



Object REXX for Linux

# REXX TCP/IP Socket Library Functions (RxSock)

*Version 1.2*

**Note!**

Before using this information and the product it supports, be sure to read the general information under "Appendix. Notices" on page 41.

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This edition applies to Version 1.2 of IBM® Object REXX for Linux, and to all subsequent releases and modifications until otherwise indicated in new editions or technical newsletters.

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## Chapter 1. What is RxSock?

**RxSock** is a REXX function package providing access to the TCP/IP socket APIs available to the C programming environment. Most of the functions described in this reference are similar to the corresponding C functions available in the TCP/IP socket library.

It is assumed that you are familiar with the basic socket APIs and can reference those specific to the system. For more information, refer to the book *Internetworking with TCP/IP Volume I: Principals, Protocols, and Architecture* by Douglas Comer (ISBN 0-132-16987-8).

The RxSock package requires TCP/IP support to be active on your system.

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## Chapter 2. Installation and Removal

The RxSock package is contained in the file **rxsock.dll**. This file must be placed in a directory listed in your LIBPATH. To get access to the functions in the RxSock package, execute the following REXX code:

```
rc = RxFuncAdd("SockLoadFuncs","rxsock","SockLoadFuncs")
rc = SockLoadFuncs()
```

To unload the DLL, call the SockDropFuncs() function and then exit all CMD.EXE shells. After exiting all command shells, the DLL is dropped by the system and can be deleted or replaced.

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## Chapter 3. Parameters and Return Values

Unless otherwise stated, the return values are the same as for the corresponding C functions. The following standard parameter types are referred to throughout this reference:

**socket**

is a socket value, which is an integral number.

**domain**

is a domain value. Currently, only the domain "AF\_INET" is supported.

**address**

is the stem of a stem variable with the following values:

**address.family**

must always be "AF\_INET".

**address.port**

is a port number.

**address.addr**

is a dotted decimal address or "INADDR\_ANY", where appropriate.

When this parameter is needed, set it the name of a stem variable for the function to set (or that the function will read from). For example, if you pass the string "xxx.!" as a parameter, the following variables are set or queried by the function:

```
"xxx.!family"  
"xxx.!port"  
"xxx.!addr"
```

A null address is an address with the family field being "AF\_INET", the port field being 0, and the addr field being "0.0.0.0".

**dotAddress**

is the standard dotted decimal address. For example, the string "9.23.19.63" is a valid address.

**host**

is the stem of a stem variable with the following values:

**host.name**

is the standard name of the host.

**host.alias.0**

is the number of aliases for this host.

**host.alias.1**  
is the first alias for this host.

**host.alias.n**  
is the nth alias for this host.

**host.addrtype**  
must always be "AF\_INET".

**host.addr**  
is a dotted decimal address (default address).

**host.addr.0**  
is the number of addresses for this host.

**host.addr.1**  
is the first address for this host.

**host.addr.n**  
is the nth address for this host.

When this parameter is needed, set it the name of a stem variable for the function to set (or that the function will read from). For example, if you pass the string "xxx.!" as a parameter, the following variables are set or queried by the function:

```
"xxx.!name"  
"xxx.!alias.0", "xxx.!alias.1" ... "xxx.!alias.n"  
"xxx.!addrtype"  
"xxx.!addr"  
"xxx.!addr.0", "xxx.!addr.1" ... "xxx.!addr.n"
```

---

## Stem Variables

The address and host type of a parameter are stems of a stem variable. Normally, when you pass a string like "addr." as a parameter, you expect the variables `addr.family`, `addr.port`, and `addr.addr` to be set by the function. In the previous examples, however, the stem contained an exclamation mark. This exclamation mark helps prevent the value that follows from getting misused as a normal variable. Example:

```
port = 923  
sNew = SockAccept(sOld,"addr.")  
say addr.port
```

In this example, you might expect the `say` statement to write the port number of the accepted socket. Instead, it writes the value of the variable, namely `addr.923`, because the port variable is set to this value.

Because exclamation marks are rarely used in variables, it is unlikely that the variable `"!port"` is used in your program.

**Note:** Do not use the characters `_`, `0`, and `1` to prefix tail values. `0` and `1` are difficult to distinguish from `O`, `I`, and `l`.



---

## Chapter 4. Special Variables

The following variables are maintained by the system: *errno* and *h\_errno*.

---

### Variable *errno*

The variable *errno* is set after each RxSock call. It can have one of the following values or any other numeric value:

- "EWOULDBLOCK"
- "EINPROGRESS"
- "EALREADY"
- "ENOTSOCK"
- "EDESTADDRREQ"
- "EMSGSIZE"
- "EPROTOTYPE"
- "ENOPROTOOPT"
- "EPROTONOSUPPORT"
- "ESOCKTNOSUPPORT"
- "EOPNOTSUPP"
- "EPFNOSUPPORT"
- "EAFNOSUPPORT"
- "EADDRINUSE"
- "EADDRNOTAVAIL"
- "ENETDOWN"
- "ENETUNREACH"
- "ENETRESET"
- "ECONNABORTED"
- "ECONNRESET"
- "ENOBUFS"
- "EISCONN"
- "ENOTCONN"
- "ESHUTDOWN"
- "ETOOMANYREFS"
- "ETIMEDOUT"
- "ECONNREFUSED"

- "ELOOP"
- "ENAMETOOLONG"
- "EHOSTDOWN"
- "EHOSTUNREACH"
- "ENOTEMPTY"

**Note:** The value is set even if the function called does not set the variable, in which case the value has no meaning. A value of 0 indicates that no error occurred.

