);

int _stacksiz(void);
```

Description

`stacksiz()` returns the maximum number of bytes of stack used at the time of the call if stack checking code is in effect. You can use `stacksiz()` to determine the stack size a program requires. `stacksiz()` is not available when compiling in strictly conforming ANSI mode.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`cstart.r`

stat()

Get File Status

Syntax

```
#include <UNIX/stat.h>
int stat(
    const char *path,
    struct stat *buf);
```

Description

`stat()` obtains information about the file named by `path` (input). Read, write, or execute permission of the named file is not required, but all directories leading to the file must be searchable.

If an error occurs, `stat()` returns `-1` and sets the global variable `errno` to indicate the error.

`buf`

is a pointer to a `stat` structure into which information about the file is placed. (Output)

A `stat` structure includes the following members:

```
unsigned short  st_mode;    /* attributes */
unsigned short  st_nlink;   /* nhard links */
unsigned short  st_uid;     /* user ID of owner */
unsigned short  st_gid;     /* group ID of owner */
unsigned long   st_size;    /* file size */
time_t          st_atime;   /* last access time */
time_t          st_mtime;   /* last modify time */
time_t                st_ctime;       /* last status change time */
long            st_ino;     /* undefined */
long            st_dev;     /* undefined */
long            st_rdev;    /* undefined */
```

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

See Also

`fstat()`

_strass()

Structure Assignment

Syntax

```
#include <strings.h>
void _strass(
    void *to,
    void *from,
    int count);
```

Description

`_strass()` is available to maintain source code compatibility. `count` bytes are copied from the memory pointed to by `from` to the memory pointed to by `to`, regardless of contents.

`_strass()` can move at most 65536 bytes. No regard is given to overlapping moves.

`to`
: is a pointer to the destination for the copy. (Output)

`from`
: is a pointer to the structure to copy. (Input)

`count`
: is the number of bytes to copy. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

strcasecmp(), strncasecmp()

Compare Null-Terminated Strings

Syntax

```
#include <strings.h>
int strcasecmp(
    const char *s1,
    const char *s2);
int strncasecmp(
     const char *s1,
     const char *s2,
     size_t len);
```

Description

The `strcasecmp()` and `strncasecmp()` functions compare the null-terminated strings `s1` and `s2` and return an integer greater than, equal to, or less than 0, according as `s1` is lexicographically greater than, equal to, or less than `s2` after translation of each corresponding character to lowercase. The strings themselves are not modified. The comparison is done using unsigned characters, so that `\200' is greater than `\0'.

The `strncasecmp()` compares at most `len` characters.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`tolower()`

strcat()
String Catenation

Syntax

```
#include <string.h>
char *strcat(
    char *orig,
    const char *append);
```

Description

`strcat()` appends a copy of `append`, including the terminating null character, to the end of `orig`. The initial character of `append` overwrites the null character at the end of `orig`. If copying takes place between overlapping objects, the behavior is undefined.

`orig`
: is a pointer to the original string. (Input/Output)

`append`
: is a pointer to the string to append to `orig`. (Input)

`strcat()`
: returns the value of `orig`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

strchr()
Locate String

Syntax

```
#include <string.h>
char *strchr(
    const char *src,
    int chr);
```

Description

`strchr()` locates the first occurrence of `chr`, converted to a `char`, in string `src`. The terminating null character is considered part of the string.

`strchr()` returns a pointer to the located character, or a null pointer if the character does not occur in the string.

`src`
: is a pointer to the string to search. (Input)

`chr`
: specifies the character for which to search. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

strcmp()

String Comparison

Syntax

```
#include <string.h>
int strcmp(
    const char *string1,
    const char *string2);
```

Description

`strcmp()` compares `string1` to `string2`.

`strcmp()` returns an integer that is:

- Positive, if `string1` is greater than `string2`
- Zero, if `string1` equals `string2`
- Negative, if `string1` is less than `string2`

`string1`
is a pointer to a string to compare. (Input)

`string2`
is a pointer to a string to compare. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

strcoll()

String Comparison

Syntax

```
#include <string.h>
int strcoll(
    const char *string1,
    const char *string2);
```

Description

`strcoll()` compares two strings, both interpreted as appropriate to the `LC_COLLATE` category of the current locale.

When both `string1` and `string2` are interpreted as appropriate to the current locale, `strcoll()` returns an integer that is:

- Positive, if `string1` is greater than `string2`.
- Zero, if `string1` equals `string2`.
- Negative, is `string1` is less than `string2`.

`string1`
: is a pointer to a string to compare. (Input)

`string2`
: is a pointer to a string to compare. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

strcpy()

String Copy

Syntax

```
#include <string.h>
char *strcpy(
    char *dest,
    const char *src);
```

Description

`strcpy()` copies a string, including the terminating null character, into an array. If copying takes place between overlapping objects, the behavior is undefined.

`strcpy()` returns the value of `dest`.

`dest`
: is a pointer to the destination array. (Output)

`src`
: is a pointer to the string to copy into `dest`. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

strcspn()
Get String Length

Syntax

```
#include <string.h>
size_t strcspn(
    const char *src,
    const char *delim);
```

Description

`strcspn()` returns the length of the segment of `src` up to the first occurrence of any character from `delim`.

`src`
: is a pointer to a source string. (Input)

`delim`
: is a pointer to a string of characters. (Input)

`strcspn()` returns the length of the segment.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

strdup()

Allocate Memory for Copy of str and Return Pointer

Syntax

```
#include <string.h>
char *
strdup(
      const char *str);
```

Description

The `strdup()` function allocates sufficient memory for a copy of the string `str`, does the copy, and returns a pointer to it. The pointer may subsequently be used as an argument to the function `free()`.

If insufficient memory is available, NULL is returned.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`sys_clib.l`

See Also

`memcpy()`

`strlen()`

strerror()

Map Error Message String

Syntax

```
#include <string.h>
```

```
char *strerror(int errnum);
```

Description

`strerror()` maps an error number to an error message string. `strerror()` returns a pointer to the string. The program cannot modify the array, but a subsequent call to `strerror()` overwrites the array.

Error messages are generally in the form:

```
<major>:<minor> <detail>
```

`<major>` is the family of error. `<minor>` is the error number within the family. `<detail>` is the information from the system `errmsg` file, if available. The system `errmsg` file (`/dd/SYS/errmsg`, `/h0/SYS/errmsg`, or `/d0/SYS/errmsg`) contains the error messages generated by `perror()`.

`errnum`
: specifies the error number. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`perror()`

strftime()

Place Formatted Time in Buffer

Syntax

```
#include <time.h>
size_t strftime(
    char *dest,
    size_t maxsize,
    const char *format,
    const struct tm *timeptr);
```

Description

`strftime()` places characters into an array as controlled by `format`. The format is a multibyte character sequence, beginning and ending in its initial shift state.

All ordinary multibyte characters, including the terminating null character, are copied unchanged into the array. If copying takes place between overlapping objects, the behavior is undefined. No more than `maxsize` characters are placed in the array.

Each conversion specifier is replaced by appropriate characters as described in the following list. These characters are determined by the `LC_TIME` category of the current locale and by the values contained in the structure pointed to by `timeptr`.

Table 2-33. strftime() Conversion Values

Value	Replaced By
`%a`	The locale's abbreviated weekday name.
`%A`	The locale's full weekday name.
`%b`	The locale's abbreviated month name.
`%B`	The locale's full month name.
`%c`	The locale's appropriate date and time representation.
`%d`	The day of the month as a decimal number (01 - 31).
`%H`	The hour (24-hour clock) as a decimal number (00 - 23).
`%I`	The hour (12-hour clock) as a decimal number (01 - 12).
`%j`	The day of the year as a decimal number (001 - 366).
`%m`	The month as a decimal number (01 - 12).
`%M`	The minute as a decimal number (00 - 59).
`%p`	The locale's equivalent of the AM/PM designations associated with a 12-hour clock.
`%S`	The second as a decimal number (00 - 61).
`%U`	The week number of the year (the first Sunday as the first day of week 1) as a decimal number (00 - 53).
`%w`	The weekday as a decimal number (0 - 6)--Sunday is 0.

Table 2-33. strftime() Conversion Values (Continued)

Value	Replaced By
`%W`	The week number of the year (the first Monday as the first day of week 1) as a decimal number (00 - 53).
`%x`	The locale's appropriate date representation.
`%X`	The locale's appropriate time representation.
`%y`	The year without century as a decimal number (00 - 99).
`%Y`	The year with century as a decimal number.
`%Z`	The time zone name or abbreviation, or by no characters if no time zone is determinable.
`%%`	%.

If a conversion specifier is not one of the above, the behavior is undefined.

If the total number of resulting characters including the terminating null character is not more than `maxsize`, `strftime()` returns the number of characters placed into array `dest` not including the terminating null character. Otherwise, zero is returned and the contents of the array are indeterminate.

`dest`
: is a pointer to the array into which to place the characters. (Output)

`maxsize`
: specifies the maximum number of characters to place in the array. (Input)

`format`
: is a pointer to a control string. (Input)

`format`
: consists of zero or more conversion specifiers and ordinary multibyte characters. A conversion specifier consists of a percent (`%`) sign followed by a character that determines the behavior of the conversion specifier.

`timeptr`
: is a pointer to a time structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

strhcpy()

Copy Old OS-9 for 68K Strings

Syntax

