



Linux Ubuntu 26.04 Manual Pages on command 'msgop.2'

\$ man msgop.2

MSGOP(2) System Calls Manual MSGOP(2)

NAME

msgrcv, msgsnd - System V message queue operations

LIBRARY

Standard C library (libc, -lc)

SYNOPSIS

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

ssize_t msgrcv(size_t msgsz;
               int msqid, void msgp[msgsz], size_t msgsz, long msgtyp,
               int msgflg);

int msgsnd(size_t msgsz;
           int msqid, const void msgp[msgsz], size_t msgsz,
           int msgflg);
```

DESCRIPTION

The msgsnd() and msgrcv() system calls are used to send messages to, and receive messages from, a System V message queue. The calling process must have write permission on the message queue in order to send a message, and read permission to receive a message.

The msgp argument is a pointer to a caller-defined structure of the following general form:

```
struct msgbuf {
    long mtype;    /* message type, must be > 0 */
    char mtext[1]; /* message data */
};
```

The mtext field is an array (or other structure) whose size is specified by msgsz, a nonneg?

ative integer value. Messages of zero length (i.e., no mtext field) are permitted. The mtype field must have a strictly positive integer value. This value can be used by the receiving process for message selection (see the description of msgrcv() below).

msgsnd()

The msgsnd() system call appends a copy of the message pointed to by msgp to the message queue whose identifier is specified by msqid.

If sufficient space is available in the queue, msgsnd() succeeds immediately. The queue capacity is governed by the msg_qbytes field in the associated data structure for the message queue. During queue creation this field is initialized to MSGMNB bytes, but this limit can be modified using msgctl(2). A message queue is considered to be full if either of the following conditions is true:

- ? Adding a new message to the queue would cause the total number of bytes in the queue to exceed the queue's maximum size (the msg_qbytes field).
- ? Adding another message to the queue would cause the total number of messages in the queue to exceed the queue's maximum size (the msg_qbytes field). This check is necessary to prevent an unlimited number of zero-length messages being placed on the queue. Although such messages contain no data, they nevertheless consume (locked) kernel memory.

If insufficient space is available in the queue, then the default behavior of msgsnd() is to block until space becomes available. If IPC_NOWAIT is specified in msgflg, then the call instead fails with the error EAGAIN.

A blocked msgsnd() call may also fail if:

- ? the queue is removed, in which case the system call fails with errno set to EIDRM; or
- ? a signal is caught, in which case the system call fails with errno set to EINTR; see signal(7). (msgsnd() is never automatically restarted after being interrupted by a signal handler, regardless of the setting of the SA_RESTART flag when establishing a signal handler.)

Upon successful completion the message queue data structure is updated as follows:

- ? msg_lspid is set to the process ID of the calling process.
- ? msg_qnum is incremented by 1.
- ? msg_stime is set to the current time.

msgrcv()

The msgrcv() system call removes a message from the queue specified by msqid and places it in the buffer pointed to by msgp.

The argument `msgsz` specifies the maximum size in bytes for the member `mtext` of the structure pointed to by the `msgp` argument. If the message text has length greater than `msgsz`, then the behavior depends on whether `MSG_NOERROR` is specified in `msgflg`. If `MSG_NOERROR` is specified, then the message text will be truncated (and the truncated part will be lost); if `MSG_NOERROR` is not specified, then the message isn't removed from the queue and the system call fails returning -1 with `errno` set to `E2BIG`.

Unless `MSG_COPY` is specified in `msgflg` (see below), the `msgtyp` argument specifies the type of message requested, as follows:

- ? If `msgtyp` is 0, then the first message in the queue is read.
- ? If `msgtyp` is greater than 0, then the first message in the queue of type `msgtyp` is read, unless `MSG_EXCEPT` was specified in `msgflg`, in which case the first message in the queue of type not equal to `msgtyp` will be read.
- ? If `msgtyp` is less than 0, then the first message in the queue with the lowest type less than or equal to the absolute value of `msgtyp` will be read.

The `msgflg` argument is a bit mask constructed by ORing together zero or more of the following flags:

`IPC_NOWAIT`

Return immediately if no message of the requested type is in the queue. The system call fails with `errno` set to `ENOMSG`.

`MSG_COPY` (since Linux 3.8)

Nondestructively fetch a copy of the message at the ordinal position in the queue specified by `msgtyp` (messages are considered to be numbered starting at 0).

This flag must be specified in conjunction with `IPC_NOWAIT`, with the result that, if there is no message available at the given position, the call fails immediately with the error `ENOMSG`. Because they alter the meaning of `msgtyp` in orthogonal ways, `MSG_COPY` and `MSG_EXCEPT` may not both be specified in `msgflg`.

