Vanguard Managed Solutions

Vanguard Applications Ware
Serial Feature Protocols

Transparent Bit Oriented Protocol (TBOP)

Notice

575 West Street
Mansfield, Massachusetts 02048
(508) 261-4000

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To comment on this manual, please send e-mail to LGEN031@vanguardms.com

Overview

Introduction

This manual describes how to configure the TBOP option on Vanguard platforms. It contains basic instructions on configuring TBOP for your nodes, including information about features, limitations, configuration, and statistics.

Alarms and Reports

For details about the alarms and reports for the TBOP protocol, refer to the *Vanguard Applications Ware Alarms and Reports* Manual (Part Number T0005).

In This Manual

About the Transparent Bit Oriented Protocol

What Is TBOP?

The Transparent Bit Oriented Protocol (TBOP) is a transmission protocol that complements the suite of access protocols such as SDLC and XDLC. These protocols offer flexibility for connectivity and efficient use of WAN bandwidth. In contrast to spoofed access protocols, TBOP has the flexibility to pass most BOP protocols. You can deploy TBOP on access ports and use it in most applications operating with BOP-based protocols.

Features

TBOP has these key features:

- Port speeds up to 2048 Kbps, depending on port hardware
- Access to Frame Relay networks via the SPFM module
- Access to X.25 networks
- Support of constant bit rate applications such as video
- Maximum frame size of 16384 bytes
- Pipelining of frames in receive direction

Receive Pipelining eliminates the need to wait for a complete frame to be received by the TBOP port before it is forwarded to the remote TBOP port. With receive pipelining, the frame being received is broken up into pieces (packets) and forwarded to the remote TBOP port. The sizes of the TBOP packets are determined by the lesser of the user configurable “Receive Byte Count” and the packet size on the networking link that the call is routed through.

Note

Transmit Pipelining is not implemented on the TBOP. The remote TBOP buffers all the packets of a remote frame and does not start to send them out to the attached device until the complete frame is received.

Limitations

TBOP has these limitations:

- BOP frames must be delimited with at least 1 flag or mark idle, and the frame must have a CRC-16 trailer.
- Support of maximum frame size of 16384 bytes and receive pipelining is limited to the serial ports on Vanguard products and the 6500*PLUS* CPU card.
- Constant Bit Rate support does not provide synchronized clocking end to end.TBOP’s receive queue size is configurable which allows the user to choose the worst case accumulated delay. Data loss occurs periodically, the application must be able to recover from this.
- Statistical multiplexers that continuously transmit small frames may make TBOP difficult to implement. Statistical multiplexers transmit a high rate of frames per second, so the load on the CPU is objectionably high. (Some statistical multiplexers can be configured to reduce the transmission rate of these small frames, which are typically sent during idle periods.)

Typical Applications

Introduction

This section contains descriptions and configuration examples for typical applications of TBOP:

- TBOP Over X.25
- TBOP Over Frame Relay
- Constant Bit Rate Application

TBOP Over X.25

Description

The configuration example shows how to use TBOP ports to connect over an X.25 network. TBOP at node 100 originates the call to TBOP on node 200.

Implementation Notes

When you are connecting with TBOP over a switched network, such as X.25, the call may be initiated either automatically or when the DTE equipment connected to TBOP raises the EIA signal DTR.

DTR maintains a network connection while this EIA signal is high. DTR-based calling is enabled when the Connection Type is set to either DTR, DTRD, or DTRP.

You should use Autocalling to establish and maintain calls through the network. The autocalling parameters offer the flexibility to persist indefinitely to establish the connection or for a finite number of attempts. Autocalling is enabled when the Connection Type is set to SIMP. When the TBOP port exceeds the configurable number of autocall attempts, a port boot is required for the TBOP port to restart autocalling.

