

MicroGlyph/SciSnet™

A Computer Sockets Communication Library

Programming Reference Manual

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PREFACE

This programming reference manual provides technical information for Fortran programming development using the SciSnet sockets communication library. SciSnet supports PC compatible computers with network controllers under Microsoft Windows operating systems. SciSnet supports up to 100 network connections with overlapped input/output messaging. Transfer rates are dependent on the network connectivity provided. SciSnet applications can be created and execute under Microsoft Windows operating systems as Windows based applications. The SciSnet library is available in versions that are compatible with a wide variety of Fortran compilers. This distribution includes the SciSnet sockets communication library with a reference manual, an example source program, and a help file.

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Chapter 1

Introduction

SciSnet provides a Fortran TCP/IP based sockets communications library. SciSnet functions provide two way machine-to-machine communications over network interfaces. SciSnet utilizes the Windows sockets API that maintains separate input and output streams, and allows parallel asynchronous two-way machine-to-machine communications with TCP/IP data integrity. This guarantees the order of the messages and the integrity of every bit.

1.1 General Information

SciSnet was designed for high speed machine-to-machine data transfers. Two data transfer threads are used to receive and send data messages between two communicating machines. The NETSND SciSnet function queues a data message to be transmitted. The data transfer thread handles immediate transfer of the queued message. The input data thread queues input messages to be retrieved later by the NETREC SciSnet function. Basically, an application can set up a send and receive node on one machine, and a send and receive node on another. One machine can acquire hardware sensor or otherwise gathered information, and send this information to the other SciSnet connected machine. This allows transfer of data at very high rates in an automated way.

1.2 System Requirements

SciSnet was designed for PC compatible computers using Microsoft Windows operating systems with the Windows sockets API and network support for TCP/IP. TCP/IP must be installed and configured with local area networks, and/or the Internet. Name lookup must be enabled and be available.

Chapter 2

Communication Environment

Before communication can take place between two machines, a network server (NETSRV) must be initialized on each machine. The Windows operating system will then perform the communication task between the two systems. The operating system determines if the socket is available and connected. SciSnet provides the capability to connect to these two machines through the use of the NETOPN routine. Sockets can be disconnected by using the NETCLS routine. At the time the socket is opened by NETOPN, the communication parameters and buffering protocol are set for the connection period.

Chapter 3

Programming Reference

This program reference section provides the basic information necessary for a Fortran user to write application programs that will use sockets communication functions provided by the SciSnet library. The various subsections provide all the communication functions representative of a complete communication system. Routines to open and close communication sockets, flush buffers, report on sockets status, and do the network communication are included in the SciSnet communication library.

3.1 Communication Library

SciSnet routines are release in two forms. There is the SCNLIB.LIB static library that can be linked with the application to produce an executable file. There is also the SCNIMP.LIB import library which is used with the SCNDLL.DLL dynamic link library to dynamically link an application to produce an executable file. The executable produced by linking to the DLL is usually smaller in the amount of disk space used. The user should consult the Fortran user's manual released by the compiler manufacturer for the exact format of the options that will compile and link the application. The RUN.BAT and README.TXT files in this release contain such rudimentary information.

3.2 Communication Functions

SciSnet communication routines are contained in the SCNLIB.LIB and SCNDLL.DLL libraries created by the library manager facility. This assures compatibility with the Fortran compiler object files and the linking loader that should be used to create and link the application Fortran programs to be executed. The user should consult the Fortran user's manual for the exact format of the Fortran language command that will compile the application programs. There is usually an integrated development environment (IDE) also provided by the compiler manufacturer. The following sections describe the network communication functions and their Fortran calling sequences.

3.2.1 NETOPN

Purpose: - This function is used to open of a network connection between a local machine and another machine on the network. A search for the remote host name is made. Upon successful lookup, the network connection is made and the specified options are set in the SciSnet control structure.

Fortran Calling Sequence:

```
CALL NETOPN(NETID,RNAME,RPORT,CODE,RTIME,CTIME,STATUS)
```

Where:

NETID	- Network connection ID 1 thru 100	(input integer)
RNAME	- Remote host name [128 chrs max]	(input character)
RPORT	- Remote host receive port Valid range 0 to 65535	(input integer)
CODE	- Option code 0 = None 1 = Use timestamp with output messages 2 = Use timeout value receiving input messages	(input integer)
RTIME	- Receive wait timeout (ms)	(input integer)
CTIME	- Connect wait timeout (ms)	(input integer)
STATUS	- Returned status 0 = Normal return 1 = Connection already open 2 = Invalid arguments 3 = Local server not running 4 = Remote host not found	(output integer)

Notes:

1. NETOPN establishes a network connection between two network connected machines. Up to 100 connections can be established at any one time.
2. The remote host receive port is an agreed upon number that is used by NETSRV on each machine in a connection pair as the local host receive port.
3. The NETSRV function must be called before attempting to call the NETOPN function.
4. To change the options established by NETOPN, it is necessary to call NETCLS first (if a network connection is open), before calling NETOPN again.

