Vanguard Managed Solutions

Vanguard Applications Ware
Serial Feature Protocols

3201 Async Protocol

Notice

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3201 Asynchronous Polled Protocol

Overview

Introduction

This manual describes the 3201 Asynchronous Polled Protocol feature for Vanguard Applications Ware. It supplements the *Vanguard Basic Configuration Manual* (Part Number T0113) and the individual Vanguard Installation Manuals.

About This Manual

This manual assumes you are familiar with your Vanguard product and its interface via the Control Terminal Port (CTP). If you need additional information, please refer to your Vanguard Installation Manuals or the Feature Protocols documentation supporting your authorized software license.

About 3201

3201 is an asynchronous polling protocol for controllers. 3201 PADs allow the host computer to communicate with the devices at the remote end via X.25 connections between the host and the controller.

Each 3201 PAD port can have up to 16 controllers connected with separate SVCs for each controller.

Reference Documents

You should also be familiar with the reference documents listed below.

Note

These documents are referenced extensively from this manual. Therefore, it is highly recommended that you have these documents available.

- (1) *Telecom Canada: Datapac 3201 Service Description* (Issue 8, January 1988)
- (2) *Telecom Canada: Point of Sale (POS) End-To-End Protocol* (Issue 6, July 1988)
- (3) *Telecom Canada: Datapac 3201 RAPID - TERMINAL Communication Protocol* (January 1989)

In This Manual

3201 PAD Support

Introduction

3201 is an asynchronous polling protocol for controllers. 3201 PADs allow the host computer to communicate with the devices at the remote end via X.25 connections between the host and the controller.

Each 3201 PAD port can have up to 16 controllers connected with separate SVCs for each controller.

Features of this Implementation

Services provided by the Datapac 3201 feature are described in Ref. [1]. Sections of Ref. [1] have been amplified below to provide clarifications and also highlight the differences between the Datapac offering and the 3201 implementation on Vanguard products (referred to below as the 3201 PAD):

- No Support for NCR 721 Protocol

  The NCR 721 protocol has been de-standardized by Datapac and is not offered for new connections. The 3201 PAD does not support the NCR 721 standard.
- Connection Establishment

  The 3201 PAD allows host-initiated and terminal-initiated calls. Only one end (TPAD or Host) should be configured for call initiation.
- Transmission Speeds

  The 3201 PAD supports four-wire full duplex access capability; the range of transmission speeds supported is listed in the “Configuring the 3201 PAD” section on page 24. Half-duplex support is not provided. (Refer to Section 2.B of Ref. [1].)
- Message Size

  The maximum message size supported by the 3201 PAD is 252. (Refer to Section 2.C of Ref. [1].)
- Error Checking

  Error checking mechanisms for both transparent (D1) and non-transparent (A1) modes are provided. (Refer to Section 2.E of Ref. [1].)
- Billing

  Billing records are generated at the 3201 PAD (i.e., the terminal end) for all calls, if BILLING is enabled at the 3201 PAD. The billing records are generated as per the format specified in the *Vanguard Basic Configuration Manual*.
- Conformance Testing

  The “Standards Compliance” section on page 46 lists the conformance verification performed for this implementation. (Refer to Section 5 of Ref. [1].)
- Multiple User Circuit Feature

  This feature is not supported on the 3201 PAD. (Refer to Sections 7.4 and 7.5 of Ref. [1].)

3201 PAD - Terminal Functionality

Poll/Select Operation

Polling of all stations on a 3201 PAD configured for TPAD-initiated calling is initiated when the 3201 PAD is initialized (that is, on power-on, node boot, 3201 port boot, or when the 3201 port is enabled). At that time, all stations on the port are placed in the active list. Also, when a station on the 3201 port is initialized (through station boot, station disable/enable), the controller is placed in the active poll list. Stations configured for Host-initiated calling are also placed in the active list at initialization; however, polling is started only when the Host establishes a connection to the PAD.