```
#include <strings.h>
char *strhcpy(
   char *dest,
   const char *src);
```

Description

`strhcpy()` makes a copy of `src` in `dest`. `strhcpy()` copies the bytes from `src` to `dest` until it reaches the null terminator. `strhcpy()` then removes the high-bit from the last character and appends a null byte to the output string.

`strhcpy()` is used primarily for copying file names from the directory entries on RBF disks. `strhcpy()` returns its first parameter.

`strhcpy()` assumes that `dest` contains adequate space for the copy. The calling routine is responsible for verifying the space.

`dest`
: is a pointer to the destination string. (Output)

`src`
: is a pointer to the source string to copy. (Input)

`src`
: is assumed to have the high-order bit set on the character byte indicating the last character.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

strlcat()

Concatenate String src

Syntax

```
#include <string.h>
size_t strlcat(
            char *dst,
            const char *src,
            size_t size);
```

Description

The `strlcat()` function appends the NULL-terminated string `src` to the end of `dst`. It will append at most `size` - strlen(dst) - 1 bytes, NULL-terminating the result.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`strlen()`

strlcpy

Copy string src

Syntax

```
#include <string.h>

size_t strlcpy(
            char *dst,
            const char *src,
            size_t size);
```

Description

The `strlcpy()` function copies up to size - 1 characters from the NUL-terminated string `src` to `dst`, NULL-terminating the result.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

```
sys_clib.l
```

strlen()

Determine String Length

Syntax

```
#include <string.h>
size_t strlen(const char *str);
```

Description

`strlen()` determines the length of `str`.

`strlen()` returns the number of characters that precede the terminating null character.

`str`
    is a pointer to a string. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

strncat()

String Catenation

Syntax

```
#include <string.h>
char *strncat(
    char *orig,
    const char *append,
    size_t count);
```

Description

`strncat()` appends characters (a null character and characters that follow it are not appended) from `append` to the end of `orig`. The initial character of `append` overwrites the null character at the end of `orig`. A terminating null character is always appended to the result. If copying takes place between overlapping objects, the behavior is undefined.

`strncat()` returns the value of `orig`.

`orig`
: is a pointer to the original string. (Input/Output)

`append`
: is a pointer to the string to append to `orig`. (Input)

`count`
: specifies the maximum number of characters to append. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

strncmp()
String Comparison

Syntax

```
#include <string.h>
int strncmp(
    const char *string1,
    const char *string2,
    size_t count);
```

Description

`strncmp()` compares not more than `count` characters from `string1` to `string2`. Characters following a null character are not compared. The strings do not need to be null terminated. `strncmp()` returns an integer that is:

- Positive, if `string1` is greater than `string2`.
- Zero, if `string1` equals `string2`.
- Negative, is `string1` is less than `string2`.

`string1`
: is a pointer to a string to compare. (Input)

`string2`
: is a pointer to a string to compare. (Input)

`count`
: specifies the maximum number of characters to compare. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

strncpy()

String Copy

Syntax

```
#include <string.h>
char *strncpy(
char        *dest,
const char  *src,
size_t      count);
```

Description

`strncpy()` copies characters from `src` to `dest`. Characters following a null character are not copied. If copying takes place between overlapping objects, the behavior is undefined.

If `src` is shorter than `count` characters, null characters are appended to the copy in `dest`, until `count` characters in all have been written.

`strncpy()` returns the value of `dest`.

`dest`
: is a pointer to the destination string. (Output)

`src`
: is a pointer to the source string to copy. (Input)

`count`
: specifies the maximum number of characters to copy. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

strpbrk()

Locate First Occurrence of String

Syntax

```
#include <string.h>
char *strpbrk(
    const char *src,
    const char *delim);
```

Description

`strpbrk()` locates the first occurrence in `src` of any character from `delim`.

`strpbrk()` returns a pointer to the character or a null pointer, if no character from `delim` occurs in `src`.

`src`
: is a pointer to a string in which to search for any character from `delim`. (Input)

`delim`
: is a pointer to a string containing characters to locate in `src`. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

strptime()

Convert Character String Stored in tmf

Syntax

```
#include <time.h>
char *
strptime(
        const char *buf,
        const char *format,
        struct tm *tm);
```

Description

The `strptime()` function converts the character string pointed to by `buf` to values which are stored in the `tm` structure pointed to by `tm`, using the format specified by format.

The format string consists of zero or more conversion specifications, whitespace characters as defined by `isspace()`, and ordinary characters. All ordinary characters in format are compared directly against the corresponding characters in buf; comparisons which fail will cause `strptime()` to fail. Whitespace characters in format match any number of whitespace characters in `buf`, including none.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`sys_clib.l`

See Also

`strcasecmp(), strncasecmp()`

`strlen()`

`strftime()`

strrchr()

Locate Last Occurrence of String

Syntax

```
#include <string.h>
char *strrchr(
    const char *src,
    int chr);
```

Description

`strrchr()` locates the last occurrence of `chr`, converted to `char`, in `src`. The terminating null character is considered part of the string.

`strrchr()` returns a pointer to the character or a null pointer, if `chr` does not occur in the string.

`src`
: is a pointer to a string. (Input)

`chr`
: is the character to search for in `src`. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

strsep()

Replace character in *stringp

Syntax

```
#include <string.h>

char *

strsep(

    char **stringp,

    const char *delim);
```

Description

The `strsep()` function locates, in the null-terminated string referenced by `*stringp`, the first occurrence of any character in the string `delim` (or the terminating `\0' character) and replaces it with a `\0'. The location of the next character after the delimiter character (or NULL, if the end of the string was reached) is stored in `*stringp`. The original value of `*stringp` is returned.

An empty field (one caused by two adjacent delimiter characters) can be detected by comparing the location referenced by the pointer returned in `*stringp` to `\0'.

If `*stringp` is initially NULL, `strsep()` returns NULL.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

```
sys_clib.l
```

strspn()
Compute String Length

Syntax

```
#include <string.h>
char *strspn(
    const char *src,
    const char *pattern);
```

Description

`strspn()` returns the length of the maximum initial segment of `src` which consists entirely of characters from `pattern`.

`src`
: is a pointer to a string. (Input)

`pattern`
: is a pointer to a string. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

strstr()

Locate First Occurrence of String

Syntax

```
#include <string.h>
char *strstr(
   const char *src,
   const char *pattern);
```

Description

`strstr()` locates the first occurrence in `src` of the sequence of characters (excluding the terminating null character) in `pattern`.

`strstr()` returns a pointer to the located string or a null pointer, if the string is not found. If `pattern` is a pointer to a string with zero length, `strstr()` returns `src`.

`src`
: is a pointer to a string. (Input)

`pattern`
: is a pointer to a string containing a sequence of characters to search for in `src`. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

strtod()

String to Double Conversion

Syntax

```
#include <stdlib.h>
double strtod(
    const char *begin,
    char **end);
```

Description

`strtod()` converts the initial portion of `begin` to `double` representation. `strtod()` separates the input string, attempts to convert the subject sequence to a floating point number, and then returns the result.

`strtod()` expects the subject sequence to have the following form:

- An optional plus or minus sign.
- A non-empty sequence of digits optionally containing a decimal point character.
- An optional exponent part, but no floating suffix.

If the subject sequence has the expected form, the character sequence starting with the first digit or the decimal point character (whichever occurs first) is interpreted as a floating constant. Currently, only the `C` locale is supported. Therefore, the decimal point character is a period. If neither an exponent part nor a decimal point character appears, a decimal point is assumed to follow the last digit in the string. If the subject sequence begins with a minus sign, the value resulting from the conversion is negated. A pointer to the final string is stored in `end`, unless `end` is a null pointer.

If the subject sequence is empty or does not have the expected form, no conversion is performed. `begin` is stored in `end`, unless `end` is a null pointer.

`strtod()` returns the converted value, if any. If no conversion could be performed, zero is returned. If the correct value is outside the range of representable values, plus or minus `HUGE_VAL` is returned, according to the sign of the value, and `ERANGE` is stored in `errno`. If the correct value would cause underflow, zero is returned and `ERANGE` is stored in `errno`.

`begin`

is a pointer to the beginning of a string. (Input)

`end`

is a pointer to the pointer to the first character after the converted string. (Input)

The input string is separated into three parts:

1. An initial, possibly empty, sequence of white space characters (as specified by `isspace()`).
2. A subject sequence resembling a floating point constant. The subject sequence is the longest initial subsequence of the input string starting with the first non-white space character having the expected form. The subject sequence contains no characters if the input string is empty or consists entirely of white space, or if the first non-white space character is other than a sign, a digit, or a decimal point character.
3. A final string of one or more unrecognized characters, including the terminating null character of the input string.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`isspace()`

`strtoll()`

`strtoul()`

Possible Error

`ERANGE`

strtok()

Break String into Tokens

Syntax