Error Conditions:

1. See STATUS parameter definition for all error codes.

Program Example:

```
PROGRAM TNETOPN
!   SciSnet interface definition
```

```

USE SCNINF
IMPLICIT NONE

!   Variables Definitions

INTEGER(4) :: NETID, LPORT, RPORT, RLEN, SLEN, CODE, RTIME,
+   CTIME, STATUS, I
CHARACTER(1), DIMENSION(9) :: RNAME = ('w', 'i', 'n', '2', '0', '0',
+   '0', 'a', ' ')

!*****!
!                                           !
!   Initialize Network servers and connections   !
!                                           !
!*****!

!   Start up the network server threads

CODE   = 1
LPORT  = 8001
RLEN   = 1440
SLEN   = 1440
CALL NETSRV(CODE, LPORT, RLEN, SLEN, STATUS)
IF (STATUS.NE.0) THEN
    WRITE(6,100)CODE, LPORT, RLEN, SLEN, STATUS
END IF

!   Open a network socket

NETID  = 1
RNAME(9:9) = CHAR(0)
RPORT  = 8001
CODE   = 0
RTIME  = 0
CTIME  = 0
CALL NETOPN(NETID, RNAME, RPORT, CODE, RTIME, CTIME, STATUS)
IF (STATUS.NE.0) THEN
    WRITE(6,101)NETID, (RNAME(I), I=1,9), RPORT, CODE, RTIME, CTIME,
+   STATUS
END IF

!*****!
!                                           !
!   Close down Network servers and connections   !
!                                           !
!*****!

!   Close down the network connection

code = 2
CALL NETCLS(NETID, CODE, STATUS)
IF (STATUS.NE.0) THEN
    WRITE(6,102)NETID, CODE, STATUS
END IF

!   Stop the network server threads

CODE   = 2
CALL NETSRV(CODE, LPORT, RLEN, SLEN, STATUS)
IF (STATUS.NE.0) THEN
    WRITE(6,100)CODE, LPORT, RLEN, SLEN, STATUS
END IF

!   Stop execution

STOP

!   Format Statements

100 FORMAT(' *** Errors: (NETSRV) *** ',/,

```

```

+      \ CODE   = \,I10,,
+      \ LPORT  = \,I10,,
+      \ RLEN   = \,I10,,
+      \ SLEN   = \,I10,,
+      \ STATUS = \,I10)
101  FORMAT(\ *** Errors: (NETOPN) *** \,/,
+      \ NETID  = \,I10,,
+      \ RNAME  = \,9A1,,
+      \ RPORT  = \,I10,,
+      \ CODE   = \,I10,,
+      \ RTIME  = \,I10,,
+      \ CTIME  = \,I10,,
+      \ STATUS = \,I10)
102  FORMAT(\ *** Errors: (NETCLS) *** \,/,
+      \ NETID  = \,I10,,
+      \ CODE   = \,I10,,
+      \ STATUS = \,I10)

      END PROGRAM TNETOPN

```

Example 3.1 – NETOPN Program Example

3.2.2 NETCLS

Purpose: - This function is used to close a network connection between a local machine and another machine on the network. Upon successful completion, the network connection is closed and the SciSnet control structure is reset to initial conditions. No other functions will operate with the network connection unless NETOPN is again called to re-establish a new network connection.

Fortran Calling Sequence:

```
CALL NETCLS(NETID, CODE, STATUS)
```

Where:

NETID	- Network connection ID	(input integer)
	1 thru 100	
CODE	- Function code	(input integer)
	1 = Purge all messages	
	2 = Wait for outgoing messages	
STATUS	- Returned status	(output integer)
	0 = Normal return	
	1 = Connection not open	
	2 = Invalid arguments	

Notes:

1. NETCLS closes the connection between the local machine and another machine on the network. No further communication is possible for the specified network connection after NETCLS has been called.

Error Conditions:

1. See STATUS parameter definition for all error codes.

Program Example:

```

PROGRAM TNETCLS

!   SciSnet interface definition

USE SCNINF
IMPLICIT NONE

!   Variables Definitions

INTEGER(4) :: NETID, LPORT, RPORT, RLEN, SLEN, CODE, RTIME,
+   CTIME, STATUS, I
CHARACTER(1),DIMENSION(9) :: RNAME = (/ 'w', 'i', 'n', '2', '0', '0',
+   '0', 'a', ' ' /)

!*****!
!
!   Initialize Network servers and connections
!
!*****!

!   Start up the network server threads

CODE = 1
LPORT = 8001
RLEN = 1440
SLEN = 1440
CALL NETSRV(CODE, LPORT, RLEN, SLEN, STATUS)
IF (STATUS.NE.0) THEN
    WRITE(6,100) CODE, LPORT, RLEN, SLEN, STATUS
END IF

!   Open a network socket

NETID = 1
RNAME(9:9) = CHAR(0)
RPORT = 8001
CODE = 0
RTIME = 0
CTIME = 0
CALL NETOPN(NETID, RNAME, RPORT, CODE, RTIME, CTIME, STATUS)
IF (STATUS.NE.0) THEN
    WRITE(6,101) NETID, (RNAME(I), I=1, 9), RPORT, CODE, RTIME, CTIME,
+   STATUS
END IF

!*****!
!
!   Close down Network servers and connections
!
!*****!

!   Close down the network connection

code = 2