Example

Figure 1 shows how to configure the node to run TBOP over an X.25 connection:

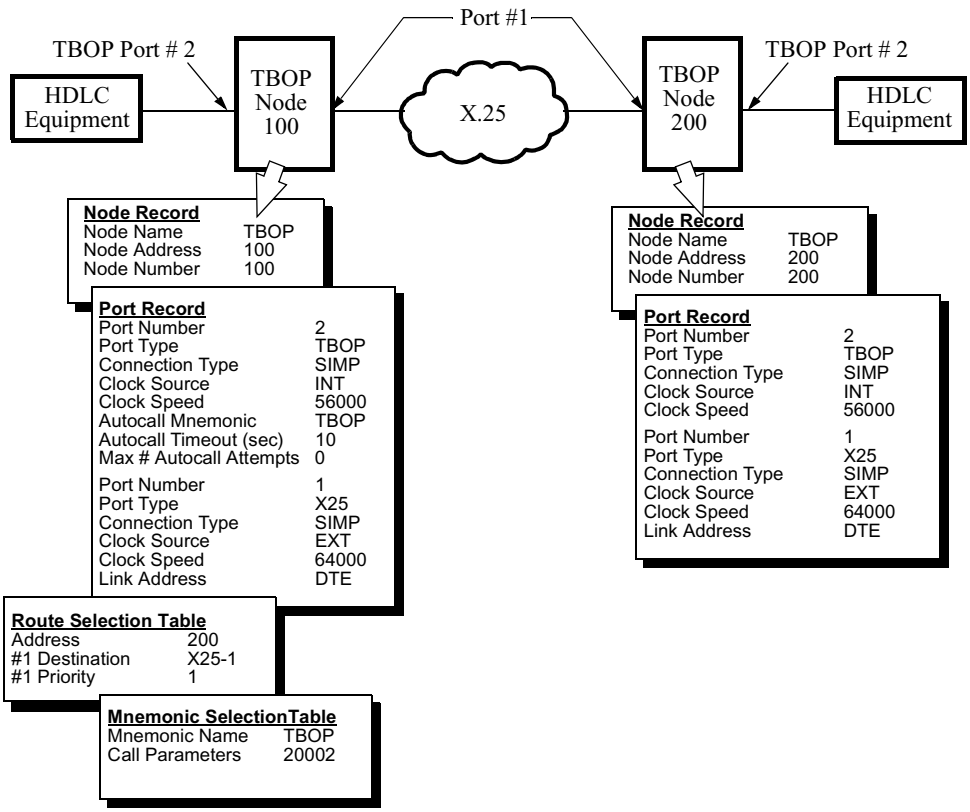

Figure 1. TBOP over X.25

TBOP Over Frame Relay

Description

This configuration example illustrates how to use TBOP to connect over a Frame Relay connection.

Implementation Notes

When you connect TBOP over a Frame Relay network, the following points are relevant:

- The autocall parameters are not meaningful (because Autocalling can only be deployed on a switched connection).
- The Connection Type parameter should always be set to SIMP.
- The Serial Protocol Forwarder Module (SPFM) is used to establish a static circuit from TBOP to a Frame Relay BYPASS station.

Example

Figure 2 shows how to configure the node to run TBOP over a Frame Relay connection:

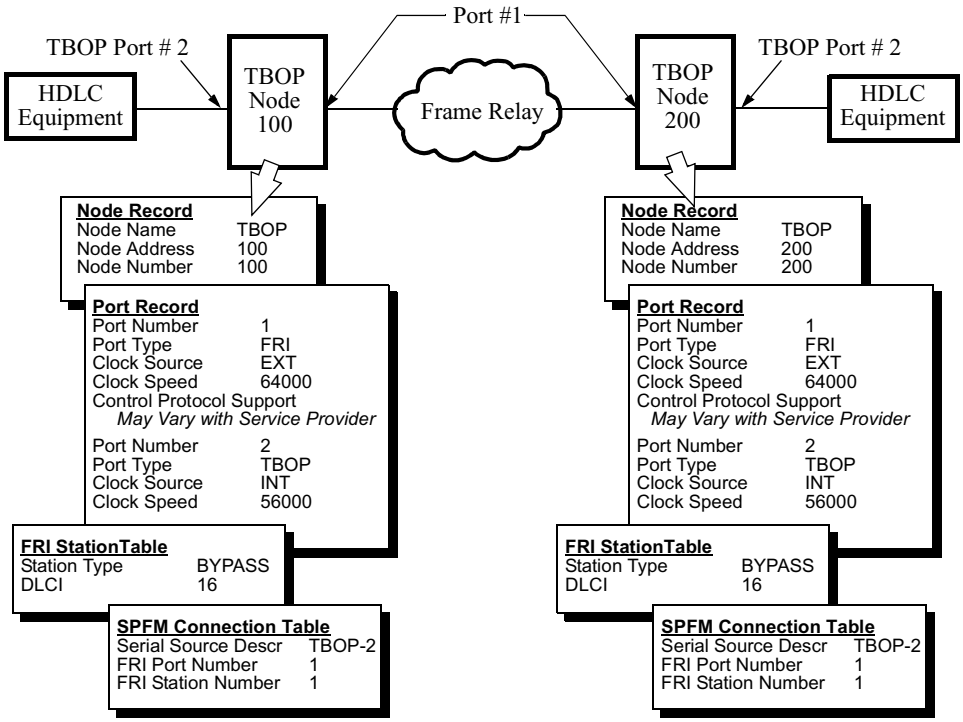

Figure 2. TBOP over Frame Relay

Constant Bit Rate Application

Description

This section describes how to use TBOP in a Constant Bit Rate Application, such as Video. TBOP's video support has been successfully tested with VTEL equipment, and it may be supported by other video equipment manufacturers that operate within the limitations stated earlier in this document.

Constant Bit Rate

The Constant Bit Rate (CBR) option allows HDLC frames to be transmitted and received with as few as one HDLC flag to delimit the frames. This table shows how TBOP controls the Transmission (Tx) Queue:

Without CBR	*With CBR*
When TBOP detects its Transmission Queue is congested, TBOP notifies the network that it is congested before this queue overflows. In a Frame Relay network, TBOP's congestion results in a Backward Explicit Congestion Notification (BECN) signalled towards the network.	TBOP does not signal that it is congested because the source of the traffic always transmits at a constant rate. TBOP never notifies the network that it is congested (that is, a BECN is never sent).
In the event that the transmission queue is filled to capacity, additional TBOP frames received from the network would be discarded as they arrive.	Once the transmission queue is filled to capacity, it is completely purged. The Transmission Queue becomes congested on the TBOP port with a slower clock.

Tx Queue Size

You must select the Tx Queue Size based on the worst case delay that can be tolerated. Initially, the video session has a negligible delay. The TBOP port operating at the slower speed has an increasing delay during a video session until the transmission queue is filled to capacity, at which time it is purged. The video equipment re-synchronizes and the session proceeds with a negligible delay and continues this cycle indefinitely.

Examples of TX Queue Size and Delay

This table provides some values for Tx Queue Size based on VTEL's HDLC frame. The VTEL HDLC frame (259 bytes) consists of the following components: 256 bytes video + 2 byte CRC + 1 HDLC flag.

Tx Queue Size Values	*1/4 sec delay*	*1/2 sec delay*	*3/4 sec delay*	*1 sec delay*
256 Kbps	31	62	93	124
384 Kbps	46	93	139	185
512 Kbps	62	124	185	247

Figure 3 shows a formula that you can use to calculate Tx Queue Size for any constant bit rate application:

$$TxQueueSize = WorstCaseDelay \times \frac{TBOPLinkSpeed}{8bits} \times \frac{1}{video + CRC16 + flag}$$

Figure 3. Formula For Calculating Tx Queue Size

Figure 4 shows a formula that you can use to calculate the resulting interval (in seconds) between purges of the transmission queue:

$$PurgeInterval = \frac{TxQueueSize \times (video + CRC16 + flag)}{\left(\frac{FasterTBOPspeed - SlowerTBOPspeed}{8bits}\right)}$$

Figure 4. Formula For Calculating Interval Between Queue Purges

Note

The slow rate of purging the transmission queue coupled with VTEL's expedient re-synchronization has a negligible effect on the video session.