```
#include <string.h>
char *strtok(
    char *src,
    const char *delims);
```

Description

`strtok()` breaks `src` into a series of tokens when a sequence of calls is made to `strtok()`. A character from `delims` separates each token. When the first call is made, `src` is the first parameter. A null pointer is the first parameter for subsequent calls.

The first call in the sequence searches `src` for the first character that is not contained in the current `delims`. If no such character is found, then there are no tokens in `src`, and `strtok()` returns a null pointer. If a character is found, it starts the first token.

`strtok()` searches from that location for a character that is contained in the current `delims`. If the character is not found, the current token extends to the end of `src`, and subsequent searches for a token return a null pointer. If the character is found, it is overwritten by a null character to terminate the current token.

The search for the next token starts with the next character. `strtok()` saves a pointer to this location. Each subsequent call behaves in the same manner.

`strtok()` returns a pointer to the first character of a token, or a null pointer if there is no token.

`src`
: is a pointer to the string to break into tokens. (Input)

`delims`
: is a pointer to a string containing characters to separate each token. (Input)

`delims`
: may be different from call to call.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

```
clib.l
```

Example

```
#include <string.h>
static char str[] = “?a???b,,,#c”;
char *t;

t = strtok(str, “?”);  /* t points to the token “a” */
t = strtok(NULL, “,”); /* t points to the token “??b” */
t = strtok(NULL, “#,”); /* t points to the token “c” */
t = strtok(NULL, “?”);  /* t is a null pointer */
```

strtol()
String to Long Conversion

Syntax

```
#include <stdlib.h>
long strtol(
const char *begin,
char **end,
int base);
```

Description

`strtol()` converts the initial portion of begin to “long int” representation.

`begin`	is a pointer to the beginning of the string. (Input)
`end`	is a pointer to the pointer to the first character after the converted string. (Input)
`base`	is the base of the number string. (Input)

`strtol()` separates the input string into three parts:

1. An initial, possibly empty, sequence of white space characters (as specified by isspace()).
2. A subject sequence resembling an integer represented in some radix determined by base. The subject sequence is the longest initial subsequence of the input string, starting with the first non-white space character of the expected form. The subject sequence contains no characters if the input string is empty or consists entirely of white space, or if the first non-white space character is other than a sign or a permissible letter or digit.
3. A final string of one or more unrecognized characters, including the terminating null character of the input string.

`strtol()` then attempts to convert the subject sequence to an integer and returns the result.

- If `base` is zero, the subject sequence is expected to be an integer constant, optionally preceded by a plus or minus sign. An integer suffix is not included. If the subject sequence is an integer constant, the character sequence starting with the first digit is interpreted as an integer constant.
- If `base` is between two and 36, the subject sequence is expected to be a sequence of letters and digits representing an integer. `base` specifies the radix, optionally preceded by a plus or minus sign. An integer suffix is not included. The letters from A through Z (regardless of case) are assigned the values 10 to 35. Only letters with assigned values less than base are permitted. If `base` is 16, the characters 0x or 0X may optionally precede the sequence, following the sign if present. If the subject sequence has the expected form, it is used as the base for conversion, ascribing to each letter its value.

If the subject sequence begins with a minus sign, the value resulting from the conversion is negated. A pointer to the final string is stored in end, unless end is a null pointer. If the subject sequence is empty or does not have the expected form, no conversion is performed. begin is stored in end, unless end is a null pointer.

`strtol()` returns the converted value, if any. If no conversion could be performed, zero is returned. If the correct value is outside the range of representable values, LONG_MAX or LONG_MIN is returned (according to the sign of the value) and ERANGE is stored in errno.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

clib.l

See Also

`isupper()`

`strtod()`

`strtoll()`

`strtoul()`

Possible Error

ERANGE

strtoll()

String to Long Long Conversion

Syntax

```
#include <stdlib.h>
long long int strtoll(
             const char *nptr,
             char **endptr,
             int base);
```

Description

The `strtoll()` function converts the string in nptr to a “long long int” value.

The string may begin with an arbitrary amount of white space (as determined by isspace(3)) followed by a single optional `+' or `-' sign. If base is zero or 16, the string may then include a `0x' prefix, and the number will be read in base 16; otherwise, a zero base is taken as 10 (decimal) unless the next character is `0', in which case it is taken as 8 (octal).

The remainder of the string is converted to a long long value in the obvious manner, stopping at the first character which is not a valid digit in the given base. (In bases above 10, the letter `A' in either upper or lower case represents 10, `B' represents 11, and so forth, with `Z' representing 35.)

If endptr is non nil, `strtoll()` stores the address of the first invalid character in *endptr. If there were no digits at all, however, `strtoll()` stores the original value of nptr in *endptr. (Thus, if *nptr is not `\0' but **endptr is `\0' on return, the entire string was valid.)

The `strtoll()` function returns the result of the conversion, unless the value would underflow or overflow. If an underflow occurs, `strtoll()` returns LONG_LONG_MIN. If an overflow occurs, `strtoll()` returns LONG_LONG_MAX. In both cases, errno is set to ERANGE.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`sys_clib.l`

See Also

`strtod()`

`strtol()`

`strtoul()`

Possible Error

`ERANGE`	The given string was out of range; the value converted has been clamped.

strtoul()

String to Long Conversion

Syntax

```
#include <stdlib.h>

#include <limits.h>

unsigned long strtoul(
       char *begin,
       char **end,
       int base);
```

Description

`strtoul()` converts the initial portion of `begin` to `unsigned long int` representation.

`strtoul()` separates the input string into three parts:

1. An initial, possibly empty, sequence of white space characters (as specified by `isspace()`).
2. A subject sequence resembling an unsigned integer represented in some radix determined by `base`. The subject sequence is the longest initial subsequence of the input string, starting with the first non-white space character of the expected form. The subject sequence contains no characters if the input string is empty or consists entirely of white space, or if the first non-white space character is other than a sign or a permissible letter or digit.
3. A final string of one or more unrecognized characters, including the terminating null character of the input string.

`strtoul()` then attempts to convert the subject sequence to an unsigned integer and returns the result.

- If `base` is zero, `strtoul()` expects the subject sequence to be an integer constant, optionally preceded by a plus or minus sign. An integer suffix is not included.

  If the subject sequence is an integer constant, the character sequence starting with the first digit is interpreted as an integer constant.

- If `base` is between 2 and 36, the subject sequence is expected to be a sequence of letters and digits representing an integer. `base` specifies the radix, optionally preceded by a plus or minus sign. It does not include an integer suffix. The letters *a* through *z* (regardless of case) are assigned the values 10 to 35. Only letters whose assigned values are less than `base` are permitted. If `base` is 16, the characters 0x or 0X may optionally precede the sequence of letters and digits, following the sign if present.

  If the subject sequence has the expected form, it is used as the base for conversion, ascribing to each letter its value.

If the subject sequence begins with a minus sign, the value resulting from the conversion is negated. A pointer to the final string is stored in `end`, unless `end` is a null pointer.

If the subject sequence is empty or does not have the expected form, no conversion is performed. `begin` is stored in `end`, unless `end` is a null pointer.

`strtoul()` returns the converted value, if any. If no conversion could be performed, zero is returned. If the correct value is outside the range of representable values, `ULONG_MAX` is returned and `ERANGE` is stored in `errno`.

`begin`
: is a pointer to the beginning of the string. (Input)

`end`
: is a pointer to the pointer to the first character after the converted string. (Input)

`base`
: is the base of the number string. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`isspace()`

`strtod()`

`strtol()`

`strtoll()`

Possible Error

`ERANGE`

strxfrm()

Transform String

Syntax

```
#include <string.h>
size_t strxfrm(
    char *dest,
    const char *trans,
    size_t count);
```

Description

`strxfrm()` transforms `trans` and places the result in `dest`. You can then use `strcmp()` to compare two transformed strings. The result of the `strcmp()` on the transformed strings is the same as the result of `strcoll()` applied to the two original strings.

If copying takes place between overlapping objects, the behavior is undefined.

`strxfrm()` returns the length of the transformed string, not including the terminating null character. If the value returned is `count` or more, the contents of `dest` are indeterminate.

`dest`
: is a pointer to the destination string.

`trans`
: is a pointer to the string to transform.

`count`
: specifies the maximum number of characters to place in `dest`.

: `count` includes the terminating null character. If `count` is zero, `dest` can be a null pointer.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`strcmp()` `strcoll()`

_subcall()

Call Subroutine Module

Syntax

```
#include <module.h>
void _subcall(void);
```

Description

`_subcall()` calls a subroutine module previously linked by `_sliblink()`. `_subcall()` expects the first two longwords in the code area following it to contain, respectively:

- The subroutine library number.
- The function number to call.

`_subcall()` retrieves these identifiers, adjusts the program stack, and dispatches to the subroutine library entry point with the correct global static storage configuration.

A process can link to a maximum of sixteen subroutine libraries, numbered from `0` to `15`.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`clib.l`

See Also

`_sliblink()`

sysctl()

Get and Set System Information

Syntax