```

```

CALL NETCLS(NETID, CODE, STATUS)
IF (STATUS.NE.0) THEN
  WRITE(6,102)NETID, CODE, STATUS
END IF

! Stop the network server threads

CODE = 2
CALL NETSRV(CODE, LPORT, RLEN, SLEN, STATUS)
IF (STATUS.NE.0) THEN
  WRITE(6,100)CODE, LPORT, RLEN, SLEN, STATUS
END IF

! Stop execution

STOP

! Format Statements

100 FORMAT(' *** Errors: (NETSRV) *** ',/,
+ ' CODE = ',I10,/,
+ ' LPORT = ',I10,/,
+ ' RLEN = ',I10,/,
+ ' SLEN = ',I10,/,
+ ' STATUS = ',I10)
101 FORMAT(' *** Errors: (NETOPN) *** ',/,
+ ' NETID = ',I10,/,
+ ' RNAME = ',9A1,/,
+ ' RPORT = ',I10,/,
+ ' CODE = ',I10,/,
+ ' RTIME = ',I10,/,
+ ' CTIME = ',I10,/,
+ ' STATUS = ',I10)
102 FORMAT(' *** Errors: (NETCLS) *** ',/,
+ ' NETID = ',I10,/,
+ ' CODE = ',I10,/,
+ ' STATUS = ',I10)

END PROGRAM TNETCLS

```

Example 3.2 – NETCLS Program Example

3.2.3 NETSTS

Purpose: - This function is used to get network connection status. It returns the current counters and error status from the SciSnet control structure.

Fortran Calling Sequence:

```

CALL NETSTS(NETID, LNAME, LADDR, RNAME, RADDR, NRMSG, NSMSG,
            NRCNT, NSCNT, NRERR, NSERR, RERR, SERR, STATUS)

```

Where:

- NETID - Network connection ID (input integer)
- 1 thru 100

LNAME	- Local host name [128 chrs]	(output character)
LADDR	- Local host ip address [128 chrs]	(output character)
RNAME	- Remote host name [128 chrs]	(output character)
RADDR	- Remote host ip address [128 chrs]	(output character)
NRMSG	- Number of receive messages	(output integer)
NSMSG	- Number of send messages	(output integer)
NRCNT	- Number bytes receive messages	(output integer)
NSCNT	- Number bytes send messages	(output integer)
NRERR	- Number receive message errors	(output integer)
NSERR	- Number send message errors	(output integer)
RERR	- Receive message error	(output integer)
SERR	- Send message error	(output integer)
STATUS	- Returned status	(output integer)

0 = Normal return
 1 = Connection not open
 2 = Invalid arguments
 3 = Transmission errors detected

Notes:

1. The number of receive messages or the receive messages total byte count indicate when the message stream has arrived and can be read using the NETREC function.

Error Conditions:

1. See STATUS parameter definition for all error codes.

Program Example:

```

PROGRAM TNETSTS
!   SciSnet interface definition
USE SCNINF
IMPLICIT NONE

```

```

!      Variables Definitions

      INTEGER(4) :: NETID, LPORT, RPORT, RLEN, SLEN, CODE, RTIME,
+      CTIME, STATUS, I, NRMSG, NSMSG, NRCNT, NSCNT, NRERR, NSERR,
+      RERR, SERR
      CHARACTER(1), DIMENSION(9) :: NAME = ('w', 'i', 'n', '2', '0', '0',
+      '0', 'a', ' ')
      CHARACTER(1), DIMENSION(128) :: RNAME, RADDR, LNAME, LADDR

!*****!
!      Initialize Network servers and connections      !
!*****!

!      Start up the network server threads

      CODE = 1
      LPORT = 8001
      RLEN = 1440
      SLEN = 1440
      CALL NETSRV(CODE, LPORT, RLEN, SLEN, STATUS)
      IF (STATUS.NE.0) THEN
         WRITE(6,100) CODE, LPORT, RLEN, SLEN, STATUS
      END IF

!      Open a network socket

      NETID = 1
      NAME(9:9) = CHAR(0)
      RPORT = 8001
      CODE = 0
      RTIME = 0
      CTIME = 0
      CALL NETOPN(NETID, NAME, RPORT, CODE, RTIME, CTIME, STATUS)
      IF (STATUS.NE.0) THEN
         WRITE(6,101) NETID, (NAME(I), I=1, 9), RPORT, CODE, RTIME, CTIME,
+      STATUS
      END IF

!*****!
!      Get Network connection status      !
!*****!

      CALL NETSTS(NETID, LNAME, LADDR, RNAME, RADDR, NRMSG, NSMSG,
+      NRCNT, NSCNT, NRERR, NSERR, RERR, SERR, STATUS)
      WRITE(6,102) NETID, (LNAME(I), I=1, 40), (LADDR(I), I=1, 40),
+      (RNAME(I), I=1, 40), (RADDR(I), I=1, 40),
+      NRMSG, NSMSG, NRCNT, NSCNT, NRERR, NSERR,
+      RERR, SERR, STATUS

!*****!
!      Close down Network servers and connections      !
!*****!

!      Close down the network connection

      code = 2
      CALL NETCLS(NETID, CODE, STATUS)
      IF (STATUS.NE.0) THEN
         WRITE(6,102) NETID, CODE, STATUS
      END IF

!      Stop the network server threads

      CODE = 2
      CALL NETSRV(CODE, LPORT, RLEN, SLEN, STATUS)

