3270 TIP ERS

For NAM/CCP

By

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3270 TIPs

3270 TIPs are currently available via the Special Products Library for NOS/BE – INTERCOM 5 – CCI and NOS-NAM R4 – CCP3.1.

The TIPs are designed for use with the IBM 3270 Information Display System, using IBM's Binary Synchronous Communications (BSC) protocol.

The NOS/BE – INTERCOM 5 TIP is available and is being used in production at Rockwell International in Seal Beach, California. The INTERCOM 5 TIP has also been sold to SGIO in Australia, SUN LIFE in London and the Danish Post and Telegraph.

The NOS-NAM variant of the 3270 TIP is in development with completion expected in June or July (August delivery can be committed to customers). The NOS-NAM 3270 TIP has been sold to FERMINAL in Chicago, BPS in France, and the Korean Oil Company.

Following are the major features of the 3270 TIPs:

- Supported 3270 Control Units and Devices/Stations

  - 3271 Control Unit, Models 1, 2

  - 3274 Control Unit, Model 1C

  - 3275 Display Station, Models 1, 2 (without Dial feature)

  - 3276 Control Unit/Display Station, Models 1, 2, 3, 4

  - 3277 Display Station, Models 1, 2

  - 3278 Display Station, Models 1, 2, 3, 4

  - (NOS/BE only) 3284, 3286, 3288 printers

  - (NOS/NAM only) card reader support (magnetic – id card) is implicitly available in transparent mode

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○ Configuration

   ○ The TIPs will support multiple 3270 display devices connected to a 3270 Control Unit and multiple 3270 Control Units on one communication line. The addressing scheme of the 3270 allows up to 32 Control Units on a multi-point line and up to 32 devices per Control Unit. The NOS-NAM TIP will not impose any additional limitation on the configuration. NOS/BE - INTERCOM 5 limits support to 12 Control Units on a line where each may have a maximum of 11 consoles and 8 line printers.

○ Line types

   ○ Basically 3 line types (synchronous) line types are supported by the TIP:

      – Dial-up, with the restriction of the 3270 point-to-point (dial) feature because that is a different protocol (no polling/selecting!).

      – Dedicated, controlled carrier. The TIP will raise and drop the carrier with every transmission (the Control Unit can run with either controlled or constant carrier).

      – Dedicated, constant carrier. The TIP will keep the carrier up (the Control Unit can run with either controlled or constant carrier).

○ Line speeds

   ○ The TIP will not impose a limit on the transmission line speeds, except with respect to timing out the largest possible block sent to the terminal, a lower limit is assumed of:

      –   600 BPS for screensize up to 480 characters
      – 1200 BPS for screensize up to 960 characters
      – 2000 BPS for screensizes over 960 characters

The upper limit depends on the capacity of the 255x (at least 19.2 KBPS).

○ Use of General Polls

   ○ Input will be solicited by the TIP through issuing General Polls to each of the configured Control Units. Output will be sent to a display device after the TIP has successfully selected the device.

- **Code Set, Protocol**

  - The TIP will support the EBCDIC versions of the 3270.

- **Display Support**

  - The TIPs will allow the 3270 terminal user to have CYBER applications interact with the terminal as follows:

    - **NOS/BE – INTERCOM 5**

      - Interactive (line) mode – 96 char ASCII

    - **NOS – NAM**

      - Virtual, through use of IVT

      - Transparent. This mode allows the user to make use of the special 3270 Data-Protect features.

The recommended sell price for the 3270 TIP is $12,500 per copy. For additional information, please contact either

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>   (612) 830-6901

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TABLES

This section describes a TIP for use with the IBM 3270
Information Display System when remotely attached to a
2550.   The protocol used is IBM's Binary Synchronous
Communications (BSC) operating as multipoint data links.

FEATURES

- 3271 Control Unit, Models 1, 2

- 3274 Control Unit, Model 1C

- 3275 Display Station, Models 1, 2 (without
  Dial-feature)

- 3276 Control Unit/Display Station Models 1, 2, 3, 4

- 3277 Display Station, Model 1, 2

- 3278 Display Station, Models 1, 2, 3, 4

- EBCDIC code set

- BSC protocol

- up to 32 controllers (clusters) on a line where each
  cluster may have a maximum of 32 Display Stations
  (devices)

- data protect is supported in transparent mode (IVT)

- card reader support (magnetic-id card) is implicitly
  available in transparent mode

- line printers are not supported

- auto recognition not performed

LINE CONTROL

The TIP commences to service a line as soon as the line is
enabled.

