

GenRef
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MDOS Reference guide.

TIPI Library

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TIPI Overview

All TIPI management routines in MDOS are provided to aid a programmer in writing applications requiring TIPI operations beyond the immediate instruction set of the TMS 9995 microprocessor. The following TIPI operations are currently supported within the operating system.

Type	Extension	Description
0x20	Mouse	Read USB mouse data
0x21	TCP	Client/Server socket connections

Opcodes within the TIPI XOP Library 12 support access to the USB mouse, as a wired or wireless connection. In addition, both client and server based TCP connections are supported. The TIPI is a continually evolving hardware and software solution for the TI-99/4A and Geneve 9640 computers.

For more information on the TIPI, please visit <https://github.com/jedimatt42/tipi/wiki>

CALLING TIPI FUNCTIONS

The MDOS TIPI Library must be called from within a machine code program running as a task under MDOS. You pass arguments to the TIPI Library via the calling registers.

The MDOS TIPI Library is invoked from a machine code program when software trap number zero (XOP 0) is called with a library number of 12. The calling program's R0 must contain the 16-bit subprogram at the time of the XOP. The following code fragment will open a TCP connection to a hostname or IP address.

```
LI    R0,>0002    Open hostname
LI    R1,HOST     Hostname to open with port number
LI    R2,22       Length of Hostname String
LI    R3,>0100    TCP Socket Handle Byte (MSB)
XOP   @TIPI,0     Access subprogram

TIPI  DATA  12
HOST  TEXT  "Heatwave.ddns.net:9640"    HOST to open
      EVEN
```

In the preceding example, two hidden assumptions were made. First it is assumed that Hostname or IP address is located on a page which is currently mapped into a memory page which has the same 16-bit address page number as its Virtual address page number (read the section on Memory Management). The second assumption is the TIPI label is currently mapped into a memory page which has the same 16-bit address page number as its Virtual address page number.

TIPI Library

Reset TIPI

Function Sends a command to the TIPI to kill the TipiService on the Raspberry PI and restarts it asynchronously. When this command is issued, allow time for the TipiService to resume.

Parameters R0 = >0000 (opcode)

Results N/A -

Parameter Description

Not applicable

Example Code

```
LI    R0,>0000    Reset TIPI opcode
XOP   @TIPI,0     Access subprogram

TIPI  DATA 12    TIPI Library
```

Identify CRU of the TIPI

Function Returns the CRU address of the TIPI.

Parameters R0 = >0001

Results R0 = Result code

Parameter Description

Result code CRU address of the TIPI
CRU = >0000, no TIPI present

Example Code

```
LI      R0,>0001    CRU address opcode
XOP    @TIPI,0     Access subprogram
MOV    R0,@CRU     Store CRU Address of TIPI

TIPI   DATA 12    TIPI Library
CRU    DATA 0     CRU of TIPI
```

Open Hostname

Function Opens a TCP socket to a Hostname or IP address at a specified port.

Parameters R0 = >0002
 R1 = Hostname or IP address
 R2 = Length of R1
 R3 = Socket handle (MSB)

Results R1 = Result code

Parameter Description

Hostname or IP	The hostname or IP address is a string in the form of "hostname:port" without the quotes.
Length	The length of the string Hostname:Port
Socket handle	Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.
Result code	>FFFF if connect >0000 for no connection

Example Code

```

LI      R0,>0002   Open Host opcode
LI      R1,HOST1  Host or IP address to open with port number
LI      R2,22     Length of Host String
LI      R3,>0100  TCP Socket Handle Byte (MSB)
XOP     @TIPI,0   Access subprogram
MOV     R0,R0     Test for connection
JEQ     NOCONCT  No connection,

TIPI   DATA  12          TIPI Library

HOST1  TEXT   "Heatwave.ddns.net:9640"   Host to open
      EVEN
HOST2  TEXT   'localhost:23'             Host to open
      EVEN
HOST3  TEXT   '192.168.1.79:9640'        Host to open
      EVEN
    
```


Receive TCP Message

Function Receive a single character from the TIPI TCP Socket Messaging system

Parameters R0 = >0003
 R1 = Socket handle (MSB)

Results R0 = Result code
 R1 = Received character (MSB)