```

```

        IF (STATUS.NE.0) THEN
            WRITE(6,100)CODE,LPORT,RLEN,SLEN,STATUS
        END IF

!      Stop execution

        STOP

!      Format Statements

100  FORMAT(\ *** Errors: (NETSRV) *** \,/,
+       \ CODE   = \,I10,/,
+       \ LPORT  = \,I10,/,
+       \ RLEN   = \,I10,/,
+       \ SLEN   = \,I10,/,
+       \ STATUS = \,I10)
101  FORMAT(\ *** Errors: (NETOPN) *** \,/,
+       \ NETID  = \,I10,/,
+       \ RNAME  = \,9A1,/,
+       \ RPORT  = \,I10,/,
+       \ CODE   = \,I10,/,
+       \ RTIME  = \,I10,/,
+       \ CTIME  = \,I10,/,
+       \ STATUS = \,I10)
102  FORMAT(\ *** Errors: (NETOPN) *** \,/,
+       \ NETID  = \,I10,/,
+       \ LNAME  = \,40A1,/,
+       \ LADDR  = \,40A1,/,
+       \ RNAME  = \,40A1,/,
+       \ RADDR  = \,40A1,/,
+       \ RPORT  = \,I10,/,
+       \ NRMSG  = \,I10,/,
+       \ NSMSG  = \,I10,/,
+       \ NRCNT  = \,I10,/,
+       \ NSCNT  = \,I10,/,
+       \ NRERR  = \,I10,/,
+       \ NSERR  = \,I10,/,
+       \ RERR   = \,I10,/,
+       \ SERR   = \,I10,/,
+       \ STATUS = \,I10)
103  FORMAT(\ *** Errors: (NETCLS) *** \,/,
+       \ NETID  = \,I10,/,
+       \ CODE   = \,I10,/,
+       \ STATUS = \,I10)

        END PROGRAM TNETSTS

```

Example 3.3 – NETSTS Program Example

3.2.4 NETSRV

Purpose - This function is used to bring up the SciSnet servers on a local machine. It is the first function to call when initiating network socket communication, and it is the last function to call when terminating network socket communication.

Fortran Calling Sequence:

```
CALL NETSRV(CODE,LPORT,RLEN,SLEN,STATUS)
```

Where:

CODE	- Function code	(input integer)
	1 = Start server 2 = Stop server	
LPORT	- Local server message port	(input integer)
	Valid range 0 to 65535	
RLEN	- Receive socket buffer space	(input integer)
	Use 1440 as a default value	
SLEN	- Send socket buffer space	(input integer)
	Use 1440 as a default value	
STATUS	- Returned status	(output integer)
	0 = Normal return 1 = Server already started 2 = Server already stopped 3 = Invalid arguments 4 = Server error 5 = Sockets open error 6 = Socket error	

Notes:

1. The LPORT variable specified with NETSRV must agree with the RPORT variable specified by the NETOPN on the remote machine. Certain port numbers are public and registered numbers, and must be avoided for use with SciSnet.
2. The RLEN variable sets the receive buffer size used by the socket WinAPI interface. This value can effect the performance of socket transmissions. The default value recommended is 1440.
3. The SLEN variable sets the send buffer size used by the socket WinAPI interface. This value can effect the performance for socket transmissions. The default value recommended is 1440.

Error Conditions:

1. See STATUS parameter definition for all error codes.

Program Example:

```
PROGRAM TNETSRV
```

```

!   SciSnet interface definition

   USE SCNINF
   IMPLICIT NONE

!   Variables Definitions

   INTEGER(4) :: NETID, LPORT, RPORT, RLEN, SLEN, CODE, RTIME,
+   CTIME, STATUS, I
   CHARACTER(1),DIMENSION(9) :: RNAME = ('w','i','n','2','0','0',
+   '0','a',' ')

!*****!
!
!   Initialize Network servers and connections
!
!*****!

!   Start up the network server threads

   CODE   = 1
   LPORT  = 8001
   RLEN   = 1440
   SLEN   = 1440
   CALL NETSRV(CODE, LPORT, RLEN, SLEN, STATUS)
   IF (STATUS.NE.0) THEN
       WRITE(6,100)CODE, LPORT, RLEN, SLEN, STATUS
   END IF

!   Open a network socket

   NETID  = 1
   RNAME(9:9) = CHAR(0)
   RPORT  = 8001
   CODE   = 0
   RTIME  = 0
   CTIME  = 0
   CALL NETOPN(NETID, RNAME, RPORT, CODE, RTIME, CTIME, STATUS)
   IF (STATUS.NE.0) THEN
       WRITE(6,101)NETID, (RNAME(I), I=1,9), RPORT, CODE, RTIME,
+   CTIME, STATUS
   END IF

!*****!
!
!   Close down Network servers and connections
!
!*****!

!   Close down the network connection

   code = 2
   CALL NETCLS(NETID, CODE, STATUS)
   IF (STATUS.NE.0) THEN
       WRITE(6,102)NETID, CODE, STATUS
   END IF

!   Stop the network server threads

   CODE   = 2
   CALL NETSRV(CODE, LPORT, RLEN, SLEN, STATUS)
   IF (STATUS.NE.0) THEN
       WRITE(6,100)CODE, LPORT, RLEN, SLEN, STATUS
   END IF

!   Stop execution

   STOP

!   Format Statements