Example

Figure 5 shows how to configure the node to run TBOP using the CBR option:

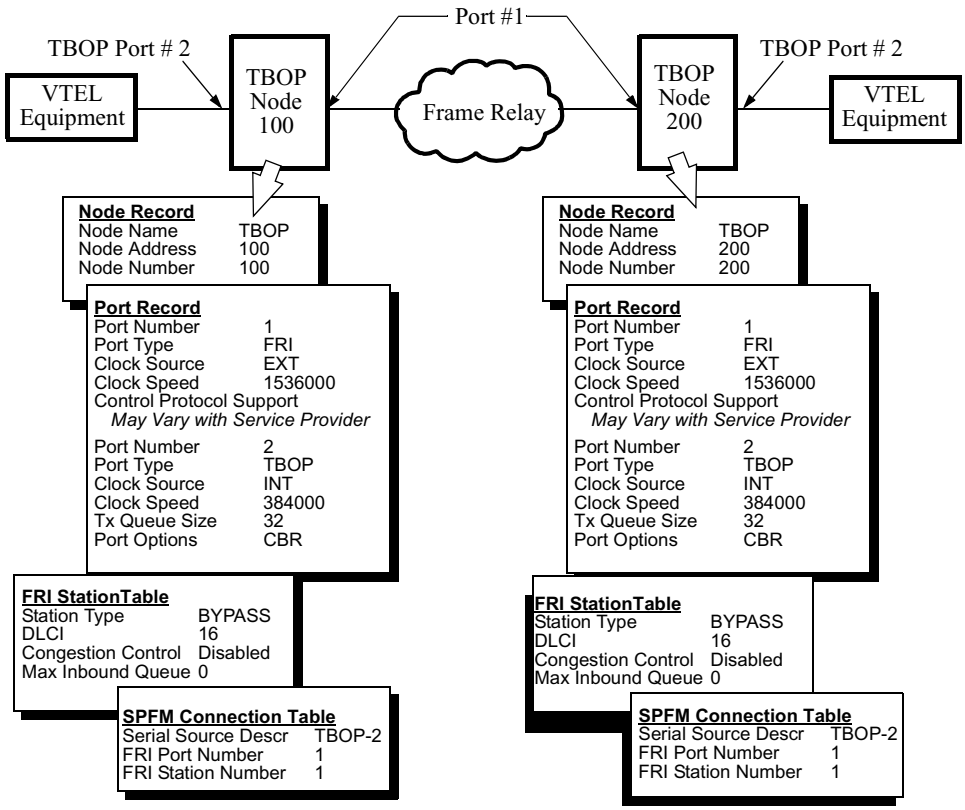

Figure 5. TBOP With CBR Option

Configuration

Introduction

This section explains how to configure parameters for a TBOP port.

Configuring a TBOP Port

Figure 6 illustrates the TBOP port configuration parameters.

Note

For this configuration to take effect, you must boot the node. For information about booting the node, refer to the *Vanguard Basic Configuration Manual* (Part Number T0113).

If you have enabled Ease of Configuration, you need to boot only the port to make changes to the parameters marked with an asterisk. For more information, refer to the Ease of Configuration section in the introductory portion of the binder (*Serial Feature Protocols Manual*, Part Number T0102).