The TIP reports line operational if the modem and CLA
signals are present, otherwise, line inoperative. If
during normal operation the line becomes inoperative, the
TIP will suspend activity on the line and report line
inoperative.

Under normal conditions the TIP will issue one general

poll per second to each cluster and then, if needed, issue

specific polls to all devices on that cluster.

The input process will terminate when the cluster

controller indicates it has no more traffic.

A device will be selected as soon as output is available

and the device is ready to receive data.

The invitation to input or output will rotate around all

the cluster controllers on the line.

OPERATIONAL OVERVIEW

The TIP will control activity on a 3270 by polling for

input and selecting for delivery of output.

The 3270 station is under control of the TIP in either of

two modes:

    control mode

    text mode

In control mode, the station is monitoring the line for a valid poll/select sequence. When detected, the station enters the text mode. In text mode, the station is either the master or slave station with the TIP assuming the opposite role.

When the entry into text mode is the result of a poll, the station is the master, the TIP is the slave. When transition is caused by a select, the roles are reversed.

In text mode, blocks of data are transferred from master to slave, one at a time with a positive acknowledgement being required for each block prior to delivery of the next. The master normally determines the end of transfer and uses the "EOT" sequence to cause return to the control mode.

The 3270 generates s   us information to assist in the correct functioning   its devices. The status will be processed by the TIP
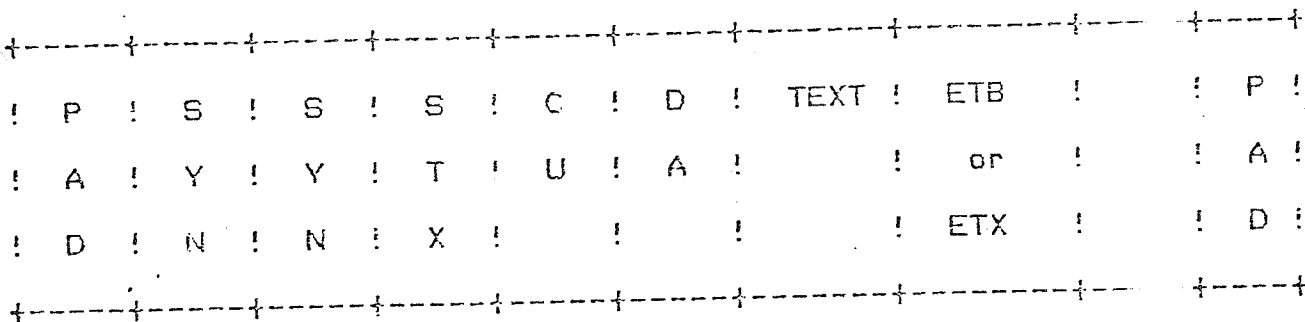
The code set is EBCDIC. EBCDIC will be translated to
ASCII prior to delivery to the host. All downline data
received from the host is also in ASCII, the TIP will
translate to EBCDIC before delivery.

EBCDIC requires standard BSC CRC.

CRC polynomial is: $X16+X15+X2+1$

7.0   TRANSMISSION_BLOCKS

7.1   INPUT

```
+------+------+------+------+------+------+--------+---------+----- +----+
! P  ! S  ! S  ! S  ! C  ! D  ! TEXT ! ETB    !      ! P !
! A  ! Y  ! Y  ! T  ! U  ! A  !      !  or    !      ! A !
! D  ! N  ! N  ! X  !    !    !      ! ETX    !      ! D !
+------+------+------+------+------+------+--------+---------+----  +----+
```

        CU = cluster unit poll address
        DA = device address   X'7F'
        PAD = x'55' at start of block and X'7F' at end
              block. The leading PAD (x'55') is required   start
              the clock of some older 3270 Controllers. ‾   TIP
              does not require to receive the leading PAD. t only
              looks for 2 SYNC's.

```
+----+-----+-----+-----+-----+---------+----+-----+-----+
! P  !  S  !  S  !  S  !  S  !  TEXT   ! E  !  C  !  P  !
! A  !  Y  !  Y  !  Y  !  T  !         ! T  !  R  !  A  !
! D  !  N  !  N  !  N  !  X  !         ! X  !  C  !  D  !
+----+-----+-----+-----+-----+---------+----+-----+-----+
```

. periodic "SYN" insertion will be necessary for output
blocks whose transmission time exceeds one second.