Parameter Description

Socket handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Result code >0000 no character received
 >FFFF if character received

Received character Received character from >00 to >FF received from the socket handle

Example Code

```

LOOP
    LI    R0,>0003    Receive a single character
    LI    R1,>0100    TCP Socket Handle Byte (MSB)
    XOP   @TIPI,0     Access subprogram

    MOV   R0,R0      Test for status
    JEQ   LOOP       No character, run through loop again
    MOVB R1,CHAR     Move character to buffer

TIPI   DATA 12     TIPI Library
CHAR   DATA 0     Character to receive
    
```

Send TCP Message

Function Send a single character from the TIPI TCP Socket Messaging system.

Parameters R0 = >0004
 R1 = Character to send (MSB)
 R2 = Socket handle (MSB)

Results Not applicable

Parameter Description

Character to Send A single byte from >00 to >FF to send via the TIPI messaging system.

Socket handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Example Code

```

LI      R0,>0004    Send single character
MOV     @CHAR,R1   Character to send
LI      R2,>0100    Socket handle
XOP     @TIPI,0     Access subprogram
    
```

```

TIPI   DATA   12      TIPI Library
CHAR   DATA   >0D00  Character to send (MSB)
    
```

Close TIPI Connection

Function Close an open TIPI TCP Socket.

Parameters R0 = >0005
 R1 = Socket handle (MSB)

Results N/A

Parameter Description

Socket handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Example Code

```

LOOP
    LI    R0,>0005    Close TIPI TCP Socket
    LI    R1,>0100    TCP Socket Handle Byte (MSB)
    XOP   @TIPI,0    Access subprogram

TIPI   DATA 12      TIPI Library
    
```

Receive TIPI String

Function Receive multiple characters from the TIPI TCP Socket Messaging system.

Parameters R0 = >0006
 R1 = String Pointer
 R2 = String length
 R3 = Socket handle (MSB)

Results R0 = Result code

Parameter Description

String Pointer An address in memory where data will be returned to a buffer in the program's physical 64K memory space.

String length The length of the buffer in memory to be processed. The Raspberry PI maintains a larger buffer passing up to the maximum amount of characters in the program's buffer. Upon return from the TIPI XOP call, the actual number of characters retrieved will be passed.

The string length shall not exceed the boundary of a 2nd page mapped in memory from the first physical page as only 2 x 8K pages are mapped into use during the TIPI XOP opcode call.

Socket handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Result code >0000 no character
 >0001 or greater, characters returned to the buffer.

Example Code

```

LOOP
    LI    R0,>0006    Receive string
    LI    R1,BUF      Buffer containing the characters
    LI    R2, 8192    Length of buffer
    LI    R3,>0100    TCP Socket Handle Byte (MSB)
    XOP   @TIPI,0     Access subprogram

    MOV   R0,R0      Test for status
    JEQ   LOOP       No character(s) received, run through loop again

TIPI   DATA 12      TIPI Library
BUF    BSS   8192    Buffer

```

Send ANSI String (Up Arrow Key)

Function Send an ANSI sequence for the Down Arrow key.

Parameters R0 = >0007
 R1 = Socket handle (MSB)

Results Not applicable

Parameter Description

Socket handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Example Code

```
LOOP
  LI    R0,>0007    Send ANSI Sequence for Up-Arrow keypress
  LI    R1,>0100    TCP Socket Handle Byte (MSB)
  XOP   @TIPI,0    Access subprogram

TIPI   DATA 12    TIPI Library
```

Send ANSI String (Down Arrow Key)
--

Function Send an ANSI sequence for the Down Arrow key.

Parameters R0 = >0008
 R1 = Socket handle (MSB)

Results Not applicable

Parameter Description

Socket handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Example Code

```

LOOP
    LI    R0,>0008    Send ANSI Sequence for Down-Arrow keypress
    LI    R1,>0100    TCP Socket Handle Byte (MSB)
    XOP   @TIPI,0     Access subprogram

TIPI   DATA 12      TIPI Library
    
```

Send ANSI String (Left Arrow Key)

Function Send an ANSI sequence for the Left Arrow key.