```

```

100  FORMAT( ' *** Errors: (NETSRV) *** ',/,
+         ' CODE   = ',I10,/,
+         ' LPORT  = ',I10,/,
+         ' RLEN   = ',I10,/,
+         ' SLEN   = ',I10,/,
+         ' STATUS = ',I10)
101  FORMAT( ' *** Errors: (NETOPN) *** ',/,
+         ' NETID  = ',I10,/,
+         ' RNAME  = ',9A1,/,
+         ' RPORT  = ',I10,/,
+         ' CODE   = ',I10,/,
+         ' RTIME  = ',I10,/,
+         ' CTIME  = ',I10,/,
+         ' STATUS = ',I10)
102  FORMAT( ' *** Errors: (NETCLS) *** ',/,
+         ' NETID  = ',I10,/,
+         ' CODE   = ',I10,/,
+         ' STATUS = ',I10)

      END PROGRAM TNETSRV

```

Example 3.4 – NETSRV Program Example

3.2.5 NETFLS

Purpose: - This function is used to flush the send and receive messages maintained in the SciSnet control structure.

Fortran Calling Sequence:

CALL NETFLS(NETID,CODE,STATUS)

Where:

NETID	- Network connection ID	(input integer)
	1 thru 100	
CODE	- Function code	(input integer)
	1 = Flush receive messages	
	2 = Flush send messages	
	3 = Flush receive and send messages	
STATUS	- Returned status	(output integer)
	0 = Normal return	
	1 = Connection not open	
	2 = Invalid arguments	

Notes:

1. None.

Error Conditions:

1. See STATUS parameter definition for all error codes.

Program Example:

```
PROGRAM TNETFLS

!   SciSnet interface definition

USE SCNINF
IMPLICIT NONE

!   Variables Definitions

INTEGER(4) :: NETID, LPORT, RPORT, RLEN, SLEN, CODE, RTIME,
+   CTIME, STATUS, I
CHARACTER(1),DIMENSION(9) :: RNAME = ('w','i','n','2','0','0',
+   '0','a',' '/')

!*****!
!
!   Initialize Network servers and connections
!
!*****!

!   Start up the network server threads

CODE = 1
LPORT = 8001
RLEN = 1440
SLEN = 1440
CALL NETSRV(CODE,LPORT,RLEN,SLEN,STATUS)
IF (STATUS.NE.0) THEN
    WRITE(6,100)CODE,LPORT,RLEN,SLEN,STATUS
END IF

!   Open a network socket

NETID = 1
RNAME(9:9) = CHAR(0)
RPORT = 8001
CODE = 0
RTIME = 0
CTIME = 0
CALL NETOPN(NETID,RNAME,RPORT,CODE,RTIME,CTIME,STATUS)
IF (STATUS.NE.0) THEN
    WRITE(6,101)NETID,(RNAME(I),I=1,9),RPORT,CODE,RTIME,
+   CTIME,STATUS
END IF

!*****!
!
!   Flush both receive and send messages
!
!*****!

CODE = 3
CALL NETFLS(NETID,CODE,STATUS)
IF (STATUS.NE.0) THEN
    WRITE(6,102)NETID,CODE,STATUS
END IF
```

```

!*****!
!      Close down Network servers and connections      !
!*****!

!      Close down the network connection

      code = 2
      CALL NETCLS(NETID, CODE, STATUS)
      IF (STATUS.NE.0) THEN
        WRITE(6,103)NETID, CODE, STATUS
      END IF

!      Stop the network server threads

      CODE = 2
      CALL NETSRV(CODE, LPORT, RLEN, SLEN, STATUS)
      IF (STATUS.NE.0) THEN
        WRITE(6,100)CODE, LPORT, RLEN, SLEN, STATUS
      END IF

!      Stop execution

      STOP

!      Format Statements

100  FORMAT(' *** Errors: (NETSRV) *** ',/,
+        ' CODE = ',I10,/,
+        ' LPORT = ',I10,/,
+        ' RLEN = ',I10,/,
+        ' SLEN = ',I10,/,
+        ' STATUS = ',I10)
101  FORMAT(' *** Errors: (NETOPN) *** ',/,
+        ' NETID = ',I10,/,
+        ' RNAME = ',9A1,/,
+        ' RPORT = ',I10,/,
+        ' CODE = ',I10,/,
+        ' RTIME = ',I10,/,
+        ' CTIME = ',I10,/,
+        ' STATUS = ',I10)
102  FORMAT(' *** Errors: (NETFLS) *** ',/,
+        ' NETID = ',I10,/,
+        ' CODE = ',I10,/,
+        ' STATUS = ',I10)
103  FORMAT(' *** Errors: (NETCLS) *** ',/,
+        ' NETID = ',I10,/,
+        ' CODE = ',I10,/,
+        ' STATUS = ',I10)

      END PROGRAM TNETFLS

```

Example 3.5 – NETFLS Program Example

3.2.6 NETREC

Purpose: - This function is used to transfer a receive message from the SciSnet

control structure. A message will be transferred up to limit of buffer size. NETREC will wait the timeout value (if provided with NETOPN) before completion.