---

## Variable `h_errno`

The variable `h_errno` is set after each `RxSock` call. It can have one of the following values or any other numeric value:

- `HOST_NOT_FOUND`
- `TRY_AGAIN`
- `NO_RECOVERY`
- `NO_ADDRESS`

**Note:** The value is set even if the function called does not set the variable, in which case the value has no meaning. A value of 0 indicates that no error occurred.

---

## Chapter 5. Function Reference

The following sections describe how the individual functions contained in RxSock are invoked from the REXX programming environment:

- SockLoadFuncs
- SockDropFuncs
- SockVersion
- SockAccept
- SockBind
- SockClose
- SockConnect
- SockGetHostByAddr
- SockGetHostByName
- SockGetHostId
- SockGetPeerName
- SockGetSockName
- SockGetSockOpt
- SockInit
- SockIoctl
- SockListen
- SockPSock\_Errno
- SockRecv
- SockRecvFrom
- SockSelect
- SockSend
- SockSendTo
- SockSetSockOpt
- SockShutDown
- SockSock\_Errno
- SockSocket
- SockSoClose

---

## SockLoadFuncs

The SockLoadFuncs() call loads all RxSock functions.

Syntax:

```
SockLoadFuncs([parm])
```

All parameters that you supply are only used to bypass copyright information.

---

## SockDropFuncs

The SockDropFuncs call drops all RxSock functions.

Syntax:

```
SockDropFuncs()
```

To unload the dynamic load library (DLL), first call SockDropFuncs() and then exit all CMD.EXE shells. After exiting all command shells, the DLL is dropped by the system and can be deleted or replaced.

---

## SockVersion

The SockVersion() call provides the version of RxSock.

Syntax:

```
vers = SockVersion()
```

Return Values:

The returned value is in the form *version.subversion*, for example 2.0.

Prior to Version 1.2, this function did not exist. To check if a former version of Rxsock is installed, use the following code after loading the function package with SockDropFuncs():

```
/* oldVersion is 1 if a version of RxSock < 1.2 is loaded */  
oldVersion = (1 = RxFuncQuery("SockVersion"))
```

---

## SockAccept

The SockAccept() call accepts a connection request from a remote host.

Syntax:

```
csocket = SockAccept(socket [, address])
```

where:

*socket*

is the socket descriptor created with the SockSocket() call. It is bound to an address using the SockBind() call and must be enabled to accept connections using the SockListen() call.

*address*

is a stem variable that contains the socket address of the connection client when the SockAccept() call returns. This parameter is optional.

SockAccept() is used by a server in a connection-oriented mode to accept a connection request from a client. The call accepts the first connection on its queue of pending connection requests. It creates a new socket descriptor with the same properties as *socket* and returns it to the caller. This new socket descriptor cannot be used to accept new connections. Only the original *socket* can accept more connection requests.

If the queue has no pending connection requests, SockAccept() blocks the caller unless the socket is in nonblocking mode. If no connection requests are queued and the socket is in nonblocking mode, SockAccept() returns a value of -1 and sets the return code to the value EWOULDBLOCK.

You cannot get information on requesters without calling SockAccept(). The application cannot tell the system from which requesters it will accept connections. The caller can close a connection immediately after identifying the requester.

The SockSelect() call can be used to check the socket for incoming connection requests.

Return values:

A positive value indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code by calling SockSock\_Errno() or SockPSock\_Errno(). Possible values:

### ENOTSOCK

*socket* is not a valid socket descriptor.

**EINTR**

Interrupted system call.

**EINVAL**

SocketListen() was not called for *socket*.

**EOPNOTSUPP**

*socket* is not connection-oriented.

**EWOULDBLOCK**

*socket* is in nonblocking mode and there are no connection requests queued.

**ECONNABORTED**

The software caused a connection close.

**Note:** SocketAccept() interfaces with the C function accept().

---

**SocketBind**

The SocketBind() call binds a local name to the socket.

Syntax:

```
rc = SocketBind(socket, address)
```

where:

*socket*

is the socket descriptor returned by a previous call to SocketSocket().

*address*

is a stem variable containing the address that is to be bound to *socket*.

SocketBind() binds the unique local name *address* to the socket with descriptor *socket*. After calling SocketSocket(), a descriptor does not have a name. However, it belongs to a particular address family that you specified when calling SocketSocket().

Because *socket* was created in the "AF\_INET" domain, the fields of the stem *address* are as follows:

The *family* field must be set to "AF\_INET". The *port* field is set to the port to which the application must bind. If *port* is set to 0, the caller allows the system to assign an available port. The application can call SocketGetSocketName() to discover the port number assigned. The *addr* field is set to the Internet address. On hosts with more than one network interface (called multihomed hosts), a caller can select the interface with which it is to bind.

Only UDP packets and TCP connection requests from this interface that match the bound name are routed to the application. This is important when a server offers a service to several networks. If *addr* is set to "INADDR\_ANY", the caller requests *socket* be bound to all network interfaces on the host. If you do not specify an address, the server can accept all UDP packets and TCP connection requests made to its port, regardless of the network interface on which the requests arrived.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code by calling `SocketErrno()` or `SocketPErrno()`. Possible values:

**EADDRINUSE**

*address* is already in use. See the `SO_REUSEADDR` option described under `SocketGetSockOpt()` and the `SO_REUSEADDR` option described under `SocketSetSockOpt()`.

**EADDRNOTAVAIL**

The address specified is not valid on this host. For example, the Internet address does not specify a valid network interface.

**EAFNOSUPPORT**

The address family is not supported.

**ENOTSOCK**

*socket* is not a valid socket descriptor.