Parameters R0 = >0009
 R1 = Socket handle (MSB)

Results Not applicable

Parameter Description

Socket handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Example Code

```

LOOP
  LI    R0,>0009    Send ANSI Sequence for Left-arrow keypress
  LI    R1,>0100    TCP Socket Handle Byte (MSB)
  XOP   @TIPI,0     Access subprogram

TIPI   DATA 12     TIPI Library
    
```

Send ANSI String (Right Arrow Key)

Function Send an ANSI sequence for the Right Arrow key.

Parameters R0 = >000A
 R1 = Socket handle (MSB)

Results Not applicable

Parameter Description

Socket handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Example Code

```

LOOP
  LI    R0,>000A    Send ANSI Sequence for Right-Arrow keypress
  LI    R1,>0100    TCP Socket Handle Byte (MSB)
  XOP   @TIPI,0    Access subprogram

TIPI   DATA 12    TIPI Library
    
```


Send ANSI String (PageUp Key)

Function Send an ANSI sequence for the PageUp Arrow key.

Parameters R0 = >000B
 R1 = Socket handle (MSB)

Results Not applicable

Parameter Description

Socket handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Example Code

```

LOOP
  LI    R0,>000B   Send ANSI Sequence for PageUp-Arrow keypress
  LI    R1,>0100   TCP Socket Handle Byte (MSB)
  XOP   @TIPI,0   Access subprogram

TIPI   DATA 12   TIPI Library
    
```

Send ANSI String (PageDown Key)

Function Send an ANSI sequence for the Up Arrow key.

Parameters R0 = >000C
 R1 = Socket handle (MSB)

Results Not applicable

Parameter Description

Socket handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Example Code

```

LOOP
  LI    R0,>000C    Send ANSI Sequence for Up-Arrow keypress
  LI    R1,>0100    TCP Socket Handle Byte (MSB)
  XOP   @TIPI,0    Access subprogram

TIPI   DATA 12    TIPI Library
    
```

Server Bind Port

Function Bind a listening server socket to a listening port.

Parameters R0 = >000D
 R1 = Interface address (IP:Port) string
 R2 = Interface address String length
 R3 = Server handle (MSB)

Results R0 = Result code

Parameter Description

Interface Port String An address in memory containing the Interface Port to be binded. An interface port can be specified by the address such as “*:9640” excluding quotes to bind port 9640 on the Raspberry PI.

Interface length The length of the interface port in memory to be binded. The Raspberry PI maintains a larger buffer passing up to the maximum amount of characters in the program’s buffer. Upon return from the TIPI XOP call, the actual number of characters retrieved will be passed.

The string length shall not exceed the boundary of a 2nd page mapped in memory from the first physical page as only 2 x 8K pages are mapped into use during the TIPI XOP opcode call.

Server handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple server sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state. This handle should not be confused with the client socket handle.

Result code >0000 binding not successful
 >FFFF binding successful

Example Code

```

LI      R0,>000D   Bind Server Port
LI      R1,SERV   Buffer containing the characters for the interface port
MOV     @LEN,R2   Length of the interface port string to be binded
LI      R3,>0100   TCP Socket Handle Byte (MSB)
XOP     @TIPI,0   Access subprogram

MOV     R0,R0     Test for status
JNE     FOUND    Server binded, let's go
BLWP   @0        Server not binded, let's exit

TIPI   DATA 12   TIPI Library
LEN    DATA 6
SERVR TEXT “*:9640”
    
```

Server Unbind

Function Unbind a previously binded server.

Parameters R0 = >000E
 R1 = Server handle (MSB)

Results Not applicable

Parameter Description

Socket handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Example Code

```

LOOP
    LI     R0,>000E    Unbind server
    LI     R1,>0100    TCP Socket Handle Byte (MSB)
    XOP   @TIPI,0     Access subprogram

TIPI  DATA 12      TIPI Library
    
```

Server Accept

Function Accept an incoming connection on a previously binded server interface address.

Parameters R0 = >000F
 R1 = Server handle (MSB)

Results R0 = Result code (MSB)

Parameter Description

Server handle Server handles will have a server handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple server handles can be managed by the TIPI XOP within a single program or with several programs in a multitasking state. This server handle should not be confused with the socket handle.