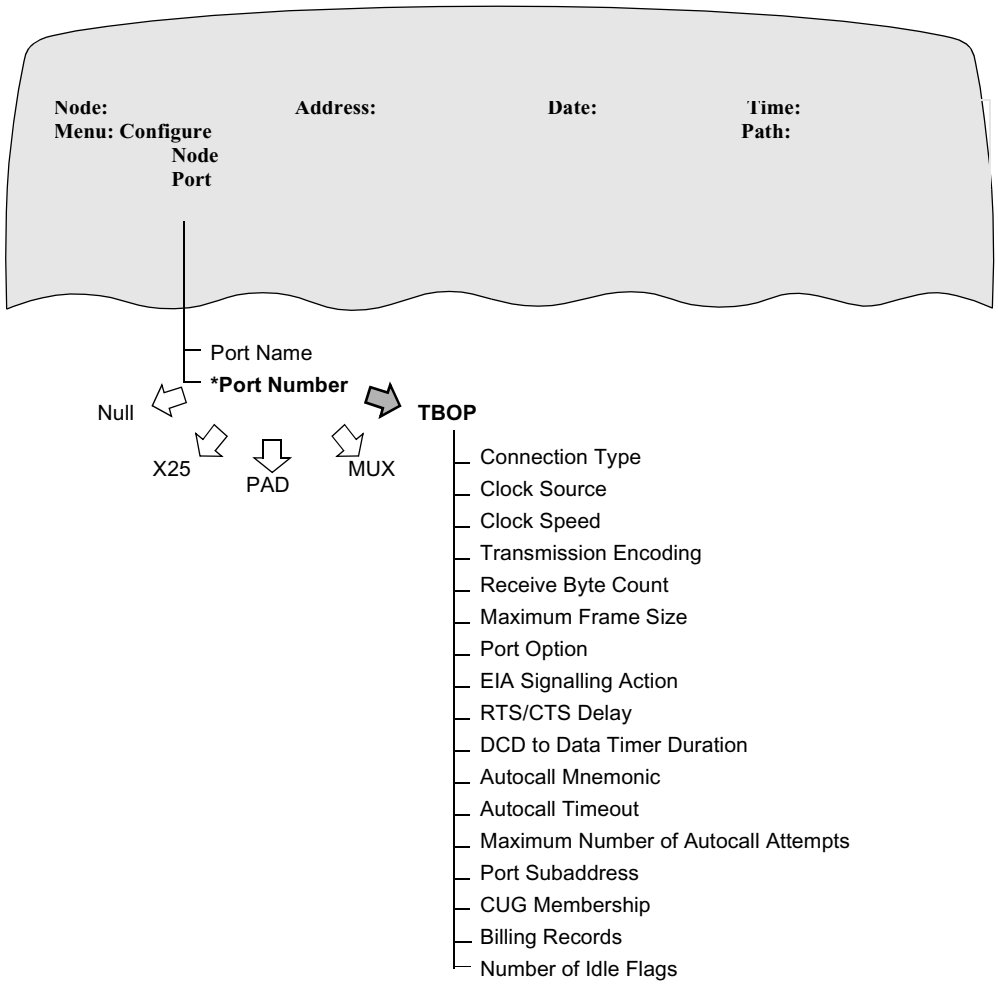

Figure 6. Configure TBOP Port Record and Parameters

Transparent CCS

When Transparent CCS, which uses TBOP, is operating, only these parameters appear:

- Tx Queue Size
- EIA Signalling Action
- Autocall Mnemonic
- Autocall Timeout
- Maximum Number of Autocall Attempts
- Port Subaddress
- CUG Membership
- Billing Records

The other parameters do not appear because they do not apply when TBOP is operating over a physical T1/E1 port. For more information about Transparent CCS, refer to the Voice Option manuals in the *Vanguard Multimedia Feature Protocols Manual* (Part Number T0104).

Configuring a Virtual Port

If you are configuring a virtual port, only the following parameters appear in a TBOP record:

- Autocall Mnemonic
- Autocall Timeout
- Maximum Number of Autocall Attempts
- Port Subaddress
- CUG Membership
- Billing Records.

Others parameters relevant to physical operation of a port are not listed in a virtual port record.

TBOP Parameters

These are the TBOP port configuration parameters:

Connection Type

Range	SIMP, DTR, DTRD, DTRP
Default	SIMP
Description	Specifies the type of control signal handshaking required before logical connections can be made to this port. • SIMP (Simple): Select this when the terminals are wired to the port with a cable that has a minimum of conductors so that no control signals are used. Such cabling provides only ground, transmit and receive data, transmit and receive clock. Control signals from the port are maintained high. • DTR: Use this when the device connected to the port provides DTR to maintain the EIA connection. • DTRD: DTR signal required. DCD, DSR, CTS drop for one second between calls. During the control signal drop, the port is unable to receive calls. • DTRP: Use this in applications where DTR is passed end to end.