**EINVAL**

*socket* is already bound to an address.

**ENOBUFS**

No buffer space available.

**Note:** `SocketBind()` interfaces with the C function `bind()`.

---

## SocketClose

The `SocketClose()` call shuts down a socket and frees resources allocated to the socket.

Syntax

```
rc = SocketClose(socket)
```

where:

*socket*

is the descriptor of the socket to be closed.

If the `SO_LINGER` option of `SockSetSockOpt()` is enabled, any queued data is sent. If this option is disabled, any queued data is flushed.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code by calling `SockSock_Errno()` or `SockPSock_Errno()`. Possible values are:

**ENOTSOCK**

*socket* is not a valid socket descriptor.

**EALREADY**

The socket *socket* is in nonblocking mode. A previous connection attempt has not completed.

`SockClose()` is exactly the same as `SockSoClose()`.

**Note:** `SockClose()` interfaces with the C function `soclose()` or, in the Windows environments, with `closesocket()`.

---

## SockConnect

The `SockConnect()` socket call requests a connection to a remote host.

Syntax:

```
rc = SockConnect(socket, address)
```

where:

*socket*

is the socket descriptor used to issue the connection request.

*address*

is a stem variable containing the address of the socket to which a connection is to be established.

The `SockConnect()` call performs the following tasks when called for a **stream socket**:

1. It completes the binding for a socket, if necessary.
2. It attempts to create a connection between two sockets.

This call is used by the client side of socket-based applications to establish a connection with a server. The remote server must have a passive open pending, which means it must successfully call `SockBind()` and `SockListen()`. Otherwise, `SockConnect()` returns the value -1 and the error value is set to `ECONNREFUSED`.

In the Internet communication domain, a timeout occurs if a connection to the remote host is not established within 75 seconds.

If the socket is in blocking mode, the `SockConnect()` call blocks the caller until the connection is established or an error is received. If the socket is in nonblocking mode, `SockConnect()` returns the value -1 and sets the error value to `EINPROGRESS` if the connection was successfully initiated. The caller can test the completion of the connection by calling:

- `SockSelect()`, to test for the ability to write to the socket
- `SockGetsockopt()`, with option `SO_ERROR`, to test if the connection was established

Stream sockets can call `SockConnect()` only once.

**Datagram or raw sockets** normally transfer data without being connected to the sender or receiver. However, an application can connect to such a socket by calling `SockConnect()`. `SockConnect()` specifies and stores the destination peer address for the socket. The system then knows to which address to send data and the destination peer address does not have to be specified for each datagram sent. The address is kept until the next `SockConnect()` call. This permits the use of the `SockRecv()` and `SockSend()` calls, which are usually reserved for connection-oriented sockets. However, data is still not necessarily delivered, which means the normal features of sockets using connectionless data transfer are maintained. The application can therefore still use the `SockSendTo()` and `SockRecvFrom()` calls.

Datagram and raw sockets can call `SockConnect()` several times. The application can change their destination address by specifying a new address on the `SockConnect()` call. In addition, the socket can be returned to a connectionless mode by calling `SockConnect()` with a null destination address. The null address is created by setting the stem variable *address* as follows: the *family* field to "AF\_INET", the *port* field to 0, and the *addr* field to "0.0.0.0".

The call to `SockConnect` returns the value -1, indicating that the connection to the null address cannot be established. Calling `SockSock_Errno()` returns the value `EADDRNOTAVAIL`.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code by calling `SockSock_Errno()` or `SockPSock_Errno()`. Possible values are:

**EADDRNOTAVAIL**

The calling host cannot reach the specified destination.

**EAFNOSUPPORT**

The address family is not supported.

**EALREADY**

The socket *socket* is in nonblocking mode. A previous connection attempt has not completed.

**ENOTSOCK**

The socket *socket* is not a valid socket descriptor.

**ECONNREFUSED**

The destination host rejected the connection request.

**EINPROGRESS**

*socket* is in nonblocking mode, and the connection cannot be completed immediately. EINPROGRESS does not indicate an error.

**EINTR**

Interrupted system call.

**EISCONN**

*socket* is already connected.

**ENETUNREACH**

The network cannot be reached from this host.

**ETIMEDOUT**

Establishing the connection timed out.

**ENOBUFS**

There is no buffer space available.

**EOPNOTSUPP**

The operation is not supported on *socket*.

**Note:** SockConnect interfaces with the C function connect().

---

**SockGetHostByAddr**

The SockGetHostByAddr() call retrieves information about a specific host using its address.

Syntax:

```
rc = SockGetHostByAddr(dotAddress, host [, domain])
```

where:

*dotAddress*

is the standard dotted decimal address of the host.

*host*

is a stem variable that is to receive the information on the host.

*domain*

is the domain "AF\_INET". This parameter is optional.

Return values:

The value 1 indicates successful execution of the call. The value 0 indicates an error.

**Note:** SockGetHostByAdress() interfaces with the C function gethostbyaddr().

---

## **SockGetHostByName**

The SockGetHostByName() call retrieves host information on a specific host using its name or any alias.

Syntax:

```
rc = SockGetHostByName(nameAddress, host)
```

where:

*nameAddress*

is the name of a host, for example www.ibm.com.

*host*

is the name of a stem variable to receive the information on the host.

Return values:

The value 1 indicates successful execution of the call. The value 0 indicates an error.

**Note:** SockGetHostByName() interfaces with the C function gethostbyname().

---

## **SockGetHostId**

The SockGetHostId() call retrieves the dotAddress of the local host.

Syntax:

```
dotAddress = SockGetHostId()
```

The return value is the dotAddress of the local host.