```
#include <sys/param.h>
#include <sys/sysctl.h>

int sysctl(int *name,
         u_int namelen,
         void *oldp,
         size_t *oldlenp, void *newp,
         size_t newlen);
```

Description

`sysctl()` retrieves system information and allows processes with appropriate privileges to set system information. Unless explicitly noted below, `sysctl()` returns a consistent snapshot of the data requested.

`name`
: array of integers specifying the system variable to get/set

`namelen`
: number of integers in the `name` array

`oldp`
: pointer to a buffer that contains the current value of the system variable

  The required size can be determined by calling `sysctl()` with a NULL parameter for `oldp`. The required size will then be returned in `oldlenp`.

`oldlenp`
: The location pointed to by `oldlenp` specifies the size of the `oldp` buffer on input; on output it specifies the number of bytes copied into the `oldp` buffer.

  If `oldlenp` is NULL, no information is returned. If the `oldp` buffer is too small, as much data as possible is copied into it and an ENOMEM error is returned.

`newp`
: pointer to a buffer that contains the new value of the system variable specified by `name`

  If the system variable is not changed, `newp` should be NULL.

`newlen`
: specifies the size of the `newp` buffer

  If the system variable is not changed, `newlen` should be 0.

The system variables controlled by `sysctl()` are grouped according to functionality and organized in a logical tree. The `name` parameter is an array of integers that identifies a particular variable. The first entry of this array is the top level group; the next entry is the second level group. Currently, the only top level group supported is CTL_NET, which contains variables related to the networking subsystem.

CTL_NET

The string and integer information available for the CTL_NET level is detailed in the table below. The "Changeable" column details whether or not a process with appropriate privilege may change the value.

Table 2-34.

Second Level Name	Type	Changeable
`PF_ROUTE`	routing messages	no
`PF_INET`	IPv4 values	yes
`PF_INET6`	IPv6 values	yes

`PF_ROUTE`

Return the entire routing table or a subset of it. The data is returned as a sequence of routing messages. The length of each message is contained in the message header.

The third level name is a protocol number, which is currently always 0. The fourth level name is an address family, which may be set to 0 to select all address families. The fifth and sixth level names are as follows:

```
Fifth Level:
Sixth Level:
NET_RT_FLAGS   rtflags
NET_RT_DUMP    None
NET_RT_IFLIST  None
```

`PF_INET`

Get or set various global information about IPv4 (Internet Protocol version 4). The third level name is the protocol. The fourth level name is the variable name. The currently defined protocols and names include:

`ip forwarding:` A changeable integer. This returns 1 when IP forwarding is enabled for the host, meaning that the host is acting as a router.

`PF_INET6`

Get or set various global information about IPv6 (Internet Protocol version 6). The third level name is the protocol. The fourth level name is the variable name. The currently defined protocols and names include:

- `ip6 forwarding`: A changeable integer. Returns 1 when IPv6 forwarding is enabled for the node, meaning that the node is acting as a router. Returns 0 when IPv6 forwarding is disabled for the node, meaning that the node is acting as a host. IPv6 specification defines node behavior for “router” case and “host” case quite differently, and changing this variable during operation may cause serious trouble. It is recommended to configure the variable at bootstrap time, and bootstrap time only.
- `ip6 accept_rtadv`: A changeable integer. If set to non-zero, the node will accept ICMPv6 router advertisement packets and autoconfigures address prefixes and default routers. The node must be a host (not a router) for the option to be meaningful.

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

Example

This example retrieves the current value for IPv4 forwarding.

```
size_t len;
int mib[4];
int ipforwarding = 0;

len = sizeof(ipforwarding);
mib[0] = CTL_NET;
mib[1] = PF_INET;
mib[2] = IPPROTO_IP;
mib[3] = IPCTL_FORWARDING;
sysctl (mib, 4, &ipforwarding, &len, 0, 0);
return (ipforwarding);
```

sys_mktime()

Convert Local Time to Greenwich Mean Time

Syntax

```
#include <time.h>
time_t sys_mktime(struct tm *tp);
```

Description

`sys_mktime()` converts the local time values in a broken-down time structure into a Universal Coordinated Time value.

`sys_mktime()` ignores the input values of `tm_wday` and `tm_yday`. It does not require the other fields of `tm` to be within the ranges specified in the structure. Instead, it normalizes the fields and sets `tm_wday`, `tm_yday`, and `tm_isdst`. This allows you to easily do temporal arithmetic without having to worry about mixed-base operations.

If `(time_t)-1` returns to indicate an error, there is a one second interval that appears to be non-representable. The encoding of times for `time_t` only represents times ranging from approximately 1902 to 2038.

`tp`

is a pointer to a broken-down time structure. (Input)

Broken-down time has the following format:

```
struct tm {
   int tm_sec;     /* seconds after the minute: [0,59]  */
   int tm_min;     /* minutes after the hour: [0,59]    */
   int tm_hour;    /* hours after midnight:   [0,23]    */
   int tm_mday;    /* day of the month:       [1,31]    */
   int tm_mon;     /* months after January:   [0,11]    */
   int tm_year;    /* years after 1900                  */
   int tm_wday;    /* days after Sunday:      [0,6]     */
   int tm_yday;    /* days after January 1: [0,365]     */
   int tm_isdst;   /* Daylight Savings Time (DST) flag  */
                   /* 0 = no, 1 = yes, -1 = unknown     */
};
```

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`sys_clib.l`

See Also

`mktime()`

_sysdate()

Get Current System Date/Time

Syntax

```
#include <time.h>
int _sysdate(
    int format,
    int *time,
    int *date,
    short *day,
    int *tick);
```

Description

`_sysdate()` obtains the current time, date, day of week, and clock tick from the system. Note that all the parameters except `format` are pointers to the receiving locations.

`format`
: specifies the format of the date and time to return. (Input)

  `format` can be any of the following:

  - `0` = Gregorian
  - `2` = Gregorian with ticks
  - `1` = Julian
  - `3` = Julian with ticks

`time`
: is a pointer to the location where `_sysdate()` stores the time value. (Output)

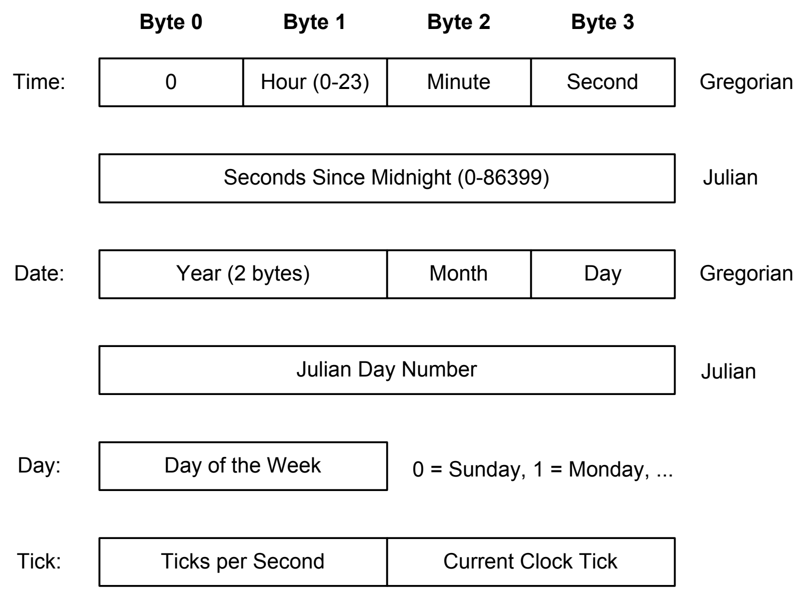
`date`
: is a pointer to the location where `_sysdate()` stores the date value. (Output)

`day`
: is a pointer to the location where `_sysdate()` stores the day of week value. (Output)

`tick`
is a pointer to the location where `_sysdate()` stores the tick value. (Output)

The values are returned in the following format:

Figure 2-11. _sysdate() Return Format



If an error occurs, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

Be careful when passing pointers to the `date`, `time`, and `day` values. Also, be sure `day` is declared to be a `short` or the value appears as `day`
`+ 65536.`

Attributes

Operating System: OS-9 and OS-9 for 68K

State: User and System

Threads: Safe

Re-entrant: Yes

Library

`sys_clib.l`

Example

```
main()
{
   int date,time,tick;
   short day;
   .
   .
   .
   _sysdate(0,&time,&date,&day,&tick);
   .
   :
}
```

See Also

`_os_getime()`

`_os_julian()`

`F$Julian`	*OS-9 for 68K Technical Manual*
`F$Time`	*OS-9 for 68K Technical Manual*
`F_TIME`	*OS-9 Technical Manual*

_sysdbg()
Call System Debugger

Syntax

```
#include <process.h>
```

```
int _sysdbg(void);
```

Description

`_sysdbg()` starts the system-level debugger, if one exists. This allows you to debug system state routines, such as drivers. The system-level debugger runs in system state and effectively stops timesharing whenever it is active. Only the super user can make this call.

If the system does not have a system-level debugger, the system is reset.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_sysdbg()`

`F$SysDbg`	*OS-9 for 68K Technical Manual*
`F_SYSDBG`	*OS-9 Technical Manual*

Syntax

```
#include <stdlib.h>

int system(const char *string);
```

Description

`system()` passes a string to the shell for execution. A null pointer may be used for the string to inquire whether a command processor exists.

The shell used to execute the string is either the current value of the `SHELL` environment variable or `shell`, if `SHELL` is unavailable.

The thread enabled version of this function contains a cancel point. For more information refer to *Using OS-9 Threads*.

`string`
is a pointer to the string to pass to the shell. (Input)

The string may be any valid shell command line.

- If `string` is a null pointer, `system()` returns non-zero only if a command processor is available.
- If `string` is not a null pointer, `system()` returns the exit status of the forked shell.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

system_addr()

Address Translation Function

Syntax

```
#include <regs.h>

void *system_addr(void *addr);
```

Description

`system_addr()` returns the system-state version of the specified address. If the passed address is already in the system-state address space or address translation is not applicable on the host processor, it is returned untouched.

`system_addr()` returns the system-state version of the specified address.

`addr`
: is the address to be converted to its system-state address (Input).

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

See Also

`user_addr()`

tan()

Tangent Function

Syntax