8.0   INTERNAL_BLOCKS

8.0.1   General_Poll/Poll_Sequence

```
---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
 P ! S ! S ! S ! E ! P ! S ! S ! S ! C ! C ! G ! G ! E ! P !
 A ! Y ! Y ! Y ! O ! A ! Y ! Y ! Y ! U ! U ! P ! P ! N ! A !
 D ! N ! N ! N ! T ! D ! N ! N ! N !   !   !   !   ! Q ! D !
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
```

first 5 characters clear any cluster controller from
text mode (the EOT-sequence).

GP = general poll code in place of DA for general
polls (x '7F' in EBCDIC).

'7F'

. . Device Response

Any device having an input requirement may be
internally selected by the 3270 cluster controller.
The response may be an input message, a test request
message or device status information.

The cluster controller will start at random a device
and input all device messages, sequentially, as long
as "ACK"s are received to blocks until all devices
have been serviced. The first 2 characters of the
first block of each input message identify the
responding device.

The TIP will send blocks terminated by "ETB"s as "BLK"
blocks; terminated by "ETX" as "MSG" blocks to the
host.

. No Traffic/End Traffic Response

The cluster controller may respond with an "EOT". The
tip moves on to its next phase of line service.

\

N number of retries will be attempted. After N
retries the device or cluster will be declared
inoperative by the TIP. If the cluster is declared
inoperative, then by default, all the devices on the
cluster will be declared inoperative.

8.0.2   Select Sequence

```
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
! P ! S ! S ! S ! E ! P ! S ! S ! S ! C ! C ! D ! D ! E ! P !
! A ! Y ! Y ! Y ! O ! A ! Y ! Y ! Y ! U ! U ! A ! A ! N ! A !
! D ! N ! N ! N ! T ! D ! N ! N ! N !   !   !   !   ! G ! D !
  -+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
```


8.0.2.1   Response to Selection

    ACKO

    The device has entered the text mode and is ready to
    receive the message.

    WACK

    The device is busy. Output will not be attempted
    until the device indicates end of busy.

The device has pending status or is unavailable. The
TIP terminates the select sequence and specifically
polls the device to obtain status.

. Timeout or Bad Response

Action is the same as for polls.

9.0   DATA_TRANSFER_PHASE

9.1   MASTER

The TIP enters the data transfer phase in the master role
after a successful select sequence. All messages in the
queue are delivered to the terminal. Each text message is
prepared for output with the appropriate communications
envelope and a redundancy checking CRC. The anticipated
response to the first message delivered is ACK1 and for
subsequent messages, the acknowledgement alternates
between ACK0 and ACK1. When the last message is
successfully delivered, the TIP returns the selected
terminal to the control mode by use of the "EOT" sequence.
The TIP limits the number of transmissions blocks sent to
the terminal during one selection sequence to 4.

- ACKO/ACK1

  Alternating acknowledgements to correctly received
  messages. Action is to prepare and deliver the next
  message, if any, or return the device to the control
  mode.

- WACK

  Acknowledges the output message but indicates the
  device is now busy. The TIP issues an "EOT" causing
  the device to return to control mode. Some time
  later, the TIP will again select the device.

  EOT

  Device is unable to perform the operation requested by
  the transaction. The TIP issues a specific poll to
  obtain the device status.

The previous message was received in error. After N
"NAK"s, the TIP will terminate the selection with an
"EOT" sequence and declare the device inoperative.

. Timeout or Invalid Sequence

Action is the same as for polls.

9.2   SLAVE

The TIP enters this phase as a result of a successful poll.

The 3270 cluster star   a search at some random device and
scans all devices in   n. Each device which has data
pending (including s   s) will input. The TIP will
acknowledge each bic   eceived, with alternating
ACKO/ACK1.