**Note:** SockGetHostId() interfaces with the C function gethostid().

---

## SockGetPeerName

The SockGetPeerName() call gets the name of the peer connected to a socket.

Syntax:

```
rc = SockGetPeerName(socket, address)
```

where:

*socket*

is the socket descriptor.

*address*

is a stem variable containing the address of the peer connected to *socket*.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code by calling SockSock\_Errno() or SockPSock\_Errno(). Possible values are:

### ENOTSOCK

*socket* is not a valid socket descriptor.

### ENOTCONN

*socket* is not connected.

### ENOBUFS

There is no buffer space available.

**Note:** SockGetPeerName() interfaces with the C function getpeername().

---

## SockGetSockName

The SockGetSockName() call gets the local socket name.

Syntax:

```
rc = SockGetSockName(socket, address)
```

where:

*socket*

is the socket descriptor.

*address*

is a stem variable that is to receive the address of the socket returned.

SockGetSockName() returns the address for socket *socket* in the stem variable address. If the socket is not bound to an address, the call returns a null address.

The returned null address is a stem variable with the *family* field set to "AF\_INET", the *port* field set to 0, and the *addr* field set to "0.0.0.0".

All sockets are explicitly assigned an address after a successful call to SockBind(). Stream sockets are implicitly assigned an address after a successful call to SockConnect() or SockAccept() if SockBind() was not called.

The SockGetSockName() call is often used to identify the port assigned to a socket after the socket has been implicitly bound to a port. For example, an application can call SockConnect() without previously calling SockBind(). In this case, the SockConnect() call completes the binding necessary by assigning a port to the socket.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code by calling SockSock\_Errno() or SockPSock\_Errno(). Possible values are:

**ENOTSOCK**

*socket* is not a valid socket descriptor.

**ENOBUFS**

There is no buffer space available.

**Note:** SockGetSockName() interfaces with the C function getsockname().

---

## SockGetSockOpt

The SockGetSockOpt() call gets the socket options associated with a socket.

Syntax:

```
rc = SockGetSockOpt(socket, level, optName, optVal)
```

where:

*socket*

is the socket descriptor.

*level*

specifies which option level is queried for the specified *optname*. The only supported level is SOL\_SOCKET.

*optname*

is the name of the specified socket option. Only one option can be specified with a call.

*optval*

is the variable to receive the option values requested. For socket options that are Boolean the option is enabled if *optval* is nonzero and disabled if *optval* is 0.

SocketGetSockOpt() returns the value of a socket option at the socket level. It can be requested for sockets of all domain types. Some options are supported only for specific socket types.

The following options are recognized for SOL\_SOCKET:

#### **SO\_BROADCAST**

returns the information whether datagram sockets are able to broadcast messages. If this option is enabled, the application can send broadcast messages using datagram socket *socket*, if the interface specified in the destination supports broadcasting of packets.

#### **SO\_DEBUG**

returns the information whether debug information can be recorded for a socket.

#### **SO\_DONTROUTE**

returns the information whether the socket is able to bypass the routing of outgoing messages. If this option is enabled, outgoing messages are directed to the network interface specified in the network portion of the destination address. When enabled, packets can only be sent to directly connected networks.

#### **SO\_ERROR**

returns any error pending at the socket and clears the error status. It can be used to check for asynchronous errors at connected datagram sockets or for asynchronous errors that are not explicitly returned by one of the socket calls.

#### **SO\_KEEPALIVE**

returns the information whether stream sockets are able to send keepalive packets. TCP uses a timer called the keepalive timer. This timer monitors idle connections that might have been disconnected because of a peer crash or timeout. If this option is enabled, a keepalive packet is periodically sent to the peer.

This option is mainly used to enable servers to close connections that are no longer active as a result of clients ending connections without properly closing them.

**SO\_LINGER**

returns the information whether stream sockets are able to linger on close if data is present. If this option is enabled and there is data still to be sent when `SocketClose()` is called, the calling application is blocked during the `SocketClose()` call until the data is transmitted or the connection has timed out. If this option is disabled, the `SocketClose()` call returns without blocking the caller while TCP is trying to send the data. Although the data transfer is usually successful, it cannot be guaranteed because TCP tries to send the data only for a specific amount of time.

**SO\_OOBINLINE**

returns the information whether stream sockets are able to receive out-of-band data. If this option is enabled, out-of-band data is placed in the normal data input queue as it is received. It is then made available to `SocketRecv()` and `SocketRecvFrom()` without the `MSG_OOB` flag being specified in those calls. If this option is disabled, out-of-band data is placed in the priority data input queue as it is received. It can then only be made available to `SocketRecv()` and `SocketRecvFrom()` by specifying the `MSG_OOB` flag in those calls.

**SO\_RCVBUF**

returns the buffer size for input.

**SO\_RCVLOWAT**

returns the receive low-water mark.

**SO\_RCVTIMEO**

returns the timeout value for a receive operation.

**SO\_REUSEADDR**

returns the information whether stream and datagram sockets are able to reuse local addresses. If this option is enabled, the local addresses that are already in use can then be bound. This alters the normal algorithm used in the `SocketBind()` call. At connection time, the system checks whether the local addresses and ports differ from foreign addresses and ports. If not, the error value `EADDRINUSE` is returned.

**SO\_SNDBUF**

returns the size of the send buffer.

**SO\_SNDLOWAT**

returns the send low-water mark. This mark is ignored for nonblocking calls and not used in the Internet domain.

**SO\_SNDTIMEO**

returns the timeout value for a send operation.