The `MSG_COPY` flag was added for the implementation of the kernel checkpoint-restore facility and is available only if the kernel was built with the `CONFIG_CHECKPOINT_RESTORE` option.

`MSG_EXCEPT`

Used with `msgtyp` greater than 0 to read the first message in the queue with message type that differs from `msgtyp`.

`MSG_NOERROR`

To truncate the message text if longer than msgsz bytes.

If no message of the requested type is available and IPC_NOWAIT isn't specified in msgflg, the calling process is blocked until one of the following conditions occurs:

- ? A message of the desired type is placed in the queue.
- ? The message queue is removed from the system. In this case, the system call fails with errno set to EIDRM.
- ? The calling process catches a signal. In this case, the system call fails with errno set to EINTR. (msgrcv() is never automatically restarted after being interrupted by a signal handler, regardless of the setting of the SA_RESTART flag when establishing a signal handler.)

Upon successful completion the message queue data structure is updated as follows:

msg_lpid is set to the process ID of the calling process.

msg_qnum is decremented by 1.

msg_rtime is set to the current time.

RETURN VALUE

On success, msgsnd() returns 0 and msgrcv() returns the number of bytes actually copied into the mtext array. On failure, both functions return -1, and set errno to indicate the error.

ERRORS

mgsnd() can fail with the following errors:

EACCES The calling process does not have write permission on the message queue, and does not have the CAP_IPC_OWNER capability in the user namespace that governs its IPC namespace.

EAGAIN The message can't be sent due to the msg_qbytes limit for the queue and IPC_NOWAIT was specified in msgflg.

EFAULT The address pointed to by msgp isn't accessible.

EIDRM The message queue was removed.

EINTR Sleeping on a full message queue condition, the process caught a signal.

EINVAL Invalid msqid value, or nonpositive mtype value, or invalid msgsz value (less than 0 or greater than the system value MSGMAX).

ENOMEM The system does not have enough memory to make a copy of the message pointed to by msgp.

msgrcv() can fail with the following errors:

E2BIG The message text length is greater than msgsz and MSG_NOERROR isn't specified in ms?

gflg.

EACCES The calling process does not have read permission on the message queue, and does not have the CAP_IPC_OWNER capability in the user namespace that governs its IPC name space.

EFAULT The address pointed to by msgp isn't accessible.

EIDRM While the process was sleeping to receive a message, the message queue was removed.

EINTR While the process was sleeping to receive a message, the process caught a signal; see signal(7).

EINVAL msgid was invalid, or msgsz was less than 0.

EINVAL (since Linux 3.14)

msgflg specified MSG_COPY, but not IPC_NOWAIT.

EINVAL (since Linux 3.14)

msgflg specified both MSG_COPY and MSG_EXCEPT.

ENOMSG IPC_NOWAIT was specified in msgflg and no message of the requested type existed on the message queue.

ENOMSG IPC_NOWAIT and MSG_COPY were specified in msgflg and the queue contains fewer than msgtyp messages.

ENOSYS (since Linux 3.8)

Both MSG_COPY and IPC_NOWAIT were specified in msgflg, and this kernel was configured without CONFIG_CHECKPOINT_RESTORE.

STANDARDS

POSIX.1-2024 XSI.

The MSG_EXCEPT and MSG_COPY flags are Linux-specific; their definitions can be obtained by defining the _GNU_SOURCE feature test macro.

HISTORY

SVr4, SUSv1, POSIX.1-2001 XSI.

The msgp argument is declared as struct msgbuf * in glibc 2.0 and 2.1. It is declared as void * in glibc 2.2 and later, as required by SUSv2 and SUSv3.

NOTES

The following limits on message queue resources affect the msgsnd() call:

MSGMAX Maximum size of a message text, in bytes (default value: 8192 bytes). On Linux, this limit can be read and modified via /proc/sys/kernel/msgmax.

MSGMNB Maximum number of bytes that can be held in a message queue (default value: 16384

bytes). On Linux, this limit can be read and modified via `/proc/sys/kernel/msgmnb`.

A privileged process (Linux: a process with the `CAP_SYS_RESOURCE` capability) can increase the size of a message queue beyond `MSGMNB` using the `msgctl(2)` `IPC_SET` operation.

The implementation has no intrinsic system-wide limits on the number of message headers (`MSGTQL`) and the number of bytes in the message pool (`MSGPOOL`).

BUGS

In Linux 3.13 and earlier, if `msgrcv()` was called with the `MSG_COPY` flag, but without `IPC_NOWAIT`, and the message queue contained less than `msgtyp` messages, then the call would block until the next message is written to the queue. At that point, the call would return a copy of the message, regardless of whether that message was at the ordinal position `msgtyp`. This bug is fixed in Linux 3.14.

Specifying both `MSG_COPY` and `MSG_EXCEPT` in `msgflg` is a logical error (since these flags impose different interpretations on `msgtyp`). In Linux 3.13 and earlier, this error was not diagnosed by `msgrcv()`. This bug is fixed in Linux 3.14.

EXAMPLES

The program below demonstrates the use of `msgsnd()` and `msgrcv()`.

The example program is first run with the `-s` option to send a message and then run again with the `-r` option to receive a message.

The following shell session shows a sample run of the program:

```
$ ./a.out -s
sent: a message at Wed Mar 4 16:25:45 2015

$ ./a.out -r
message received: a message at Wed Mar 4 16:25:45 2015
```

Program source

```
#include <errno.h>

#include <stdio.h>

#include <stdlib.h>

#include <sys/ipc.h>

#include <sys/msg.h>

#include <time.h>

#include <unistd.h>

struct msgbuf {
```

```

    long mtype;

    char mtext[80];

};

static void

usage(char *prog_name, char *msg)
{
    if (msg != NULL)
        fputs(msg, stderr);

    fprintf(stderr, "Usage: %s [options]\n", prog_name);
    fprintf(stderr, "Options are:\n");
    fprintf(stderr, "-s      send message using msgsnd()\n");
    fprintf(stderr, "-r      read message using msgrcv()\n");
    fprintf(stderr, "-t      message type (default is 1)\n");
    fprintf(stderr, "-k      message queue key (default is 1234)\n");
    exit(EXIT_FAILURE);
}

static void

send_msg(int qid, int msgtype)
{
    time_t      t;
    struct msgbuf msg;
    msg.mtype = msgtype;
    time(&t);
    snprintf(msg.mtext, sizeof(msg.mtext), "a message at %s",
             ctime(&t));
    if (msgsnd(qid, &msg, sizeof(msg.mtext),
              IPC_NOWAIT) == -1)
    {
        perror("msgsnd error");
        exit(EXIT_FAILURE);
    }
    printf("sent: %s\n", msg.mtext);
}

```

```

static void
get_msg(int qid, int msgtype)
{
    struct msgbuf msg;

    if (msgrcv(qid, &msg, sizeof(msg.mtext), msgtype,
        MSG_NOERROR | IPC_NOWAIT) == -1) {
        if (errno != ENOMSG) {
            perror("msgrcv");
            exit(EXIT_FAILURE);
        }

        printf("No message available for msgrcv()\n");
    } else {
        printf("message received: %s\n", msg.mtext);
    }
}

int
main(int argc, char *argv[])
{
    int qid, opt;

    int mode = 0;          /* 1 = send, 2 = receive */
    int msgtype = 1;
    int msgkey = 1234;
    while ((opt = getopt(argc, argv, "srt:k:")) != -1) {
        switch (opt) {
            case 's':
                mode = 1;
                break;

            case 'r':
                mode = 2;
                break;

            case 't':
                msgtype = atoi(optarg);

                if (msgtype <= 0)

```

```

        usage(argv[0], "-t option must be greater than 0\n");
    break;
case 'k':
    msgkey = atoi(optarg);
    break;
default:
    usage(argv[0], "Unrecognized option\n");
}
}
if (mode == 0)
    usage(argv[0], "must use either -s or -r option\n");
qid = msgget(msgkey, IPC_CREAT | 0666);
if (qid == -1) {
    perror("msgget");
    exit(EXIT_FAILURE);
}
if (mode == 2)
    get_msg(qid, msgtype);
else
    send_msg(qid, msgtype);
exit(EXIT_SUCCESS);
}

```

SEE ALSO

msgctl(2), msgget(2), capabilities(7), mq_overview(7), sysvipc(7)