Clock Source

Range	EXT, INT
Default	EXT
Description	Specifies the source of clocking: • INT: Port provides clocking • EXT: External device provides clocking signals. When set to EXT, the port's clock speed is determined by an external device, and the clock speed must be set to the external clock’s speed.

Clock Speed

Range	1200 to 2048000
Default	9600
Description	Specifies the speed of the port in bits per second. This parameter must be set to the external device's clock speed when the parameter Clock Source=EXT.

Transmission Encoding

Range	NRZ, NRZI
Default	NRZ
Description	Specifies the type of transmission coding used on this TBOP link. • NRZ: Non-Return to Zero • NRZI: Non-Return to Zero Inverted

Receive Byte Count

Range	128, 256, 384, 512, 640, 768, 896, MAX (1024)
Default	MAX
Description	Specifies the number of bytes that are collected before data is forwarded to the network. This parameter can be used to decrease the network delay by controlling the rate of pipelining.

Maximum Frame Size

Range	1036 - 16384
Default	4500
Description	Specifies the maximum allowable frame size (in bytes).

Tx Queue Size

Range	16-800
Default	32
Description	Specifies the size of the transmission queue. When the transmission queue is full, it purges all the frames in it. You must select the Tx Queue Size based on the worst case delay that can be tolerated. **Note** Perform a Node boot for changes to this parameter to take effect.

Channelized T1/E1 Connectivity

Range	NO,YES
Default	NO
Description	Specifies if a frame check sequence is generated for transmitted frames and if the frame check sequence is stripped from received frames. Set to YES when connecting to a virtual TBOP port which maps to a T1 or E1 port. • YES: Generate FCS for transmitted frames and strip FCS from received frames. • NO: Don't generate FCS for transmitted frames or strip FCS from received frames.

Port Option

Range	NONE, MARKi, CBR
Default	NONE
Description	Specifies the type of idle that is used between frames. • NONE: Port uses Flag idle between frame exchanges. • MARKi: Port uses Mark idle between frame exchanges. • CBR (Constant Bit Rate): Port uses a constant bit rate and, therefore, may not have flag idles between frame exchanges. **Note** If you select the MARKi option, set the Number of Idle Flags parameter to 2 or greater. The Number of Idle Flags parameter does not appear if you choose the CBR option.

EIA Signalling Action

Range	NONE, SWITCH, CTS
Default	NONE
Description	Specifies the EIA signalling action that is allowed: • NONE: None • SWITCH: The Vanguard node raises DCD at the beginning of the frame and drops DCD when frame transmission is complete. The DCD is held high after transmitting the frame for the duration of three character times based on the configured clock speed. • CTS: The Vanguard node raises CTS when it receives an RTS signal. **Note** SWITCH+CTS: The operations can be combined by summing SWITCH and CTS.

RTS/CTS Delay

Range	2 to 200
Default	2
Description	Specifies the length of time the device delays CTS after RTS is raised (when EIA Signalling Action = CTS). The delay is specified in 50 millisecond units (1 = 50 ms).

DCD to Data Timer Duration

Range	1 to 255
Default	1
Description	Specifies the length of time (in milliseconds) that DCD is held high before data is forwarded to the attached device. This is used when EIA Signalling Action = SWITCH or SWITCH+CTS.

Autocall Mnemonic

Range	0 to 8 alphanumeric characters
Default	(blank)
Description	Specifies the mnemonic name used for autocalling.

Autocall Timeout

Range	5 to 255
Default	10
Description	Specifies the time (in seconds) between call attempts when autocalling.

Maximum Number of Autocall Attempts

Range	0 to 255
Default	0
Description	Specifies the number of times the TBOP port attempts to call. A value of zero allows unlimited attempts.

Port Subaddress

Range	0 to 3 decimal digits
Default	the number of this port
Description	Specifies the subaddress for this TBOP port. Incoming calls from the network with a network address consisting of the Node Address specified in the node record and this subaddress arrive at this TBOP port. When a TBOP port makes a call, the Node Address plus this subaddress is inserted into the calling address field.