**SO\_TYPE**

returns the socket type. The integer pointed to by *optval* is then set to one of the following: "STREAM", "DGRAM", "RAW", or "UNKNOWN".

## SO\_USELOOPBACK

bypasses hardware where possible.

All option values are integral except for SO\_LINGER, which contains the following blank-delimited integers:

- The `l_onoff` value. It is set to 0 if the SO\_LINGER option is disabled.
- The `l_linger` value. It specifies the amount of time, in seconds, to be lingered on close. A value of 0 causes `SocketClose()` to wait until disconnection completes.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code by calling `SocketErrno()` or `SocketPSockErrno()`. Possible values are:

## EADDRINUSE

The address is already in use.

## ENOTSOCK

*socket* is not a valid socket descriptor.

## ENOPROTOPT

*optname* or *level* is not recognized.

**Note:** `SocketGetSockOpt()` interfaces with the C function `getsockopt()`.

---

## SocketInit

The `SocketInit()` call initializes the socket data structures and checks whether the TCP/IP network is active.

Syntax:

```
rc = SocketInit()
```

`SocketInit()` can be called at the beginning of each program that uses `SocketSocket()`. However, it is not obligatory because each `RxSocket` function is automatically initialized. For this reason, explicit initialization is not available in all system environments.

Return values:

The value 0 indicates successful execution of the call. The value 1 indicates an error.

**Note:** `SocketInit()` interfaces with the C function `socket_init()`.

---

## SocketIoctl

The SocketIoctl() call performs special operations on the socket.

Syntax:

```
rc = SocketIoctl(socket, ioctlCmd, ioctlData)
```

where:

*socket*

is the socket descriptor.

*ioctlCmd*

is the ioctl command to be performed.

*ioctlData*

is a variable containing data associated with the particular command. Its format depends on the command requested. Valid commands are:

### **FIONBIO**

sets or clears nonblocking input or output for a socket. This command is an integer. If the integer is 0, nonblocking input or output on the socket is cleared. If the integer is a number other than 0, input or output calls do not block until the call is completed.

### **FIONREAD**

gets the number of immediately readable bytes for the socket. This command is an integer.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code SocketErrno() or SocketPSock\_Errno(). Possible values are:

### **ENOTSOCK**

*socket* is not a valid socket descriptor.

### **EINVAL**

The request is not valid or not supported.

### **EOPNOTSUPP**

The operation is not supported on the socket.

**Note:** SocketIoctl() interfaces with the C function ioctl() or, in the Windows environments, with ioctlsocket().

---

## SocketListen

The SocketListen() call completes the binding necessary for a socket to accept connections and creates a connection request queue for incoming requests.

Syntax:

```
rc = SocketListen(socket, backlog)
```

where:

*socket*

is the socket descriptor.

*backlog*

controls the maximum queue length for pending connections.

SocketListen() performs the following tasks:

1. It completes the binding necessary for socket *socket*, if SocketBind() has not been called for the socket.
2. It creates a connection request queue with a length of *backlog* to queue incoming connection requests.

When the queue is full, additional connection requests are ignored.

SocketListen() can only be called for connection-oriented sockets.

SocketListen() is called after allocating a socket with SocketSocket() and after binding a name to *socket* with SocketBind(). It must be called before SocketAccept().

SocketListen() indicates when it is ready to accept client connection requests. It transforms an active socket to a passive socket. After it is called, *socket* cannot be used as an active socket to initiate connection requests.

If *backlog* is smaller than 0, SocketListen() interprets the backlog to be 0. If it is greater than the maximum value defined by the network system, SocketListen() interprets the backlog to be this maximum value.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code SocketSock\_Errno() or SocketPsock\_Errno(). Possible values are:

### **ENOTSOCK**

*socket* is not a valid socket descriptor.

## EOPNOTSUPP

*socket* is not a socket descriptor that supports the SockListen() call.

**Note:** SockListen() interfaces with the C function listen().

---

## SockPSock\_Errno

The SockPSock\_Errno() call writes a short error message to the standard error device. It describes the last error encountered during a call to a socket library function.

Syntax:

```
SockPSock_Errno([error_string])
```

where:

*error\_string*

is the error string written to the standard error device describing the last error encountered. The string printed is followed by a colon, a space, and then the message. If it is omitted or empty, only the message is printed. The string is optional.

The error code is acquired by calling SockSock\_Errno(). It is set when errors occur. Subsequent socket calls do not clear the error code.

**Note:** SockPSock\_Errno() interfaces with the C function psock\_errno().

---

## SockRecv

The SockRecv() call receives data on a connected socket.

Syntax:

```
rc = SockRecv(socket, var, len[, flags])
```

where:

*socket*

is the socket descriptor.

*var*

is the name of a REXX variable to receive the data.

*len* is the maximum amount of data to be read.

*flags*

is a blank-delimited list of options:

**MSG\_OOB**

reads any out-of-band data on the socket.

**MSG\_PEEK**

peeks at the data on the socket. The data is returned but not removed, so the subsequent receive operation sees the same data.

SocketRecv() receives data on a socket with descriptor *socket* and stores it in the REXX variable *var*. It applies only to connected sockets. For information on how to use SocketRecv() with datagram and raw sockets, see Datagram or raw sockets.

SocketRecv() returns the length of the incoming data. If a datagram is too long to fit the buffer, the excessive data is discarded. No data is discarded for stream sockets. If data is not available at *socket*, the SocketRecv() call waits for a message and blocks the caller unless the socket is in nonblocking mode. See SocketIoctl() for a description of how to set the nonblocking mode.