The first block of ea   message identifies the responding
terminal by containi   the CU and the DA. These
characters immediate.   ollow the STX. Status and test
request messages car   SOH and two id bytes prior to the
STX.

. Data Blocks

The TIP performs the appropriate redundancy check on
each data block. For the first block successfully
received after a role reversal or poll, an ACK1 is
returned. For each succeeding block, the ACK is
alternated. Status messages are identified by the
characters "%R", immediately following the "SOH."

. Data Block Ending in ENQ

The 3270 terminates a data block abnormally with an
"ENQ" charac-   upon detection of internal errors.

The TIP "NA-   the block. The 3270 is expected to
respond with   "EOT". The TIP performs a specific
poll to obta: status. The status will be such that
the device i: eclared inoperative.

. EOT

The 3270 sen: n "EOT" sequence to end a normal data
transfer sequ   :e. The TIP enters control mode and
performs the -   :t task in turn for the line.

The TIP "NAK"s bad blocks. The 3270 does not count
"NAK"s. The TIP will count "NAK"s, send out and allow
the 3270 for N retries.

. Timeout

The TIP must timeout a 3270 when operating in the
slave mode during data transfers. If the 3270 does
not continue a data transfer sequence, the TIP must
regain control of the line in order to continue
servicing other 3270 lines. The TIP must commence a
timeout after each response to a data block.

I. he 3270 does not continue the transfer within the
t.   T, the TIP must abort the transfer with an EOT
se   -nce. Action at this point is the same as for
F.   sequences.

T .s 1 second for the data to get started and 3
se   nds during transfer of the data.

- TTD
- Forward Abort
- Conversational Mode
- 3275 dial-feature

.O   EXCEPTION_HANDLING

The 3270 has self diagnostic capabilities. This results
in presentation of status messages from cluster
controllers with devices experiencing abnormal
conditions. Some information in such messages requires
action by the TIP to modify the communications activity of
the terminal, e.g., device busy, r= busy, inoperative,
operative, etc.

1.1   STATUS MESSAGE FORMAT

```
+-----+-----+-----+-----+-----+-----+-----+------ ------+-----+-----+
!  S  !  %  !  R  !  S  !  C  !  D  !  E  !  S  !  E  !  C  !
!  O  !     !     !  T  !  U  !  A  !  E  !  S  !  T  !  R  !
!  H  !     !     !  X  !     !     !  C     1  !  X  !  C  !
+-----+-----+-----+-----+-----+-----+--- ------+-----+-----+
```

- % after "SOH" signifies status message

Table 1.

The status message is returned for a device under the
following conditions:

- general poll
  for all conditions other than device busy or
  unavailable

- specific poll
  all conditions

If error conditions occur during a data transfer phase,
status is returned.

The TIP will be fo   into performing a specific poll to
obtain status in t   ollowing cases:

- "RVI" in respo-   to a selection

- "EOT" in respon== to output of data

- input block te- ated by "ENQ".

During normal operation of the line, BSC will detect
various fault conditions, all of which (if they persist)
will result in the cluster controller being declared
inoperative.

Detection of failure of individual devices on a cluster is
only possible by examination of status messages.

The busy condition is signified by a "WACK" response to a
select, followed by a status message indicating busy
response to a specific poll or more normally, a "WACK"
response to an output message. In both of these
conditions, further output must not be attempted until
device end (non-busy) status is received in response to
the normal general poll/poll sequences.

Since any declaration of a terminal inoperative require
corresponding method of detecting a return to the
operational state, the actions by the TIP are limited to
positive failure cases.

- detect terminal I/O malfunctions

- monitor device available/unavailable, ready/not ready, busy/not busy

The TIP will not output to a device which is not ready, not available or busy.

A device will be reported as inoperative if

- it malfunctions

- it goes not ready or not available and this has not yet been reported.

A device will be reported as operational if it goes from not ready or not available to ready and available, or when input is received for an inoperative device.

A controller or line failure will be detected by one of
the following methods

- invalid or no response to N successive polls.

- invalid or no response to N successive selects.

- "NAK" response to N successive block retransmissions.

- Timeout of input data phase.

Each of these conditions will result in the cluster
controller, or the device which was currently being
actioned, being declared inoperative.