CUG Membership

Range	0 to 8 two-digit numbers
Default	--,--,--,--,--,--,--,--
Description	Specifies membership to Closed User Groups (CUGs). A port may be a member of up to eight CUGs. Each CUG membership must be a two-digit number (00 to 99) separated from other groups by a comma. To indicate that the port is not a member of a CUG, press the space bar twice (--).

Billing Records

Range	Off, On
Default	Off
Description	Controls creation of billing records for this port. • On: Billing records are generated for all calls to and from this port and failed calls from this port. • Off: No billing records are generated.

Number of Idle Flags

Range	1 to 15
Default	2
Description	Controls the number of idle flags placed between two TBOP frames during transmission. **Note** If you enable the MARKi (Mark idle) port option, set the number of idle flags to 2 or greater. This parameter does not appear if you select the CBR option.

Statistics

Introduction

This section describes the statistics used with TBOP. Other statistics are described in the *Vanguard Basic Configuration Manual.* You can use the information appearing on the following screen to monitor the operation of a TBOP port.

Detailed TBOP Port Statistics

Detailed TBOP Port Statistics provide status reports about various operations of a TBOP port. To view the Detailed TBOP Port Statistics perform these steps:

Step	Action
1	Select **Status/Statistics** from the CTP Main menu.
2	Select **Detailed Port Statistics** from the Status/Statistics menu
3	At the prompt, enter the number of the selected port.

The information displayed is similar to that shown in Figure 7 and Figure 8.

Detailed TBOP Port Statistics Screens

You can acquire statistics for any active TBOP port as you do for any other port. The fields appear on the screen to reflect the status of the TBOP port (see Figures 7 and 8).

```
Node:                                Address:                Date:          Time:
Detailed TBOP Port Statistics: Port 3                                       Page: 1 of 2

Port Number: 3       Port Type:  TBOP
Port Status: Up      Port Speed:  9610

Physical Summary:
 Overrun: 0    Underrun: 0    CRC: 2927  Non-Octet Aligned: 58411

Data Summary:
          IN       OUT                IN       OUT
   Characters:  37237278   42548484   Characters/sec:  635                    728
      Frames:  365073    417605       Frames /sec:  6                         7
 Lost Segments:  0        0
 Frames Queued:  0        1          Utilization: 53%                          61%
 Queue Capacit:  100      16


Interface Summary:  EIA-232-D  DCE          INPUT        OUTPUT
                              DTR RTS MB P14   DSR DCD RI CTS
 State: Connected (SIMPLE)              H   H   L  L     H   H   L  H


Press any key to continue ( ESC to exit ) ...
```