Return values:

If successful, the length of the data in bytes is returned. The value 0 indicates that the connection is closed. The value -1 indicates an error. You can get the specific error code SocketErrno() or SocketPSock\_Errno(). Possible values are:

**ENOTSOCK**

*socket* is not a valid socket descriptor.

**EINTR**

Interrupted system call.

**EINVAL**

Invalid argument.

**EWOULDBLOCK**

*socket* is in nonblocking mode and no data is available, or the SO\_RCVTIMEO option has been set for *socket* and the timeout expired before any data arrived.

**Note:** SocketRecv() interfaces to the C function recv().

---

## SockRecvFrom

The SockRecvFrom() call receives data on a socket.

Syntax:

```
rc = SockRecvFrom(socket, var, len[, flags], address)
```

where:

*socket*

is the socket descriptor.

*var*

is the name of a REXX variable to receive the data.

*len* is the maximum amount of data to be read.

*flags*

is a blank delimited list of options:

**MSG\_OOB**

reads any out-of-band data on the socket.

**MSG\_PEEK**

peeks at the data present on the socket. The data is returned but not consumed. The subsequent receive operation thus sees the same data.

*address*

is a stem variable specifying the address of the sender from which the data is received, unless it is a null address.

SockRecvFrom() receives data on a socket with descriptor *socket* and stores it in a REXX variable named *var*. It applies to any socket type, whether connected or not.

SockRecvFrom() returns the length of the incoming message or data. If a datagram is too long to fit the supplied buffer, the excessive data is discarded. No data is discarded for stream sockets. If data is not available at *socket*, the SockRecvFrom() call waits for a message to arrive and blocks the caller, unless the socket is in nonblocking mode. See SockIoctl() for a description of how to set the nonblocking mode.

Return values:

If successful, the length of the data in bytes is returned. The value -1 indicates an error. You can get the specific error code SockSock\_Errno() or SockPSock\_Errno(). Possible values are:

**ENOTSOCK**

*socket* is not a valid socket descriptor.

**EINVAL**

Invalid argument.

**EWOULDBLOCK**

*socket* is in nonblocking mode, no data is available, or the SO\_RCVTIMEO option has been set for *socket* and the timeout expired before data arrived.

**Note:** SockRecvFrom() interfaces with the C function recvfrom().

---

**SockSelect**

The SockSelect() call monitors the activity on a socket with regard to readability, readiness for writing, and pending exceptional conditions.

Syntax:

```
rc = SockSelect(reads, writes, excepts[, timeout])
```

where:

*reads*

is the number of sockets to be checked for readability.

*writes*

is the number of sockets to be checked for readiness for writing.

*excepts*

is the number of sockets to be checked for pending exceptional conditions. For Network Services sockets, the only pending exceptional condition is out-of-band data in the receive buffer.

*timeout*

is the maximum number of seconds the system waits for the selection to complete.

Each parameter specifying a number of sockets is qualified by a stem variable which is queried and set by this function. The stem variable has the following format: stem.0 contains the number of sockets, stem.1 the first socket, and so on. Upon return, the stem variables are reset to the sockets that are ready. If any of the stem variables are empty (""), or no parameter is passed, no sockets for that type are checked.

The timeout value must be integral (no fractional values). Nonnumeric and negative numbers are considered to be 0. If no timeout value is passed, an empty string ("") is assumed.

If the timeout value is 0, `SockSelect()` does not wait before returning. If the timeout value is an empty string (`""`), `SockSelect()` does not time out, but returns when a socket becomes ready. If the timeout value is in seconds, `SockSelect()` waits for the specified interval before returning. It checks all indicated sockets at the same time and returns as soon as one of them is ready.

Return values:

The number of ready sockets is returned. The value 0 indicates an expired time limit. In this case, the stem variables are not modified. The value -1 indicates an error. You can get the specific error code `SockSock_Errno()` or `SockPsock_Errno()`. Possible values are:

**ENOTSOCK**

*socket* is not a valid socket descriptor.

**EFAULT**

The address is not valid.

**EINVAL**

Invalid argument.

**EINTR**

Interrupted system call.

Examples:

```
r.0 = 2          /* specify 2 sockets for read in stem r. */
r.1 = 101
r.2 = 102

                /* specify 1 socket for write in stem w. */
w.0 = 1
w.1 = 103

                /* no sockets for exceptions in stem e. */
e.0 = 0
rc = SockSelect("r.", "w.", "e.")

do i = 1 to r.0      /* display sockets ready for read      */
  say "socket" r.i "is ready for reading."
end
```

That `SockSelect()` call can be invoked as:

```
rc = SockSelect("r.", "w.", "")
```

or

```
rc = SockSelect("r.", "w.", )
```

The function call `SockSelect(, , , x)` results in the program pausing for *x* seconds.

**Note:** SockSelect() interfaces with the C function select().

---

## SockSend

The SockSend() call sends data to a connected socket.

Syntax:

```
rc = SockSend(socket, data[, flags])
```

where:

*socket*

is the socket descriptor.

*data*

is the name of a REXX variable containing the data to be transmitted.

*flags*

is a blank delimited list of options:

**MSG\_OOB**

sends out-of-band data to sockets that support SOCK\_STREAM communication.

**MSG\_DONTROUTE**

turns on the SO\_DONTROUTE option for the duration of the send operation. This option is usually only used by diagnostic or routing programs.

SockSend() sends data to a connected socket with descriptor *socket*. For information on how to use SockSend() with datagram and raw sockets, see Datagram or raw sockets.

If the socket does not have enough buffer space to hold the data to be sent, the SockSend() call blocks unless the socket is placed in nonblocking mode. See SockIoctl() for a description of how to set the nonblocking mode. Use the SockSelect() call to determine when it is possible to send more data.