Fortran Calling Sequence:

```
CALL NETREC(NETID,BUFFER,LENGTH,NBYTES,STATUS)
```

Where:

NETID	- Network connection ID	(input integer)
	1 thru 100	
BUFFER	- Message data buffer	(output character)
LENGTH	- Length of message buffer	(input integer)
NBYTES	- Number bytes received	(output integer)
STATUS	- Returned status	(output integer)

0 = Normal return
1 = Connection not open
2 = Invalid arguments
3 = Message data buffer truncated
4 = Transmission errors detected
5 = Receive timed out

Notes:

1. A receive message will be transferred up to the limits of the buffer length. An error will be indicated if the message will not fit in the user buffer. The SciSnet input thread handles queuing the input receive messages as they arrive.
2. The use of the receive wait timeout option/value in NETOPN allows a user to delay a fixed amount of time, waiting for the arrival of a message from a remote machine.
3. Using an alternate technique, the user may interrogate the status of receive messages before calling NETREC by calling the NETSTS function. With the NETSUS function , a way to delay a fixed amount of time, allows an application to wait for arrival of a message.

Error Conditions:

1. See STATUS parameter definition for all error codes.

Program Example:

```
PROGRAM TNETREC
```

```

!      SciSnet interface definition

      USE SCNINF
      IMPLICIT NONE

!      Variables Definitions

      INTEGER(4) :: NETID, LPORT, RPORT, RLEN, SLEN, CODE, RTIME,
+      CTIME, STATUS, I, LENGTH, NBYTES
      CHARACTER(1),DIMENSION(9) :: RNAME = ('w','i','n','2','0','0',
+      '0','a',' '/')
      CHARACTER(1),DIMENSION(128) :: BUFFER

!*****!
!      Initialize Network servers and connections      !
!*****!

!      Start up the network server threads

      CODE   = 1
      LPORT  = 8001
      RLEN   = 1440
      SLEN   = 1440
      CALL NETSRV(CODE, LPORT, RLEN, SLEN, STATUS)
      IF (STATUS.NE.0) THEN
         WRITE(6,100)CODE, LPORT, RLEN, SLEN, STATUS
      END IF

!      Open a network socket

      NETID  = 1
      RNAME(9:9) = CHAR(0)
      RPORT  = 8001
      CODE   = 0
      RTIME  = 0
      CTIME  = 0
      CALL NETOPN(NETID, RNAME, RPORT, CODE, RTIME, CTIME, STATUS)
      IF (STATUS.NE.0) THEN
         WRITE(6,101)NETID, (RNAME(I), I=1,9), RPORT, CODE, RTIME,
+      CTIME, STATUS
      END IF

!*****!
!      Get one receive message      !
!*****!

      LENGTH = 128
      CALL NETREC(NETID, BUFFER, LENGTH, NBYTES, STATUS)
      IF (STATUS.NE.0) THEN
         WRITE(6,102)NETID, LENGTH, NBYTES, STATUS
      END IF

!*****!
!      Close down Network servers and connections      !
!*****!

!      Close down the network connection

      code = 2
      CALL NETCLS(NETID, CODE, STATUS)
      IF (STATUS.NE.0) THEN
         WRITE(6,103)NETID, CODE, STATUS
      END IF

!      Stop the network server threads

```

```

CODE = 2
CALL NETSRV(CODE,LPORT,RLEN,SLEN,STATUS)
IF (STATUS.NE.0) THEN
WRITE(6,100)CODE,LPORT,RLEN,SLEN,STATUS
END IF

! Stop execution

STOP

! Format Statements

100 FORMAT(' *** Errors: (NETSRV) *** ',/,
+ ' CODE = ',I10,/,
+ ' LPORT = ',I10,/,
+ ' RLEN = ',I10,/,
+ ' SLEN = ',I10,/,
+ ' STATUS = ',I10)
101 FORMAT(' *** Errors: (NETOPN) *** ',/,
+ ' NETID = ',I10,/,
+ ' RNAME = ',9A1,/,
+ ' RPORT = ',I10,/,
+ ' CODE = ',I10,/,
+ ' RTIME = ',I10,/,
+ ' CTIME = ',I10,/,
+ ' STATUS = ',I10)
102 FORMAT(' *** Errors: (NETREC) *** ',/,
+ ' NETID = ',I10,/,
+ ' LENGTH = ',I10,/,
+ ' NBYTES = ',I10,/,
+ ' STATUS = ',I10)
103 FORMAT(' *** Errors: (NETCLS) *** ',/,
+ ' NETID = ',I10,/,
+ ' CODE = ',I10,/,
+ ' STATUS = ',I10)

END PROGRAM TNETREC

```

Example 3.6 – NETREC Program Example

3.2.7 NETSND

Purpose: - This function is used to send a message to a remote machine. NETSND does not wait for the message to be sent, but queues the message to the SciSnet control structure. The output processing thread handles the transmission and verification of complete transfer to the remote machine.