The controller will be set to the slow poll mode.   the
slow poll mode, a controller is polled once per 10
seconds. Only one attempt is made to establish co-   t
with the controller during the slow poll mode. If - e
controller responds with a valid sequence other tha EOT,
the device that responded is declared operational :   he
TIP and normal polling of the cluster controller is
resumed.

can only be obtained through a specific poll can be
received by the TIP.

A controller becomes operational as soon as a device on
that controller becomes operational. A device can become
operational by correctly sending data or status (good
status).

As soon as the first device on a controller becomes
operational, the TIP will assume normal general-polling
(one per second).

2.1   RETRIES

The TIP will attempt the following retries in case of
consecutive errors:

.   15 on NAK's or CRC-errors received.

.   7 on ENQ's, Time-outs or Bad-responses.

.   3 on Text-terminated-by-ENQ or ACKO/ACK1
    out-of-sequence.

In case of mix consecutive errors the TIP has a retry
limit of 31.

13.1   NORMAL INTERACTIVE MODE

In this mode all the standard IVT features (page-wait,
auto-input, line-folding, CR/LF in text,·format-effectors)
are supported by the TIP. In addition, the TIP will after
having sent all the available output to the terminal, send
a blank line to the screen. This line will unlock the
keyboard and give the terminal-user space to enter a next
line of input.

13.1.1   Page-wait

The TIP will =clare a terminal in page-wait as soon as a
screen-full   output is sent to a terminal without any
reception c=   ut inbetween. Any input received
afterwards ь   take the terminal out of page-wait and
output trans-   sion will continue.

The TIP will =isplay a message (OVER..) at the bottom of
the screen, -   lecting the page-wait condition and the
fact that mc-   output is available.

by hitting the CLEAR key. This will cause the screen to
clear and the next line of output to start at the
top-of-screen.

13.1.2   Auto-input

After a block of auto-input is sent to the terminal, the
TIP will upon reception of a text-block from the terminal,
send the first 20 characters of output and the received
text as one block to the host-application that requested
this auto-input.

13.1.3   IVT_Commands

The TIP allows the following IVT commands to be sent by
the host-application to the terminal-user:

.   PW Page width (default - 80, range 20-255)

.   PL Page length (default - 24, range 12-255)

.   PG Paging on/off default - ON range ON, OFF)

- CT Control character (default - %)

- TC Terminal class (must enter % TC = 28)

User breaks are supported but not as special alterable
input-characters. The TIP interprets the
Program-attention keys as breaks. (PA1 = User-break 1,
PA2 = User-break 2).

The TIP does not support the Cancel, because the terminal
allows the user to locally cancel text before hitting the
ENTER (send) key.

13.1.4   Format-effectors

The ¯   allows all valid Format-effectors with the
exce⁻   ⊃n of the NO-ACTION which is treated as
Pre-¯   it-one.

Home- _rsor and Clear-Screen format-effectors will force
the ꞇꞇrminal into page-wait unless the last interaction
with   e terminal was input.

A Pc⸗ rint FE will be given an additional pre-print-one
after   iput is received, such that output will not
overw-.te the input on the screen.

The TIP replaces a CR/LF or LF/CR sequence logically by a
Format-effector, Pre-Print-One. CR/LF sequences can force
the terminal into page-wait in the middle of a logical
line.

3.1.6   Line_Folding

If downline logical-lines are larger than the page-width,
the TIP will perform line-folding. Folded lines will not
force the TIP into page-wait. More than 3 folded lines
out of one logical line can cause the TIP to overwrite
text on the screen not yet seen by the user.

13.1.7   Cursor-control

In the non-transparent mode, the ⁻   supplies all
cursor-addresses for output. The   minal-user has
control over where the next line :   utput goes after
input: After a line of input, th: IP will start output
on the screen one line from where ⁻ie user left the cursor
(normally this will be the next l:⁻: after input).

In this mode, all the data-protect features of the 3270 display are available to the application.

13.2.1   Downline

The application will have to construct a screen-full of protected/unprotected fields and supply all the desired attribute-characters and screen-buffer-addresses for the fields. The first character of a downline block must be a valid (allowed) command-code (such as clear-screen, etc.) The TIP remains responsible for preceding the block of output by SYNC-characters, Start-of-text, and Escape-char, and attaches ETX, CRC, PAD at the end. The TIP will also translate all downline data ASCII to EBCDIC and perform SYNC-fill.