Figure 7. Detailed TBOP Port Statistics Screen - Page 1

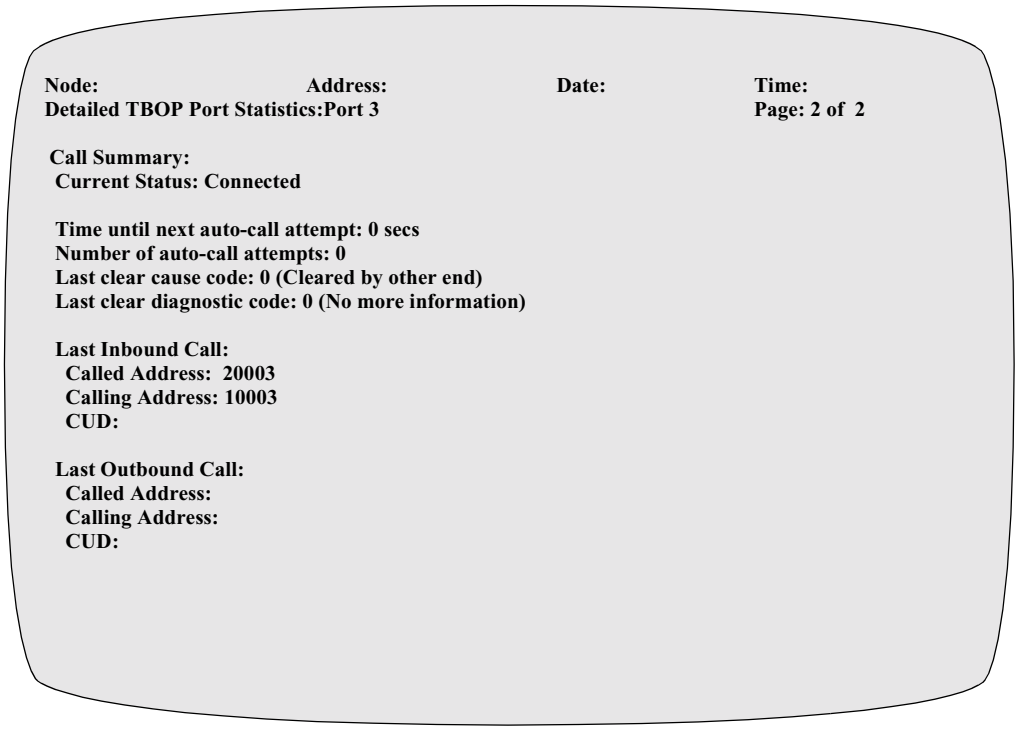

Figure 8. Detailed TBOP Port Statistics Screen - Page 2

TBOP Port Statistics Terms

This table explains the terms found in the TBOP Port Statistics screens:

Term	*Description*
Port Number	Specifies a specific port in the node.
Port Type	Indicates the type of port.
Port Status	Specifies the current port status. • Up: Port is enabled by the CTP. • Disabled: Port is disabled by the CTP. • Busy Out: The port is busied out by the CTP. • Down: Port is not enabled, disabled, or busied out by the CTP.
Port Speed	Message transmission speed in bits per second.
Physical Summary	Overrun Errors: Total number of overrun errors counted by the I/O driver. • Underrun Errors: Total number of underrun errors counted by the I/O driver. • CRC Errors: Total number of CRC errors counted by the I/O driver.

Term	Description
Data Summary	Characters In/Out: Number of characters received or transmitted since last boot or statistics reset. Header characters are not included. • Frames In/Out: Number of SDLC frames received or transmitted since last boot or statistics reset. • Characters/sec In/Out: The average number of characters received or transmitted per second. • Frames/sec In/Out: The average number of messages received or transmitted per second. • Lost Frames: The number of discarded inbound and outbound segments. This statistic can indicate: – The node is becoming congested. – The inbound node is congested. – The received segment cannot be queued in the inbound queue. – The received segments size is greater that the configured frame size. – The node received out of sequence segments from the network. – The outbound queue holding the segments received from the network is full. • Frames Queued: Number of outstanding queued segments in the inbound and outbound queues. • Utilization: Displays the inbound and outbound use of the port expressed as the ratio of bytes per second / port speed in bytes. – For example: if the inbound bytes/second rate is 600 and the port speed is 9600 baud, then the inbound utilization is 600(9600/8) = 600/1200*100 = 50%. • Queue Capacity: – In: Maximum number of TBOP frames in the inbound queue that can be stored without discarding frames. These frames are in the queue. When the network is congested, they are sent later. – Out: Maximum number of TBOP frames that can be stored in the outbound queue. These recombined frames are held in the order that they are originally received by the remote TBOP. **Note** IN and OUT are used with reference to the interface at the TBOP port.
Summary	• INPUT/OUTPUT: Summary of the current status of EIA control leads. • State: The EIA state of the port.

Term	Description
Call Summary	• Current Status: Status of the call on the specific port. – Connected: Call between TBOP ports is established. – Called: TBOP port is autocalled by another TBOP port and is waiting for the EIA connection to be established. – Disconnected: No calls in progress. • Time Until Next Auto-Call Attempt: Time until the next autocall attempt. • Number of Auto-Call Attempts: Number of autocalls to be attempted. • Last Clear Cause Code: Last clear cause code received by the port. • Last Clear Diagnostics Code: Last clear diagnostic code received by the port.
Last Inbound Call	Called Address/Calling Address/CUG: Report on called and calling addresses and CUG of the last outbound call.
Last Outbound Call	Called Address/Calling Address/CUG: Report on called and calling addresses and CUG of the last outbound call.

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