Fortran Calling Sequence:

```
CALL NETSND(NETID,BUFFER,NBYTES,STATUS)
```

Where:

NETID - Network connection ID (input integer)

1 thru 100

BUFFER - Message data buffer (input character)
NBYTES - Number bytes to send (input integer)
STATUS - Returned status (output integer)

0 = Normal return
1 = Connection not open
2 = Invalid arguments
3 = Queued memory exhausted
4 = Transmission errors detected

Notes:

1. NETSND does not wait for a message to be sent, but queues the message to the SciSnet control structure. The output processing thread handles the transmission and verification of message transfer to remote machines.
2. The user may interrogate the status of sent messages by using the NETSTS function.
3. The NETSND routine provides the capability to have a timestamp inserted at the beginning of all output messages. NETOPN provides a way to set this timestamp option at the time the network connection is made.

Error Conditions:

1. See STATUS parameter definition for all error codes.

Program Example:

```
PROGRAM TNETSND

!   SciSnet interface definition

USE SCNINF
IMPLICIT NONE

!   Variables Definitions

INTEGER(4) :: NETID, LPORT, RPORT, RLEN, SLEN, CODE, RTIME,
+   CTIME, STATUS, I, NBYTES
CHARACTER(1),DIMENSION(9) :: RNAME = ('w','i','n','2','0','0',
+   '0','a',' '/')
CHARACTER(28) :: TMSG = ('Test message to a remote host//')
CHARACTER(1),DIMENSION(128) :: BUFFER

!*****!
!
!   Initialize Network servers and connections
!
!*****!

!   Start up the network server threads
```

```

CODE = 1
LPORT = 8001
RLEN = 1440
SLEN = 1440
CALL NETSRV(CODE,LPORT,RLEN,SLEN,STATUS)
IF (STATUS.NE.0) THEN
    WRITE(6,100)CODE,LPORT,RLEN,SLEN,STATUS
END IF

!   Open a network socket

NETID = 1
RNAME(9:9) = CHAR(0)
RPORT = 8001
CODE = 0
RTIME = 0
CTIME = 0
CALL NETOPN(NETID,RNAME,RPORT,CODE,RTIME,CTIME,STATUS)
IF (STATUS.NE.0) THEN
    WRITE(6,101)NETID,(RNAME(I),I=1,9),RPORT,CODE,RTIME,
+   CTIME,STATUS
END IF

!*****!
!
!   Send one message
!
!*****!

NBYTES = 28
DO I = 1 , NBYTES
    BUFFER(I) = TMSG(I:I)
END DO
CALL NETSND(NETID,BUFFER,NBYTES,STATUS)
IF (STATUS.NE.0) THEN
    WRITE(6,102)NETID,NBYTES,STATUS
END IF

!*****!
!
!   Close down Network servers and connections
!
!*****!

!   Close down the network connection

code = 2
CALL NETCLS(NETID,CODE,STATUS)
IF (STATUS.NE.0) THEN
    WRITE(6,103)NETID,CODE,STATUS
END IF

!   Stop the network server threads

CODE = 2
CALL NETSRV(CODE,LPORT,RLEN,SLEN,STATUS)
IF (STATUS.NE.0) THEN
    WRITE(6,100)CODE,LPORT,RLEN,SLEN,STATUS
END IF

!   Stop execution

STOP

!   Format Statements

100  FORMAT(' *** Errors: (NETSRV) *** ',/,
+        ' CODE = ',I10,/,
+        ' LPORT = ',I10,/,
+        ' RLEN = ',I10,/,
+        ' SLEN = ',I10,/,

```

```

+      \ STATUS = \,I10)
101  FORMAT(\ *** Errors: (NETOPN) *** \,/,
+      \ NETID = \,I10,/,
+      \ RNAME = \,9A1,/,
+      \ RPORT = \,I10,/,
+      \ CODE = \,I10,/,
+      \ RTIME = \,I10,/,
+      \ CTIME = \,I10,/,
+      \ STATUS = \,I10)
102  FORMAT(\ *** Errors: (NETSND) *** \,/,
+      \ NETID = \,I10,/,
+      \ NBYTES = \,I10,/,
+      \ STATUS = \,I10)
103  FORMAT(\ *** Errors: (NETCLS) *** \,/,
+      \ NETID = \,I10,/,
+      \ CODE = \,I10,/,
+      \ STATUS = \,I10)

      END PROGRAM TNETSND

```

Example 3.7 – NETSND Program Example

3.2.8 NETDTM

Purpose: - This function is used to get the local time and date from Windows.