```
#include <math.h>
double tan(double x);
```

Description

`tan()` returns the tangent of `x` (input). `x` is presumed to be in radians.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

tanh()

Hyperbolic Tangent Function

Syntax

```
#include <math.h>
double tanh(double x);
```

Description

`tanh()` returns the hyperbolic tangent of `x` (input).

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

telldir()

Return Current Location

Syntax

```
#include <dir.h>
long telldir(DIR *dirp);
```

Description

`telldir()` returns the current location associated with the named directory stream.

`dirp`
: is a pointer to the directory stream. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`closedir()`

`opendir()`

`readdir()`

`rewinddir()`

`seekdir()`

tempnam()

Create Names for Temporary Files

Syntax

```
#include <UNIX/os9def.h>

char *tempnam(
    char *dir,
    char *pfx);
```

Description

`tempnam()` generates names that can safely be used for temporary files. `tempnam()` allows the user to control the choice of a directory.

`tempnam()` uses `malloc()` to get space for the constructed file name, and returns a pointer to this area. Thus any pointer value returned from `tempnam()` may serve as an argument to `free()`. If `tempnam()` cannot return the expected result for any reason, that is `malloc()` failed, or none of the above mentioned attempts to find an appropriate directory was successful, a NULL pointer is returned.

`dir`

points to the name of the directory in which the file is to be created. (Input)

If `dir` is `NULL` or points to a string which is not a name for an appropriate directory, "." is used. This entire sequence can be preempted by setting the environment variable `TMPDIR`, whose value is the name of the desired temporary-file directory.

`pfx`

Many applications prefer their temporary files to have certain favorite initial letter sequences in their names. Use the `pfx` argument for this. (Input)

This argument may be NULL or point to a string to be used as the first few characters of the temporary-file name.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

tgetent()
Get Termcap Entries

Syntax

```
#include <termcap.h>
extern char *BC;
extern char *UP;
int tgetent(
    char *bufptr,
    const char *name);
```

Description

`tgetent()` extracts the entry for the specified terminal type. The entry is placed in a buffer. The buffer size must be at least 1,024 characters and must remain intact for all subsequent calls to `tgetnum()`, `tgetflag()`, and `tgetstr()`.

If the `termcap` file cannot be opened, `-1` is returned. If the terminal name cannot be found, `0` is returned. If the terminal name is found, `1` is returned and the data is placed in the buffer.

By defining the shell environment variables `TERMCAP` and `TERM`, you can modify the behavior of `tgetent()`. If `TERMCAP` is found in the environment and its value string begins with a slash (`/`), that string is used as the path to the file to use instead of the default `termcap` file. If the value string does not begin with a slash and `name` is the same as the environment string for `TERM`, `tgetent()` uses this file to search for the terminal entry. This mode is useful for testing or for custom `termcap` definitions. If the `TERMCAP` value string does not begin with a slash, the string is used as the `termcap` string instead of reading a file.

`tgetent()` must be called before any of the other `termcap` library functions.

`bufptr`
: is a pointer to the buffer in which to place the entry. (Output)

`name`
: is a pointer to the name of the terminal type. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`termlib.l`

See Also

`tgetflag()` `tgetnum()` `tgetstr()`

tgetflag()

Check Terminal Capability Presence

Syntax

```
#include <termcap.h>
extern char *BC;
extern char *UP;
int tgetflag(const char *id);
```

Description

`tgetflag()` returns `1` if the capability ID was specified for the terminal type and `0` if not specified for the terminal type.

`tgetent()` must be called before any of the other `termcap` library functions.

`id`
: is a pointer to the capability ID. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`termlib.l`

tgetnum()
Get Terminal Capability ID

Syntax

```
#include <termcap.h>
extern char *BC;
extern char *UP;
int tgetnum(const char *id);
```

Description

`tgetnum()` returns the numeric value given for the capability ID.

`tgetent()` must be called before any of the other `termcap` library functions.

`id`
: is a pointer to the capability ID. (Input)

  If `id` was not specified for the terminal type, `-1` is returned.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`termlib.l`

tgetstr()

Get Terminal Capability

Syntax

```
#include <termcap.h>
extern char *BC;
extern char *UP;
char *tgetstr(
    const char *id,
    char **strptr);
```

Description

`tgetstr()` places the string given for the capability ID into a buffer.

`tgetent()` must be called before any of the other `termcap` library functions.

`tgetstr()` returns null or `0` upon error.

Cursor motion and padding information are interpreted when the string is actually output with `tgoto()` and `tputs()`.

`id`
: is a pointer to the capability ID. (Input)

`strptr`
: is a pointer to the pointer to the buffer for the capability string. (Output)

  `strptr` is advanced past the last character of the returned data.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`termlib.l`

See Also

`tgoto()`

`tputs()`

tgoto()

Get Cursor Movement Capability

Syntax

```
#include <termcap.h>
extern char *BC;
extern char *UP;
char *tgoto(
    const char *motion_string,
    int column,
    int line);
```

Description

`tgoto()` returns a string suitable for positioning a cursor on the terminal.

`tgetent()` must be called before any other `termcap` library functions.
The `extern` variables `UP` and `BC` (set to the `up` and `bc` capability strings, respectively) are used to avoid placing a null or newline character into the output string.

`tgoto()` returns a pointer to the translated motion string if the motion string was successfully created. Otherwise, the string `"OOPS"` is returned.

`motion_string`
: is a pointer to the string given by the `cm` capability. (Input)

`column`
: specifies the column destination for the cursor. (Input)

`line`
: specifies the line destination for the cursor. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`termlib.l`

time()

Get Calendar Time

Syntax

```
#include <time.h>

time_t time(time_t *timer);
```

Description

`time()` determines the current calendar time. The encoding of the value is unspecified.

`time()` returns the implementation's best approximation to the current calendar time. The value `(time_t)-1` is returned if the calendar time is unavailable. If `timer` is not a null pointer, the return value is also assigned to the object to which it points.

`timer`
is a returned value. It is a pointer to the calendar time. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`getenv()`

`_os_getime()`

`_os9_getime()`

times()

Get Process Times

Syntax

```
#include <UNIX/times.h>
int times(struct tms *buffer);
```

Description

`times()` returns time-accounting information for the current process and for the terminated child processes of the current process. All times are in 1/60 seconds.

`buffer` (output) points to the following structure:

```
struct tms {
    clock_t   tms_utime;   /* user time */
    clock_t   tms_stime;   /* system time */
    clock_t   tms_cutime;  /* user time, children */
    clock_t   tms_cstime;  /* system time, children */
};
```

This information comes from the calling process.

`tms_utime` is the CPU time used while executing instructions in the user space of the calling process.

`tms_stime` is the CPU time used by the system on behalf of the calling process.

`tms_cutime` and `tms_cutimes` are not implemented and set to zero by `times()`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

tmpfile()

Create Temporary Binary File

Syntax

```
#include <stdio.h>
FILE *tmpfile(void);
```

Description

`tmpfile()` creates a temporary binary file that is automatically removed when it is closed or at program termination. If the program terminates abnormally, temporary files are not removed. The file is opened for update with `"wb+"` mode.

`tmpfile()` returns a pointer to the stream of the file that it created. If the file cannot be created, `tmpfile()` returns a null pointer.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fopen()`

tmpnam()

Generate Unique Valid Filename

Syntax

```
#include <stdio.h>

char *tmpnam(char *filename);
```

Description

`tmpnam()` generates a string. The string is a valid file name and is not the same as the name of an existing file. `tmpnam()` generates a different string each time it is called up to `TMP_MAX` times. If it is called more than `TMP_MAX` times, it returns a null pointer.

`filename`
: is a pointer to the generated file name. (Output)

- If `filename` is a null pointer, `tmpnam()` leaves its result in an internal static object and returns a pointer to that object. Subsequent calls to `tmpnam()` modify the same object.
- If `filename` is not a null pointer, it is assumed to point to an array of at least `L_tmpnam` chars. `tmpnam()` writes its result in that array and returns the parameter as its value.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

toascii(), _toascii()
Character Translation

Syntax

```
#include <ctype.h>
```

```
int toascii(int c);
```

```
int _toascii(int c);
```

Description

`_toascii()` returns a character with all bits that are not part of a standard ASCII character turned off. It is used for compatibility with other systems. Only `_toascii()` is available in strictly conforming ANSI mode.

`c`
: is the returned character. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`clib.l`

See Also

`getc()`, `getchar()`

_tolower()

Convert Character to Lowercase

Syntax

```
#include <ctype.h>
int _tolower(int c);
```

Description

`_tolower()` is a macro that changes the uppercase parameter to lowercase. The parameter must be uppercase or the results are unpredictable and useless. Use `tolower()` if the parameter is not guaranteed to be uppercase.

`_tolower()` is hard-coded to the ASCII character set. Changing the locale does not cause `_tolower()` to recognize a non-ASCII character. You must use `tolower()` if you are not using ASCII characters.

`c`
: is the character to convert. (Input)

  Only the lower 8 bits of `c` are used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`ctype.h.`

See Also

`tolower()`

`toupper()`

`_isascii(), isascii()`

tolower()

Convert Character to Lowercase

Syntax