Result code >0000 no incoming socket
 >FF00 error on server handle
 >0100 to >FE00, Socket handle of the MSB

Socket handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Example Code

```

LOOP
  LI    R0,>000F    Accept incoming connection
  LI    R1,>0100    Server handle
  XOP   @TIPI,0    Access subprogram

  MOV   R0,R0      Test for status
  JEQ   LOOP       No connection, loop again as still waiting
  MOV   R0,SOCK    Store socket handle

TIPI   DATA 12    TIPI Library
SOCK   DATA 0     Socket handle

```

TIPI Mouse Movement

Function Get Mouse release data. This data call mimics the Video XOP opcode call >32.

Parameters R0x = >0010

Results R1x = Returned X displacement
 R2x = Returned Y displacement
 R3x = Button State

Parameter Description

Returned X displacement Returns the x direction displacement from the last call.

Returned Y displacement Returns the y direction displacement from the last call.

Button State The button state will return the left, middle, and right button status.

 b1 b2 b3 0 xxxx xxxx xxxx (MSB bits)

 b1 = left 1 = down
 b2 = middle 1 = down
 b3 = right 1 = down

Example Code

```

LI      R0,>0010   Send single character
XOP    @TIPI,0    Access subprogram

MOV    R1,@XDIS   X distance movement
MOV    R2,@YDIS   Y Distance movement
MOV    R3,@BUT    Mouse button status

TIPI   DATA 12   TIPI Library
XDIS   DATA 0    X Distance movement
YDIS   DATA 0    Y Distance movement
BUT    DATA 0    Button status
    
```

Send TCP String

Function Send TIPI TCP message, maximum 10 characters. Useful when sending a response sequence when a single byte one at a time has timing issues with the receiving system.

Parameters R0 = >0011
R1 = String length contained in R2,R3,R4,R5,R6 (max 10 bytes)
R2 = Chars
R3 = Chars
R4 = Chars
R5 = Chars
R6 = Chars
R7 = Socket handle (MSB)

Results R0 = >0000 no character, greater than or equal to >0001 or more characters returned to the buffer.

Parameter Description

String length The length of the buffer in the registers in the current workspace in registers R2 to R6 to be processed. The maximum length of the buffer is 10 characters.

Socket handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Example Code

```

LI      R0,>0011    Send String
LI      R1,8        Length of string to send
*      Build string containing "Client#1"
LI      R2,'Cl'     Two characters, "Cl"
LI      R3,'ie'     Two characters, "ie"
LI      R4,'nt'     Two characters, "nt"
LI      R5,'#1'     Two characters, "#1"
CLR     R6          Clear register, but not required to be cleared
LI      R7,>0100    TCP Socket Handle Byte (MSB)
XOP     @TIPI,0    Access subprogram

TIPI    DATA 12   TIPI XOP Library

```

Send TCP String

Function Send TCP TCP message, maximum 8K characters. Useful when sending a response sequence when a single byte one at a time has timing issues with the receiving system.

Parameters R0 = >0012
 R1 = String pointer to write
 R2 = String length beginning after first three bytes of the string pointer destination.

Results R0 = >0000 no character, greater than or equal to >0001 or more characters returned to the buffer.

Parameter Description

String length String length is defined as:

1 st Byte	>22
2 nd Byte	Socket handle byte >01 to >FF
3 rd Byte	>03 (write command)
4 th Byte to 8K	String up to 8K

Socket handle Socket handles will have a socket handle of a single byte from >01 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Example Code

```

LI      R0,>0013   Send String
LI      R1,HELLO  String Pointer
LI      R2,7      String length
XOP    @TIPI,0    Access subprogram

HELLO BYTE >22   Write
        BYTE >00  Socket handle
        BYTE >03  Write
        TEXT 'Hello'
        BYTE >0D,>0A  cr/lf

TIPI   DATA 12  TIPI XOP Library
    
```


Open UDP URL

Function Opens a TIPI UDP socket to a Hostname or IP address at a specified port.