Fortran Calling Sequence:

```
NETDTM(MONTH, DAY, YEAR, HOUR, MINS, SECS, MSECS, STATUS)
```

Where:

MONTH	- Month (1-12)	(output integer)
DAY	- Day (1-31)	(output integer)
YEAR	- Year	(output integer)
HOUR	- Hour	(output integer)
MINS	- Minutes	(output integer)
SECS	- Seconds	(output integer)
MSECS	- Milliseconds	(output integer)

Notes:

1. The user may use NETDTM to measure the length of time between two events in a user application. Be aware that not all systems provide accurate time.

Error Conditions:

None.

Program Example:

```
PROGRAM TNETDTM
!   SciSnet interface definition
!
!   USE SCNINF
!   IMPLICIT NONE
!
!   Variables Definitions
!
!   INTEGER(4) :: MONTH, DAY, YEAR, HOUR, MINS, SECS, MSECS
!*****!
!
!   Get current date and time
!
!*****!
!
!   CALL NETDTM(MONTH, DAY, YEAR, HOUR, MINS, SECS, MSECS)
!   WRITE(6, 100) MONTH, DAY, YEAR, HOUR, MINS, SECS, MSECS
!
!   Stop execution
!
!   STOP
!
!   Format Statements
100  FORMAT(' Month = ', I10, /,
+        ' Day   = ', I10, /,
+        ' Year  = ', I10, /,
+        ' Hour  = ', I10, /,
+        ' Mins  = ', I10, /,
+        ' Secs  = ', I10, /,
+        ' Msecs = ', I10)
!
!   END PROGRAM TNETDTM
```

Example 3.8 – NETDTM Program Example

3.2.9 NETSUS

Purpose: - This function is used to suspend execution of the application for a fixed period of time.

Fortran Calling Sequence:

```
CALL NETSUS(MSECS,STATUS)
```

Where:

MSECS - Milliseconds to suspend for (input integer)

STATUS - Returned status (output integer)

0 = Normal return

1 = Function failed

Notes:

1. An application can use NETSUS to delay execution, waiting for the arrival of input messages without using any cpu cycles.

Error Conditions:

1. See STATUS parameter definition for all error codes.

Program Example:

```
PROGRAM TNETSUS
!   SciSnet interface definition
USE SCNINF
IMPLICIT NONE
!   Variables Definitions
INTEGER(4) :: WAITMS
!*****!
!
!   Delay execution for 2 seconds
!
!*****!
WAITMS = 2000
CALL NETSUS(WAITMS,STATUS)
!   Stop execution
STOP
END PROGRAM TNETSUS
```

Example 3.9 – NETSUS Program Example

3.3 Communication Test Program

The communication test program TNET is released as Fortran source code with SciSnet. This program can be compiled and linked with the SciSnet library to produce an executable program. The program allows a user to test network communication through the use of an interactive menu driven program. TNET allows the user to test out and examine the transfer of known user generated data messages.

The functions provided in the SciSnet sockets communication library can be tested through TNET. A socket to another machine may be opened. The network status may be interrogated. The number of messages received or left to send can be viewed by using the status function. Finally, the flush function will delete all messages in the input or output buffers.

3.4 Communication Library

SciSnet is released with two Fortran linkable libraries. There is the SCNLIB.LIB static library that can be linked with the application to produce an executable file. There is also the SCNDLL.DLL dynamic link library that can be dynamically linked during execution by including the SCNIMP.LIB during the LINK process. These SciSnet libraries are used in conjunction with the standard runtime Fortran library. The user application software makes calls to SciSnet routines described in this manual. At LINK time, the user should include the SciSnet library as one of the libraries along with the Fortran multithreaded run time library.

Chapter 4

Performance Considerations

SciSnet utilizes TCP/IP under the Microsoft Windows operating system. The sockets WinAPI is the foundation for SciSnet. Data bytes are 8 bits. The underlying protocol is stream based. All data bytes are ordered in the stream. SciSnet has implemented a message based technology upon the sockets WinAPI. Headers are prepended to each message, describing message type and extent. A client/server is implemented on each SciSnet node via NETSRV. Once NETOPN is active, an application can send or receive messages from one node to any other SciSnet node by use of the sockets WinAPI. The only parameters that influence performance are the receive/send socket buffer space variables provided in NETSRV. These values can be adjusted to obtain optimum performance. Usually the values are operating system and medium sensitive.

4.1 Ethernet Controller Measured Data

The SciSnet product was tested by connecting two processors via ethernet controllers. An application on the first processor was executed that sent messages to the second processor. The second processor read in the messages and then sent these same messages back to the first processor. The first processor verified the integrity of every byte and recorded the round trip time. This sequence was repeated 10 times to obtain reasonable statistics. The results of this test were:

Buffer Size (Bytes)	Measured Rate (Bytes/second)	Measured Rate (Bits/second)	Bandwidth Used (%)
200000	9090909	72727272	73
500000	9310987	74487896	75
800000	9523809	76555024	77
1000000	9950249	79601992	80
2000000	10000000	80000000	80
5000000	9988015	79904120	80
8000000	9796718	78373744	78
10000000	9749440	77995520	78

Table 4.1 – Ethernet Controller Measurements

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