Return values:

If successful, the number of bytes of the socket with descriptor *socket* that is added to the send buffer is returned. Successful completion does not imply that the data has already been delivered to the receiver.

The return value -1 indicates that an error was detected on the sending side of the connection. You can get the specific error code SockSock\_Errno() or SockPSock\_Errno(). Possible values are:

**ENOTSOCK**

*socket* is not a valid socket descriptor.

**EINTR**

Interrupted system call.

**EINVAL**

Invalid argument.

**ENOBUFS**

There is no buffer space available to send the message.

**EWOULDBLOCK**

*socket* is in nonblocking mode, the data cannot be sent without blocking, or the SO\_SNDTIMEO option has been set for *socket* and the timeout expired before any data was sent.

**Note:** SockSend() interfaces with the C function send().

---

**SockSendTo**

The SockSendTo() call sends data to a connected or unconnected socket.

Syntax:

```
rc = SockSendTo(socket, data[, flags], address)
```

where:

*socket*

is the socket descriptor.

*data*

is a string of data to be transmitted.

*flags*

is a blank delimited list of options:

**MSG\_OOB**

sends out-of-band data to sockets that support SOCK\_STREAM communication.

**MSG\_DONTROUTE**

turns on the SO\_DONTROUTE option for the duration of the send operation. This option is usually only used by diagnostic or routing programs.

*address*

is a stem variable containing the destination address.

SocketSendTo() sends data to a connected or unconnected socket with descriptor *socket*. For unconnected datagram and raw sockets, it sends data to the specified destination address. For stream sockets, the destination address is ignored.

Datagram sockets are connected by calling SocketConnect(). This call identifies the peer to send or receive the datagram. After a datagram socket is connected to a peer, you can still use the SocketSendTo() call but you cannot include a destination address.

To change the peer address when using connected datagram sockets, issue SocketConnect() with a null address. Specifying a null address removes the peer address specification. You can then issue either a SocketSendTo() call and specify a different destination address or a SocketConnect() call to connect to a different peer. For more information on connecting datagram sockets and specifying null addresses, see Datagram or raw sockets.

Return values:

If successful, the number of bytes sent is returned. Successful completion does not guarantee that the data is delivered to the receiver. The return value -1 indicates that an error was detected on the sending side. You can get the specific error code SocketErrno() or SocketPSocketErrno(). Possible values are:

**ENOTSOCK**

*socket* is not a valid socket descriptor.

**EMSGSIZE**

The message *data* was too big to be sent as a single datagram.

**ENOBUFS**

There is no buffer space available to send the message.

**EWouldBlock**

*socket* is in nonblocking mode, the data cannot be sent without blocking, or the SO\_SNDTIMEO option has been set for *socket* and the timeout expired before any data was sent.

**ENOTCONN**

The socket is not connected.

**EDESTADDRREQ**

Destination address required.

**Note:** SocketSendTo() interfaces with the C function sendto().

---

## SocketSetSocketOpt

The SocketSetSocketOpt() call sets options associated with a socket.

Syntax:

```
rc = SocketSetSocketOpt(socket, level, optName, optVal)
```

where:

*socket*

is the socket descriptor.

*level*

specifies which option level is set. The only supported level is SOL\_SOCKET.

*optname*

is the name of a specified socket option.

*optval*

is the variable containing the data needed by the set command. It is optional.

SocketSetSocketOpt() sets options associated with a socket with descriptor *socket* such as enabling debugging at the socket or protocol level, controlling timeouts, or permitting socket data broadcasting. Options can exist at the socket or the protocol level. They are always present at the highest socket level. When setting socket options, the option level and name must be specified.

For socket options that are toggles, the option is enabled if *optval* is nonzero and disabled if *optval* is 0.

The following options are recognized for SOL\_SOCKET:

### SO\_BROADCAST

enables datagram sockets to broadcast messages. The application can then send broadcast messages using datagram socket *socket*, if the interface specified in the destination supports broadcasting of packets.

### SO\_DEBUG

enables debug information to be recorded for a socket.

### SO\_DONTROUTE

enables the socket to bypass the routing of outgoing messages. Outgoing messages are then directed to the network interface specified in the network portion of the destination address. When enabled, packets can only be sent to directly connected networks.

**SO\_KEEPALIVE**

enables stream sockets to send keepalive packets, which keep the connection alive. TCP uses a timer called the keepalive timer. This timer monitors idle connections that might have been disconnected because of a peer crash or timeout. If this option is enabled, a keepalive packet is periodically sent to the peer.

This option is mainly used to enable servers to close connections that are no longer active as a result of clients ending connections without properly closing them.

**SO\_LINGER**

enables stream sockets to linger on close if data is present. If this option is enabled and there is data still to be sent when `SockSoClose()` is called, the calling application is blocked during the `SockSoClose()` call until the data is transmitted or the connection has timed out. If this option is disabled, the `SockSoClose()` call returns without blocking the caller while TCP is trying to send the data. Although the data transfer is usually successful, it cannot be guaranteed because TCP tries to send the data only for a specific amount of time.

**SO\_OOBINLINE**

enables stream sockets to receive out-of-band data, which is a logically separate data path using the same connection as the normal data path. If this option is enabled, out-of-band data is placed in the normal data input queue as it is received. It is then made available to `SockRecv()` and `SockRecvFrom()` without the `MSG_OOB` flag being specified in those calls. If this option is disabled, out-of-band data is placed in the priority data input queue as it is received. It can then only be made available to `SockRecv()` and `SockRecvFrom()` by specifying the `MSG_OOB` flag in those calls.