Parameters R0 = >0013
 R1 = Hostname or IP address
 R2 = Length of R1
 R3 = Socket handle (MSB)

Results R1 = Result code

Parameter Description

Hostname or IP	The hostname or IP address is a string in the form of "hostname:port" without the quotes.
Length	The length of the string Hostname:Port
Socket handle	Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.
Result code	>FFFF if connect >0000 for no connection

Example Code

```

LI      R0,>0013   Open Host opcode
LI      R1,HOST1  Host or IP address to open with port number
LI      R2,22     Length of Host String
LI      R3,>0100  TCP Socket Handle Byte (MSB)
XOP     @TIPI,0   Access subprogram
MOV     R0,R0    Test for connection
JEQ     NOCONCT  No connection,

TIPI   DATA  12          TIPI Library

HOST1  TEXT   "Heatwave.ddns.net:9640"   Host to open
      EVEN
HOST2  TEXT   'localhost:23'             Host to open
      EVEN
HOST3  TEXT   '192.168.1.79:9640'        Host to open
      EVEN
    
```

Close UDP Connection

Function Close an open TIPI UDP Socket.

Parameters R0 = >0014 (opcode)
 R1 = Socket handle (MSB)

Results N/A

Parameter Description

Socket handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Example Code

```

LOOP
    LI    R0,>0014    Close TIPI TCP Socket
    LI    R1,>0100    TCP Socket Handle Byte (MSB)
    XOP   @TIPI,0    Access subprogram

TIPI   DATA 12      TIPI Library
    
```

Send UDP Message

Function Send TIPI UDP message, maximum 8K characters.

Parameters R0 = >0015
 R1 = String pointer to write
 R2 = String length beginning after first three bytes of the string pointer destination.

Results R0 = >0000 all characters sent, not >0000 then error on sending string.

Parameter Description

String length String length is defined as:

1st Byte >23
 2nd Byte Socket handle byte >01 to >FF
 3rd Byte >03 (write command)
 4th Byte to 8K String up to 8K

Socket handle Socket handles will have a socket handle of a single byte from >01 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Example Code

```

LI      R0,>0015   Send String
LI      R1,HELLO  String Pointer
LI      R2,7      String length
XOP    @TIPI,0    Access subprogram

HELLO BYTE >23   Write
        BYTE >00   Socket handle
        BYTE >03   Write
        TEXT 'Hello'
        BYTE >0D,>0A  cr/lf
  
```

TIPI DATA 12 TIPI XOP Library

Receive UDP Message

Function Receive a single character from the TIPI UDP Socket Messaging system

Parameters R0 = >0016
 R1 = String Pointer
 R2 = String length
 R3 = Socket handle (MSB)

Results R0 = Result code

Parameter Description

String Pointer An address in memory where data will be returned to a buffer in the program's physical 64K memory space.

String length The length of the buffer in memory to be processed. The Raspberry PI maintains a larger buffer passing up to the maximum amount of characters in the program's buffer. Upon return from the TIPI XOP call, the actual number of characters retrieved will be passed.

The string length shall not exceed the boundary of a 2nd page mapped in memory from the first physical page as only 2 x 8K pages are mapped into use during the TIPI XOP opcode call.

Socket handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Result code >0000 no character
 >0001 or greater, characters returned to the buffer.

Example Code

```

LOOP
    LI    R0,>0016    Receive string
    LI    R1,BUF      Buffer containing the characters
    LI    R2, 8192    Length of buffer
    LI    R3,>0100    TCP Socket Handle Byte (MSB)
    XOP   @TIPI,0     Access subprogram

    MOV   R0,R0      Test for status
    JEQ   LOOP       No character(s) received, run through loop again

TIPI   DATA 12      TIPI Library
BUF    BSS   8192    Buffer

```

Open TLS URL

Function Opens a TIPI TLS socket to a Hostname or IP address at a specified port.