Allowed Command-codes are:

- Normal-write   x'31'

- Erase-write   x'35'

- Erase-unprotected   x'31'

Invalid Command-codes are replaced by an x'31' (normal write).

A typical start of a field would be:

- SBA   Set-buffer-address x'11'

- BA1   Buffer-address-1   See 3270 manuals,

- BA2   Buffer-address-2   all in ASCII.

- ATT   Attribute-char.

The attribute-character determines e characteristics of the field:

- protected
- unprotected
- intensified
- numeric shift
- etc.

- Erase-unprotected   x'3F'

Invalid Command-codes are replaced by an x'31' (normal write).

A typical start of a field would be:

- SBA   Set-buffer-address x'11'

- BA1   Buffer-address-1   See 3270 manuals,

- BA2   Buffer-address-2   all in ASCII.

- ATT   Attribute-char.

The attribute-character determines the characteristics of the field:

- protected
- unprotected
- intensified
- numeric shift
- etc.

REMOTE STATUS AND SENSE BYTE DEFINITION

Bit

No.   Bit Definition

             S/S Byte 0;

0,1   Not Used

2   Reserved.

3   Reserved.

4   Device Busy (DB) - This bit indicates that the addressed

             device is busy executing an operation or that a busy

             detection was previously made by a command or a print

             operation, accepting data from the Operator Identification

             Card Reader, or performing various keyboard operations

             (Erase Input, Backtab, and Clear).

             This bit is set with Operation Check when a Copy command

             is received which specifies a "busy" device with its

             "from" address.

This bit is set with Unit Specify when a command is addressed to a busy device. This can occur by chaining a command to a Write, Erase/Write, or Copy command which started a Printer or by chaining a command to a Specific Poll addressed to a busy device.

5 Unit Specify (US) - This bit is set if any S/S bit is set as a result of a device-detected error, if a command is addressed to a busy device.

6 Device End (DE) - This bit indicates that the addressed device has changed from unavailable to available and not ready to ready, or busy to not busy. This bit is included during a Specific or General Poll but is not considered pending status by a Selection Addressing sequence.

If a Selection Addressing sequence detects that the addressed device has pending status and also detects one of the above status changes that warrants a Device End, then the Device End bit is set and preserved along with the other pending status, and an RVI response is made.

7 Transmission Check — - Not used by the 3271. This bit is set when the 3271 detects a BCC error on the TCU transmission.

S/S Byte 1:

0,1   Not Used.

2   Command Reject (CR) - This bit is set upon receipt of an
           invalid 3270 command (or Copy command if this feature is
           not installed).

3   Intervention Required (IR) - This bit is set if:

           .   A Copy command contains a "from" address in its data
               stream which specifies an unavailable device.

           ~~.   A command attempted to start a printer but found it
               not ready. The printout is suppressed.~~

           Intervention Required (IR) - This bit is set if:

           .   The 3271 receives a Selection Addressing sequence or a
               Specific Poll sequence for a device which is
               unavailable or which became not ready. A general Poll
               sequence does not respond to the unavailable/not ready
               indication and proceeds to determine the state of the
               next device.

The 3271 receives a command for a device which the 3271 has logged as unavailable or not ready.

4 Equipment Check (EC) - This bit indicates 3271 detected bad parity from the device.

5 Data Check (DC) - This bit indicates the detection of a parity or Cursor check in either the 3271 or a device buffer or in the 3275 buffer, or 3271 detected bad parity from the device.

6 Control Check (CC) - This bit is set with Control Check, Intervention, Data Check, Device Busy, or Data Check with Unit Specify to indicate that the errors that set these sense bits were detected while the 3271 was executing an operation with the "from" device during a Copy command. This bit is set with Unit Specify to indicate that the "from" address in a Copy command specified a device with a "locked" buffer (the device data is secure).

The TIP will receive input in transparent mode as long as the applications sends downline transparent data. So the first transparent output will signal to the TIP to receive input in transparent mode and vice versa. Note the TIP command to interpret input in transparent mode is supported by the TIP (but it does not seem to be to useful).