```
#include <ctype.h>
```

```
int tolower(int c);
```

Description

`tolower()` converts an uppercase letter to the corresponding lowercase letter.

If the parameter `c` is such that `islower(c)` returns a non-zero value (is uppercase), `tolower()` returns the corresponding character. Otherwise, `c` is returned unchanged.

`c`

is the character to convert. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`islower()`

_toupper()
Convert Character to Uppercase

Syntax

```
#include <ctype.h>
```

```
int _toupper(int c);
```

Description

`_toupper()` is a macro that changes the lowercase parameter to uppercase. The parameter *must* be lowercase or the results are unpredictable and useless. Use `toupper()` if the parameter is not guaranteed to be lowercase.

`_toupper()` is hard-coded to the ASCII character set. Changing the locale does not cause `_toupper()` to recognize a non-ASCII character. You must use `toupper()` if you are not using ASCII characters.

`c`

is the character to convert. (Input)

Only the lower 8 bits of `c` are used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`ctype.h`

See Also

`tolower()`

`toupper()`

`_isascii(), isascii()`

toupper()

Convert Character to Uppercase

Syntax

```
#include <ctype.h>
int toupper(int c);
```

Description

`toupper()` converts a lowercase letter to the corresponding uppercase letter.

If the parameter `c` is such that `isupper(c)` returns a non-zero value (is uppercase), `toupper()` returns the corresponding character. Otherwise, `c` is returned unchanged.

`c`
: is the character to convert. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`isupper()`

tputs()

Output Capability String

Syntax

```
#include <termcap.h>
extern char *BC;
extern char *UP;
void tputs(
    const char *str,
    int lines_affected,
    int (*outfunc)(char));
```

Description

`tputs()` is used to output the capability strings to the terminal. `tputs()`decodes leading padding information from the `str` string.

`tgetent()` must be called before any of the other `termcap` library functions.

`str`
: is a pointer to the string. (Input)

`lines_affected`
: is the number of lines the operation affects. (Input)

  This should be set to `1` if not applicable.

`outfunc`
: is a pointer to a function called by `tputs()` to output each successive character of the `str` string. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`termlib.l`

See Also

`_gs_opt()`

tsleep()

Sleep for Specified Interval

Syntax

```
#include <signal.h>

int tsleep(unsigned svalue);
```

Description

`tsleep()` deactivates the calling process for a specified interval. For values greater than one, `svalue` is considered a tick count to sleep, if the high bit is clear. If the high bit of `svalue` is set, the remaining 31 bits are considered the number of 256ths of a second to sleep. If the sleeping process is awakened prematurely by a signal, `tsleep()` returns the number of ticks remaining to sleep.

The thread enabled version of this function contains a cancel point. For more information see *Using OS-9 Threads*.

`svalue`

specifies the interval below. (Input)

- If `svalue` is `0`, the process sleeps indefinitely.
- If `svalue` is `1`, the process gives up the current time slice.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_sleep()`
`_os9_sleep()`

`F$Sleep`	*OS-9 for 68K Technical Manual*
`F_SLEEP`	*OS-9 Technical Manual*

ungetc()

Unget Character

Syntax

```
#include <stdio.h>
int ungetc(
    int c,
    FILE *stream);
```

Description

`ungetc()` pushes a character, converted to an `unsigned char`, back onto the input stream. The pushed-back character is returned by subsequent reads on that stream in the reverse order of their pushing. A successful intervening call with the stream pointed to by `stream` to a file positioning function (`fseek()`, `fsetpos()`, or `rewind()`) discards any pushed-back characters for the stream. The external storage corresponding to the stream is unchanged.

One character of pushback is guaranteed. If `ungetc()` is called too many times on the same stream without an intervening read or file positioning operation on that stream, the operation may fail.

A successful call to `ungetc()` clears the end-of-file indicator for the stream. The value of the file position indicator for the stream after reading or discarding all pushed-back characters is the same as it was before the characters were pushed back. For a text stream, the value of the file position indicator after a successful call to `ungetc()` is unspecified until all pushed-back characters are read or discarded. For a binary stream, the file position indicator is decremented by each successful call to `ungetc()`. If the value was zero before a call, it is indeterminate after the call.

`ungetc()` returns the character pushed back after conversion. If the conversion fails, `EOF` is returned.

`c`
: is the character to push back. (Input)

  If `c` is `EOF`, the operation fails and the input stream is unchanged.

`stream`
: is a pointer to the C I/O `FILE` structure. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`getc()`, `getchar()`

`fopen()`

`fseek()`

`fsetpos()`

`rewind()`

`setbuf()`

unlink()

Unlink (Delete) File

Syntax

```
#include <modes.h>

int unlink(const char *name);
```

Description

`unlink()` decrements the link count of a file. When the link count reaches zero (0), the space occupied by the file on the disk is freed and the file no longer exists.

OS-9 for 68K does not yet support multiple links to a file. `unlink()` always causes the file to be removed from the disk. Attempting to delete an open file by the calling (or another) process results in an `EOS_SHARE` error.

`name`

is a pointer to the name of the file. (Input)

If successful, `unlink()` returns `0`. Otherwise, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_delete()`

`I$Delete`	*OS-9 for 68K Technical Manual*
`I_DELETE`	*OS-9 Technical Manual*

unlinkx()

Unlink (Delete) File

Syntax

```
#include <modes.h>
int unlinkx(
    const char *name,
    int mode);
```

Description

`unlinkx()` decrements the link count of a file.

If successful, `unlinkx()` returns `0`. Otherwise, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

OS-9 for 68K does not support multiple links to a file. `unlinkx()` always causes the file to be removed from the disk. Attempting to delete an open file by the calling (or another) process results in an `EOS_SHARE` error.

`name`
: is a pointer to the name of the file.(Input)

`mode`
: specifies the file's access mode. (Input)

  If the execution bit (`FAM_EXEC` or `S_IEXEC`) in the `mode` is set, the path is assumed to be based in the current execution directory. The header file `modes.h` defines the legal `mode` values. When the link count reaches zero, the space occupied by the file on the disk is freed and the file no longer exists. Only the lower 16 bits of `mode` are used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`_os_delete()`

`I$Delete`	*OS-9 for 68K Technical Manual*
`I_DELETE`	*OS-9 Technical Manual*

user_addr()

Address Translation Function

Syntax

```
#include <regs.h>
```

```
void *user_addr(void *addr);
```

Description

`user_addr()` returns the user-state version of the specified address. If the passed address is already in the user-state address space or address translation is not applicable on the host processor, it is returned untouched.

`user_addr()` returns the user-state version of the specified address.

`addr`
: is the address to be converted to its user-state address. (Input)

Attributes

Operating System:	OS-9
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`cpu.l`

See Also

`system_addr()`

utimes()

Change Access and Modification Times

Syntax

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

int utimes(
        const char *path,
        const struct timeval *times);
```

Description

The access and modification times of the file named by `path` or referenced by `fd` are changed as specified by the argument times.

If `times` is NULL, the access and modification times are set to the current time. The caller must be the owner of the file, have permission to write the file, or be the super-user.

If `times` is non-NULL, it is assumed to point to an array of two timeval structures. The access time is set to the value of the first element, and the modification time is set to the value of the second element. The caller must be the owner of the file or be the super-user. In either case, the inode-change-time of the file is set to the current time.

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and errno is set to indicate the error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`unix.l`

See Also

`_os_close()`
`_os_gs_devtyp()`
`_os_gs_fd()`
`_os_open()`
`_os_ss_fd()`
`localtime()`
`mktime()`
`time()`

va_arg()

Get Parameter in Variable Parameter List

Syntax

```
#include <stdarg.h>
```

```
type va_arg(va_list ap, type);
```

Description

`va_arg()` is a macro associated with the `stdarg.h` header file. `stdarg.h` provides a method for stepping through a list of function parameters whose length and type are unknown.

`va_arg()` expands into an expression. The expression returns a value that has the type and value of the next unnamed parameter. It also modifies `ap` such that the next call to `va_arg()` returns the next parameter. `ap` must have been previously initialized using `va_start()`. If there is no actual next parameter or if `type` is not compatible with the type of the actual next parameter (as promoted according to the default parameter promotions), the behavior is undefined.

`ap`	is an object representing the next unnamed parameter. (Input)
`type`	is a type name. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`va_start()`

va_end()

End References to Current Variable Parameter List

Syntax

```
#include <stdarg.h>
void va_end(va_list ap);
```

Description

`va_end()` is a macro associated with the `stdarg.h` header file. `stdarg.h` provides a method for stepping through a list of function parameters whose length and type are unknown.

`va_end()` expands into an expression. The expression facilitates a normal return from the function whose variable parameter list was referred to by the expansion of the `va_start()` call that initialized `ap`.

`va_end()` may modify `ap` so that you can no longer use it without an intervening call to `va_start()`. If there is no corresponding call to `va_start()` or if `va_end()` is not called before the return, the behavior is undefined. `va_end()` returns no value.

`ap`
: is an object representing the next unnamed parameter. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`va_start()`

va_start()

Initialize Variable Parameter List

Syntax

```
#include <stdarg.h>
void va_start(va_list ap, parmN);
```

Description

`va_start()` is a macro associated with the `stdarg.h` header file. `stdarg.h` provides a method for stepping through a list of function parameters whose length and type are unknown.