Parameters R0 = >0017
 R1 = Hostname or IP address
 R2 = Length of R1
 R3 = Socket handle (MSB)

Results R1 = Result code

Parameter Description

Hostname or IP	The hostname or IP address is a string in the form of "hostname:port" without the quotes.
Length	The length of the string Hostname:Port
Socket handle	Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.
Result code	>FFFF if connect >0000 for no connection

Example Code

```

LI      R0,>0017   Open Host opcode
LI      R1,HOST1  Host or IP address to open with port number
LI      R2,22     Length of Host String
LI      R3,>0100  TCP Socket Handle Byte (MSB)
XOP     @TIPI,0   Access subprogram
MOV     R0,R0    Test for connection
JEQ     NOCONCT  No connection,

TIPI   DATA  12          TIPI Library

HOST1  TEXT   "Heatwave.ddns.net:9640"   Host to open
      EVEN
HOST2  TEXT   'localhost:23'             Host to open
      EVEN
HOST3  TEXT   '192.168.1.79:9640'        Host to open
      EVEN
    
```

Close TLP Connection

Function Close an open TIPI TLP Socket.

Parameters R0 = >0018 (opcode)
 R1 = Socket handle (MSB)

Results N/A

Parameter Description

Socket handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Example Code

```

LOOP
    LI    R0,>0018    Close TIPI TCP Socket
    LI    R1,>0100    TCP Socket Handle Byte (MSB)
    XOP  @TIPI,0     Access subprogram

TIPI  DATA 12      TIPI Library
    
```

Send TLP Message

Function Send a TIPI TLP message, maximum 8K characters.

Parameters R0 = >0019
 R1 = String pointer to write
 R2 = String length beginning after first three bytes of the string pointer destination.

Results R0 = >0000 all characters sent, not >0000 then error on sending string.

Parameter Description

String length String length is defined as:

1st Byte >24
 2nd Byte Socket handle byte >01 to >FF
 3rd Byte >03 (write command)
 4th Byte to 8K String up to 8K

Socket handle Socket handles will have a socket handle of a single byte from >01 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Example Code

```

LI      R0,>0019   Send String
LI      R1,HELLO  String Pointer
LI      R2,7      String length
XOP    @TIPI,0    Access subprogram

HELLO BYTE >24   TLP Extension
        BYTE >00  Socket handle
        BYTE >03  Write
        TEXT 'Hello'
        BYTE >0D,>0A  cr/lf

TIPI   DATA 12   TIPI XOP Library

```

Receive TLS Message

Function Receive a single character from the TIPI TLS Socket Messaging system

Parameters R0 = >001A
 R1 = String Pointer
 R2 = String length
 R3 = Socket handle (MSB)

Results R0 = Result code

Parameter Description

String Pointer An address in memory where data will be returned to a buffer in the program's physical 64K memory space.

String length The length of the buffer in memory to be processed. The Raspberry PI maintains a larger buffer passing up to the maximum amount of characters in the program's buffer. Upon return from the TIPI XOP call, the actual number of characters retrieved will be passed.

The string length shall not exceed the boundary of a 2nd page mapped in memory from the first physical page as only 2 x 8K pages are mapped into use during the TIPI XOP opcode call.

Socket handle Socket handles will have a socket handle of a single byte from >00 to >FF, assigned arbitrarily by the code it passes in the open command. Multiple sockets can be managed by the TIPI XOP within a single program or with several programs in a multitasking state.

Result code >0000 no character
 >0001 or greater, characters returned to the buffer.

Example Code

```

LOOP
    LI    R0,>001A    Receive string
    LI    R1,BUF      Buffer containing the characters
    LI    R2, 8192    Length of buffer
    LI    R3,>0100    TCP Socket Handle Byte (MSB)
    XOP   @TIPI,0     Access subprogram

    MOV   R0,R0       Test for status
    JEQ   LOOP        No character(s) received, run through loop again

TIPI   DATA 12      TIPI Library
BUF    BSS   8192    Buffer
    
```


TIPI Log Extension

Function Writes a message to the “tipi.log” file on the TIPI. Useful for Debugging purposes.

Parameters R0 = >001B
 R1 = String Pointer
 R2 = String length

Results Not Applicable

Parameter Description

String length String length is defined as:
 1st Byte >25
 2nd Byte to 8K String up to 8K

Example Code

```

LOOP
LI      R0,>0025   Receive a single character
LI      R1,HELLO  String Pointer
LI      R2,7      String length
XOP    @TIPI,0    Access subprogram

HELLO BYTE >25    TLP Extension
        TEXT 'Hello'
        BYTE >0D,>0A  cr/lf

TIPI   DATA 12    TIPI XOP Library
    
```