**SO\_RCVBUF**

sets the buffer size for input. This option sets the size of the receive buffer to the value contained in the buffer pointed to by *optval*. In this way, the buffer size can be tailored for specific application needs, such as increasing the buffer size for high-volume connections.

**SO\_RCVLOWAT**

sets the receive low-water mark.

**SO\_RCVTIMEO**

sets the timeout value for a receive operation.

**SO\_REUSEADDR**

enables stream and datagram sockets to reuse local addresses. Local addresses that are already in use can then be bound. This alters the normal algorithm used in the `SockBind()` call. At connection time, the

system checks whether the local addresses and ports differ from foreign addresses and ports. If not, the error value EADDRINUSE is returned.

#### **SO\_SNDBUF**

Sets the buffer size for output. This option sets the size of the send buffer to the value contained in the buffer pointed to by *optval*. In this way, the send buffer size can be tailored for specific application needs, such as increasing the buffer size for high-volume connections.

#### **SO\_SNDLOWAT**

sets the send low-water mark. This mark is ignored for nonblocking calls and not used in the Internet domain.

#### **SO\_SNDTIMEO**

sets the timeout value for a send operation.

#### **SO\_USELOOPBACK**

bypasses hardware where possible.

Except for SO\_LINGER, all values are integral. SO\_LINGER expects two blank delimited integers:

1. The `l_onoff` value. It is set to 0 if the SO\_LINGER option is disabled.
2. the `l_linger` value. The `l_linger` field specifies the amount of time, in seconds, to be lingered on close. A value of 0 causes `SocketClose()` to wait until disconnection completes.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code `SocketErrno()` or `SocketSockErrno()`. Possible values are:

#### **EADDRINUSE**

The address is already in use.

#### **ENOTSOCK**

*socket* is not a valid socket descriptor.

#### **ENOPROTOPT**

*optname* is not recognized.

#### **EINVAL**

Invalid argument.

#### **ENOBUFS**

There is no buffer space available.

**Note:** `SocketSetSockOpt()` interfaces with the C function `setsockopt()`.

---

## SocketShutdown

The SocketShutdown() call shuts down all, or part, of a full duplex connection. This call is optional.

Syntax:

```
rc = SocketShutdown(socket, howto)
```

where:

*socket*

is the socket descriptor.

*howto*

is the condition of the shutdown of socket *socket*.

Because data flows in different directions are independent of each other, SocketShutdown() allows you to independently stop data flows in one direction, or all data flows, with one API call. For example, you can enable yourself to send data but disable other senders to send data to you.

The *howto* parameter sets the condition for shutting down the connection to socket *socket*. It can be set to one of the following:

- 0 No more data can be received on socket *socket*.
- 1 No more output is allowed on socket *socket*.
- 2 No more data can be sent or received on socket *socket*.

Return values:

The value 0 indicates successful execution of the call. The value -1 indicates an error. You can get the specific error code SocketErrno() or SocketPSock\_Errno(). Possible values are:

### **ENOTSOCK**

*socket* is not a valid socket descriptor.

### **EINVAL**

*howto* was not set to a valid value.

**Note:** SocketShutdown() interfaces with the C function shutdown().

---

## Socket\_Errno

The `Socket_Errno()` call returns the last error code set by a socket call. Subsequent socket API calls do not reset this error code.

Syntax:

```
errno = Socket_Errno()
```

**Note:** `Socket_Errno()` interfaces with the C function `sock_errno()`.

---

## Socket

The `Socket()` call creates an end point for communication and returns a socket descriptor representing the end point. Each socket type provides a different communication service.

Syntax:

```
socket = Socket(domain, type, protocol)
```

where:

*domain*

is the communication domain requested. It specifies the protocol family to be used. Currently, only the domain "AF\_INET" is supported, which uses addresses in the Internet address format.

*type*

is the type of socket created. The following types are supported:

### SOCK\_STREAM

provides sequenced, two-way byte streams that are reliable and connection-oriented. It supports a mechanism for out-of-band data. Stream sockets are supported by the Internet ("AF\_INET") communication domain.

### SOCK\_DGRAM

provides datagrams, which are connectionless messages of a fixed length whose reliability is not guaranteed. Datagrams can be received out of order, lost, or delivered several times. Datagram sockets are supported by the Internet ("AF\_INET") communication domain.

### SOCK\_RAW

provides the interface to internal protocols, such as IP and ICMP. Raw sockets are supported by the Internet ("AF\_INET") communication domain.

*protocol*

is the protocol to be used with the socket. It can be "IPPROTO\_UDP", "IPPROTO\_TCP", or "0". If it is set to 0, which is the default, the system selects the default protocol number for the domain and socket type requested.

Sockets are deallocated with the SockClose() call.

Return values:

A non-negative socket descriptor return value indicates successful execution of the call. The return value -1 indicates an error. You can get the specific error code SockSock\_Errno() or SockPSock\_Errno(). Possible values are:

**EMFILE**

The maximum number of sockets are currently in use.

**EPROTONOSUPPORT**

The protocol is not supported in the specified domain or the protocol is not supported for the specified socket type.

**EPFNOSUPPORT**

The protocol family is not supported.

**ESOCKTNOSUPPORT**

The socket type is not supported.

**Note:** SockSocket() interfaces with the C function socket().

---

## **SockSoClose**

The SockSoClose() call shuts down a socket and frees resources allocated to the socket.

Syntax:

```
rc = SockSoClose(socket)
```

where:

*socket*

is the socket descriptor of the socket to be closed.

This function is identical to SockClose().

---

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