`ap`

is an object representing the next unnamed parameter. (Input)

`parmN`

identifies the right-most parameter in variable parameter list in the function definition (the parameter just before the `, ...`). (Input)

If `parmN` is declared with one of the following types, the behavior is undefined:

- The register storage class
- A function type
- An array type
- A type that is not compatible with the type that results after applying the default parameter promotions. For example, `char`, `short`, and `float`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

verr(), verrx()

Display Error Message

Syntax

```
#include <UNIX/err.h>

void verr(int eval, const char *fmt, va_list args);

void verrx(int eval, const char *fmt, va_list args);
```

Description

The `err()` family of functions, to which these functions belong, displays a formatted error message on the standard error output. In all cases, the last component of the program name, a colon character, and a space are output. If the `fmt` argument is not NULL, the formatted error message is output. In the case of the `verr()` function, the error message string affiliated with the current value of the global variable errno is output next, preceded by a colon character and a space if fmt is not NULL. In all cases, the output is followed by a newline character.

These functions do not return, rather they exit with the value of the argument `eval`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`err()`, `errx()`

vfprintf()

Print to File

Syntax

```
#include <stdarg.h>
#include <stdio.h>
int vfprintf(
    FILE *stream,
    const char *format,
    va_list arg);
```

Description

`vfprintf()` performs formatted output to a stream. It converts, formats, and prints any parameters as indicated by the control string. `vfprintf()` is similar to `fprintf()`. However, `arg` replaces the variable parameter list.

`vfprintf()` does not call `va_end()`. `vfprintf()` returns the number of characters transmitted. If an output error occurs, a negative value is returned.

The `sclib.l` and `sclib.il` libraries contain a smaller version of the `vfprintf()` function. Refer to the *Using Ultra C/C++* manual for more information about the small library functions.

`stream`
: is a pointer the C I/O `FILE` structure. (Input)

`format`
: is a pointer to a control string. (Input)

`arg`
: is initialized by `va_start()` (and possibly subsequent `va_arg()` calls). (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

Example

The following example shows the use of `vfprintf()` in a general error-reporting routine.

```
#include <stdarg.h>

#include <stdio.h>

void error(char *function_name, char *format, ...)

{

     va_list args;

     va_start(args, format);    /* print out name of function */

                                /* causing error */

     fprintf(stderr, “ERROR in %s “, function_name);

                                /* print out remainder of message */

     vfprintf(stderr, format, args);

     va_end(args);

}
```

See Also

`fprintf()`

`va_arg()`

`va_end()`

`va_start()`

vprintf()

Print to Standard Output

Syntax

```
#include <stdarg.h>
#include <stdio.h>
int vprintf(
    const char *format,
    va_list arg);
```

Description

`vprintf()` performs formatted output to `stdout`. It converts, formats, and prints any parameters as indicated by the control string. `vprintf()` is similar to `printf()`. However, `arg` replaces the variable parameter list.

`vprintf()` does not call `va_end()`.

`vprintf()` returns the number of characters transmitted. If an output error occurs, a negative value is returned.

The `sclib.l` and `sclib.il` libraries contain a smaller version of the `vprintf()` function. Refer to the *Using Ultra C/C++* manual for more information about the small library functions.

`format`
: is a pointer to a control string. (Input)

`arg`
: is initialized by `va_start()` (and possibly subsequent `va_arg()` calls). (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fprintf()` `printf()`
`va_arg()` `va_end()`
`va_start()`

vsnprintf()

Write Formatted Output to Character Array

Syntax

```
#include <stdarg.h>
#include <stdio.h>
int vsnprintf( char *buf,
               size_t count,
               const char* format,
               va_list arg );
```

Description

The `vsnprintf()` function is equivalent to `snprintf()`, with a variable argument list. It writes formatted output to a character array, up to a given maximum number of characters.

`vsnprintf()` returns the number of characters generated by expanding the `format` string, regardless of whether or not the number generated exceeds that specified by `count`.

`buf`
: is the location in which `vsnprintf()` stores the data controlled by `format` (Output)

`count`
: specifies the maximum number of characters allowed in the array, including a terminating null character (Input)

`format`
: is the control string under which `vsnprintf()` formats data (Input)

`arg`
: is a variable argument list (Input)

For details on the format string, refer to the `fprintf()` function.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`sys_clib.l`

Examples

The following shows the use of `vsnprintf()` in a general error message routine:

```
#include <stdio.h>
#include <stdarg.h>
#include <string.h>

char msgbuf[80];

char *fmtmsg( char *format, ... )
{
    va_list arglist;

    va_start( arglist, format );
    strcpy( msgbuf, "Error: " );
    vsnprintf( &msgbuf[7], 80-7, format, arglist );
    va_end( arglist );
    return( msgbuf );
}

int main( void )
{
    char *msg;

    msg = fmtmsg( "%s %d %s", "Failed", 100, "times" );
    printf( "%s\n", msg );

    return 0;
```

See Also

`fprintf()`
`printf()`
`snprintf()`
`sprintf()`
`va_arg()`
`va_end()`
`va_start()`
`vfprintf()`
`vprintf()`
`vsprintf()`

vsprintf()

Print to String

Syntax

```
#include <stdarg.h>
#include <stdio.h>
int vsprintf(
    char *str,
    const char *format,
    va_list arg);
```

Description

`vsprintf()` performs formatted output to a string. It converts, formats, and prints any parameters as indicated by the control string. `vsprintf()` is similar to `sprintf()`. However, `arg` replaces the variable parameter list.

`vsprintf()` does not call `va_end()`. If copying takes place between overlapping objects, the behavior is undefined.

`vsprintf()` returns the number of characters written in the array, not counting the terminating null character.

The `sclib.l` and `sclib.il` libraries contain a smaller version of the `vprintf()` function. Refer to the *Using Ultra C/C++* manual for more information.

`str`
: is a pointer to a string. (Output)

`format`
: is a pointer to a control string. (Input)

`arg`
: is initialized by `va_start()` (and possibly subsequent `va_arg()` calls). (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No
Standards:	ANSI

Library

`clib.l`

See Also

`fprintf()` `sprintf()`
`va_arg()` `va_end()` `va_start()`

vwarn(), vwarnx()

Display Warning Message

Syntax

```
#include <UNIX/err.h>
void vwarn(const char *fmt, va_list args);
void vwarnx(const char *fmt, ...);
```

Description

The `warn()` family of functions displays a formatted error message on the standard error output. In all cases, the last component of the program name, a colon character, and a space are output. If the `fmt` argument is not NULL, the formatted error message is output. In the case of the `vwarn()` function, the error message string affiliated with the current value of the global variable errno is output next, preceded by a colon character and a space if fmt is not NULL. In all cases, the output is followed by a newline character.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`warn(), warnx()`

wait()

Wait for Process Termination

Syntax

```
#include <process.h>
int wait(unsigned int *status);
int wait(0);
```

Description

`wait()` suspends the current process until a child process has terminated.

`wait()` returns the process ID of the terminating child process and places the exit status of that process in the `unsigned int` pointed to by `status`. If `status` is passed as zero, no child status is available to the caller.

The lower 16 bits of the status value contains the parameter of the `exit()` or `_exit()` call as executed by the child process, or the signal number if it was interrupted with a signal. A normally terminating C program with no explicit call to `exit()` in `main()` returns a status equal to the returned value of `main()`.

`wait()` returns:

- `-1` if there is no child process for which to wait.
- `0` if a signal was received before a child process terminated.

The status codes used in the operating system may not be compatible with other operating systems. A wait must be executed for each child process created.

The thread enabled version of this function contains a cancel point. For more information see *Using OS-9 Threads*.

`status`
: is a pointer to a storage location where the exit status of the terminating child process is stored. (Output)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`exit()`	`_exit()`
`_os_wait()`	`_os_fork()`
`F$Wait`	*OS-9 for 68K Technical Manual*
`F_WAIT`	*OS-9 Technical Manual*

waitpid()

Wait for Process

Syntax

```
#include <sys/wait.h>
pid_t waitpid(
pid_t     pid,
int       *stat_loc,
int       options);
```

Description

`waitpid()` allows a thread to wait for a process and get its exit status.

If or when a child's exit status is available `waitpid()` returns the process ID and, if `stat_loc` (output) is non-NULL, writes the exit status at `stat_loc`. If a blocking `waitpid()` is interrupted by a signal it sets `errno` to `EINTR` and returns -1. If `options` is `WNOHANG` and the calling process has children, but none of the specified children has available exit status, 0 is returned. Otherwise `errno` is set to the error number and -1 is returned.

`pid and options`

The `pid` and `options` arguments determine how the wait is done. (Input)

For values of `pid` less than or equal to 0, the next available child process' status is returned. For values of `pid` greater than 1 (1 is an invalid process ID) the exit status of the specified process is returned. The `options` parameter can either be 0 to indicate a blocking wait or `WNOHANG` to indicate a non-blocking wait.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

Possible Errors

`ECHLD`	The calling process has no children or not the specific child requested.
`EINTR`	A blocking `waitpid()` was interrupted by a signal.
`EINVAL`	The value of `options` is invalid.

Example

```
while (waitpid(child, &status, 0) == -1 && errno == EINTR)
    ;
```

See Also

`wait()`

`pthread_join()`

`pthread_exit()`

warn(), warnx()

Display Error Message

Syntax

```
#include <UNIX/err.h>
void warn(const char *fmt, ...);
void warnx(const char *fmt, ...);
```

Description

The `warn()` family of functions displays a formatted error message on the standard error output. In all cases, the last component of the program name, a colon character, and a space are output. If the `fmt` argument is not NULL, the formatted error message is output. In the case of the `warn()` function, the error message string affiliated with the current value of the global variable errno is output next, preceded by a colon character and a space if fmt is not NULL. In all cases, the output is followed by a newline character.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

See Also

`vwarn(), vwarnx()`

wcstombs()

Convert Sequence of Wide Chars to Multibyte Chars

Syntax

```
#include <stdlib.h>
size_t wcstombs(
   char *str,
   const wchar_t *pwcs,
   size_t maxnum);
```

Description

`wcstombs()` converts a sequence of codes that correspond to multibyte characters from an array into a sequence of multibyte characters that begins in the initial shift state. `wcstombs()` stores these multibyte characters, stopping if a multibyte character would exceed the limit of `maxnum` total bytes or if a null character is stored. Each code is converted as if by a call to `wctomb()`, except that the shift state of `wctomb()` is not affected.

No more than `maxnum` bytes are modified in `str`. If copying takes place between overlapping objects, the behavior is undefined.

If a code is encountered that does not correspond to a valid multibyte character, `wcstombs()` returns `(size_t)-1`. Otherwise, `wcstombs()` returns the number of bytes modified, not including a terminating null character, if any.

`wcstombs()` is supported for both the `C` and `JAPAN` locales.

`str`
: is a pointer to the string in which to store the multibyte characters. (Output)

`pwcs`
: is a pointer to the array from which to read. (Input)

`maxnum`
: specifies the maximum number of bytes to convert. (Input)

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

See Also

`wctomb()`

wctomb()

Convert Wide Character to Multibyte Character

Syntax

```
#include <stdlib.h>
int wctomb(
    char *str,
    wchar_t wchar);
```

Description

`wctomb()` determines the number of bytes needed to represent the multibyte character corresponding to the code whose value is `wchar`. This includes any change in shift state. `wctomb()` stores the multibyte character representation in `str`, if `str` is not a null pointer. At most `MB_CUR_MAX` characters are stored.

`wchar`
: is the multibyte character to be represented. (Input)

  If `wchar` is zero, `wctomb()` is left in the initial shift state.

The returned value is never greater than `MB_CUR_MAX`.

`wctomb()` is supported for both the `C` and `JAPAN` locales.

`str`
: points to the string that stores a multibyte character representation. (Output)

  If `str` is a null pointer, `wctomb()` returns:

  - a non-zero value if multibyte character encodings have state-dependent encodings
  - zero if multibyte character encodings do not have state-dependent encodings

  If `str` is not a null pointer, `wctomb()` returns:

  - `-1` if the value of `wchar` does not correspond to a valid multibyte character
  - the number of bytes contained in the multibyte character corresponding to the value of `wchar`

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes
Standards:	ANSI

Library

`clib.l`

write()

Write Bytes to Path

Syntax

```
#include <modes.h>
int write(
    int path,
    const char *buffer,
    unsigned count);
```

Description

`write()` writes bytes to a path.

`write()` essentially performs a raw `write`; that is, the `write` is performed without translating characters. The characters are passed to the file (or device) as transmitted by the program.

`write()` returns the number of bytes actually written. If an error occurred, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`write()` performs a "raw" `write` to the terminal; no linefeeds after returns are transmitted.

The thread enabled version of this function contains a cancel point. For more information see *Using OS-9 Threads*.

`path`
: is the path number. (Input)

  The path number is an integer which specifies one of the standard path numbers (`0`, `1`, or `2`) or a path number returned from a successful call to `open()`, `creat()`, `create()`, or `dup()`.

`buffer`
: is a pointer to space with at least `count` (input) bytes of memory from which `write()` obtains the data to write to the path. (Output)

  It is guaranteed that at most `count` bytes are written. If fewer bytes are written, an error has occurred.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`creat()`

`create()`

`dup()`

`open()`

`_os_write()`

`writeln()`

`I$Write`	*OS-9 for 68K Technical Manual*
`I_WRITE`	*OS-9 Technical Manual*

writeln()

Write Bytes to Path

Syntax

```
#include <modes.h>
int writeln(
    int path,
    const char *buffer,
    unsigned count);
```

Description

`writeln()` writes bytes to a path.

`writeln()` causes output-filtering to take place such as outputting a linefeed after a carriage return or handling the page pause facility. `writeln()` writes, at most, one line of data. A carriage return indicates the end of a line. `writeln()` is the preferred call for writing to the terminal.

`writeln()` returns the number of bytes actually written. If an error occurred, `-1` is returned and the appropriate error code is placed in the global variable `errno`.

`writeln()` stops when the carriage return is written, even if the byte count has not been exhausted.

The thread enabled version of this function contains a cancel point. For more information refer to *Using OS-9 Threads*.

`path`
: is the path number. (Input)

  The path number is an integer which specifies one of the standard path numbers (`0`, `1`, or `2`) or a path number returned from a successful call to `open()`, `creat()`, `create()`, or `dup()`.

`buffer`
: is a pointer to space with at least `count` (input) bytes of memory from which `writeln()` obtains the data to write to the path. (Output)

  It is guaranteed that at most `count` bytes are written.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	Yes

Library

`sys_clib.l`

See Also

`creat()`

`create()`

`dup()`

`open()`

`_os_writeln()`

`write()`

`I$WritLn`	*OS-9 for 68K Technical Manual*
`I_WRITELN`	*OS-9 Technical Manual*

writev()

Write Output from iovcnt Buffers

Syntax

```
#include <UNIX/os9def.h>;
int writev(
   unsigned int fd,
   struct iovec *iov,
   unsigned int iovcnt);
```

Description

`writev()` performs the same action as `write()`, but gathers the output data from the `iovcnt` buffers specified by the members of the `iov` array: `iov[0], iov[1], ..., iov[iovcnt-1]`. If `iovcnt` is zero, any `iov_len` member of a passed `iovec` structure is less than zero, or all the `iov_len` members of the passed `iovec` structures are zero, `writev()` returns `-1` and sets the global variable `errno`.

For `writev()`, the `iovec` structure is defined as follows.

```
struct iovec {
     caddr_t      iov_base;
     int iov_len;
};
```

Each `iovec` entry specifies the base address and length of an area in memory from which data should be written. `writev()` always writes a complete area before proceeding to the next.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User and System
Threads:	Safe
Re-entrant:	No

Library

`unix.l`

A Prototyping sys_clib.l Functions

Before this topic is discussed in depth, it is important to note that the primary purpose of `sys_clib.l` is to provide a library for compatibility with the Microware K&R C compiler. This allows people who wrote code for that compiler to use the Ultra C/C++ ANSI C compiler without altering their original code.

- It is strongly recommended that when writing new code, a programmer not use the `sys_clib` library functions.
- Table 1-37 provides a table to look up equivalent functions for the `sys_clib` functions.

Declarations and K&R Compiler vs. Prototypes and ANSI C

In the past, the concept of a function protoype did not exist. The closest equivalent concept was a "function declaration". The purpose of the function declaration was to "pre-define" what the return type of a function was so that some degree of type checking could be done on its use. An example of a function declaration is:

```
struct direct *readdir();
```

This shows that the function "`readdir`" returns a pointer to a structure of the type `direct` (found in `dir.h`).

There is nothing in the declaration which mentions what type, or even how many, arguments the readdir function takes. As a result, no type checking was ever done on these functions parameters. The "standard promotion" of arguments was always assumed to have occurred.

The "standard promotion" rules are quite simple, all types being passed in that are "narrower" than an int type, are "widened" to an int type, and all arguments that are of floating point type are "widened" to a double precision. As a natural consequence, all functions which are compiled in K&R mode (for instance, all the `sys_clib.l` functions) assume that the calling function has already promoted the function arguments to their widened forms. ANSI C prototypes are somewhat different. For example:

```
int os9fork(char *, int, char *, short, short, int short);
```

This shows that the function "`os9fork`" returns an `int` and accepts the parameters specified. Of particular interest is the three "short" parameters. In ANSI mode, the compiler assumes that the prototype was visible to the calling program, and as a result, the values were NOT widedned to `int`. If the prototype was not visible to the calling function, the values would have been widened. This could have potentially caused a problem (especially if the parameters were passed on the stack and NOT in registers). As a result, the Ultra C compiler has an option (`-cw`) which warns the user if a function is being called without a prototype for that function being visible.

Making Code and Function Prototypes ANSI Compliant

It has been a common practice as of late to take code and switch it over to ANSI-compliant code. This often entails prototyping many of the functions which used to be compiled with K&R C compilers. If this were done strictly as in the prototype from the "`os9fork`" function mentioned above, and the `os9fork` function was not recompiled with an ANSI compiler, things would not work since the function itself would be expecting the short arguments to be widened to ints and the calling program, after having seen the prototype, would send shorts.

There is really only one way to handle this in a manner that causes everything to still work and that is to prototype the functions to their widened types, as follows:

```
int os9fork(char *, int, char *, int, int, int, int);
```

Unfortunately, this has the undesired side effect of implying that the fourth, fifth and seventh arguments are valid integers, when indeed only their lower 16 bits are valid. As a result, Microware has decided to optionally prototype these functions in system header files.

`sys_clib.l` functions affected by this include:

`os9exec()`
`os9fork()`, `os9forkc()`
`os9kexec()`