A controller is moved into the slow poll list when it exceeds the thresholds for invalid response/no response to poll or select. Once a controller is placed in the slow poll list, it is polled once after every N full poll cycles, where N is the configured value for the slow poll wait cycle. A full poll cycle is defined as polling all the actively responding controllers once. If the slow poll list has two controllers, each of these is polled every 2N cycles. A controller is moved back into the active list when it responds correctly to a poll.

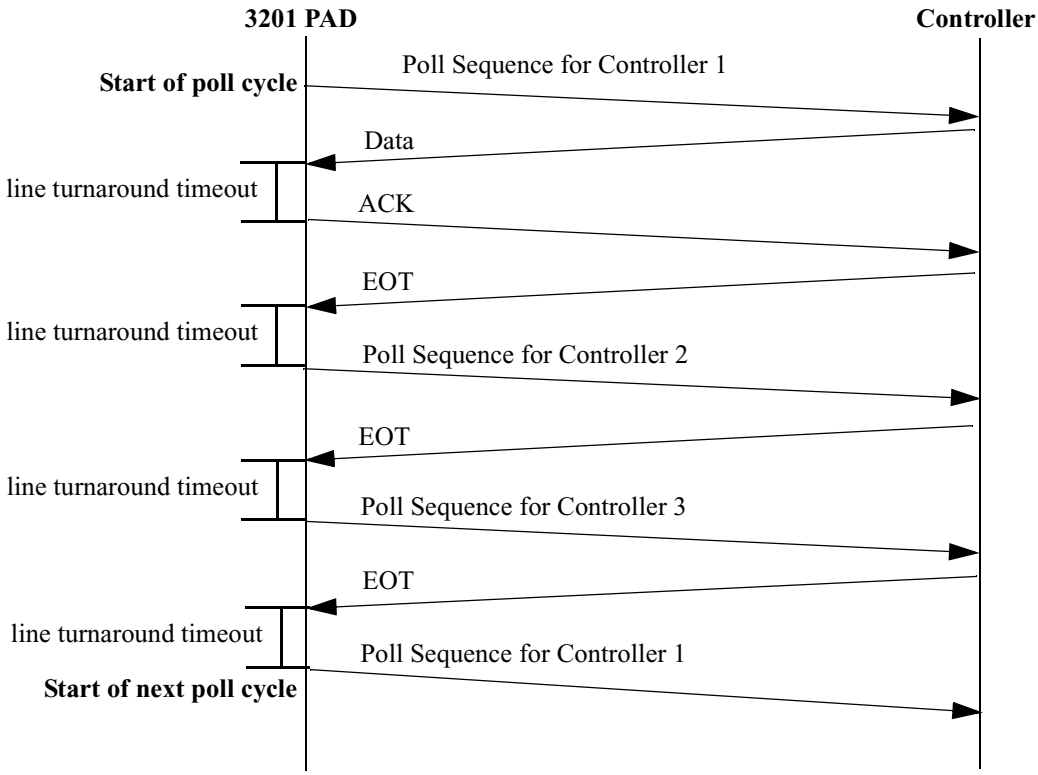
Since the slow poll interval is defined in terms of the number of active poll cycles, if all the controllers are on the slow poll list, the polling frequency is the same as when all controllers are on the active list.

For stations configured for TPAD-initiated calling, polling is suspended when the connection to its Host is being established; polling resumes after the connection is established. Polling is also suspended when an interrupt packet with a user data octet of 10000000 is received from the Host; it resumes when an interrupt packet with a user data octet 00000000 is received. Reports are generated as specified in the “Reports” section on page 30 when polling of a controller is suspended/resumed. If the station is re-initialized (by node/port/station boot or by station disable/enable operation) or the call to the Host gets cleared when polling of the controller has been suspended, normal polling of the controller resumes. In case of stations configured for Host-initiated calling, the polling is suspended whenever the connection to the Host is cleared.

The select operation has a higher priority than the poll operation. If the PAD has data queued for transmission to one or more controllers, a select is issued to one of the controllers after every second poll. Polling of a controller which has data queued for it at the PAD is not skipped. Selects are not issued to controllers which are in the slow poll list.

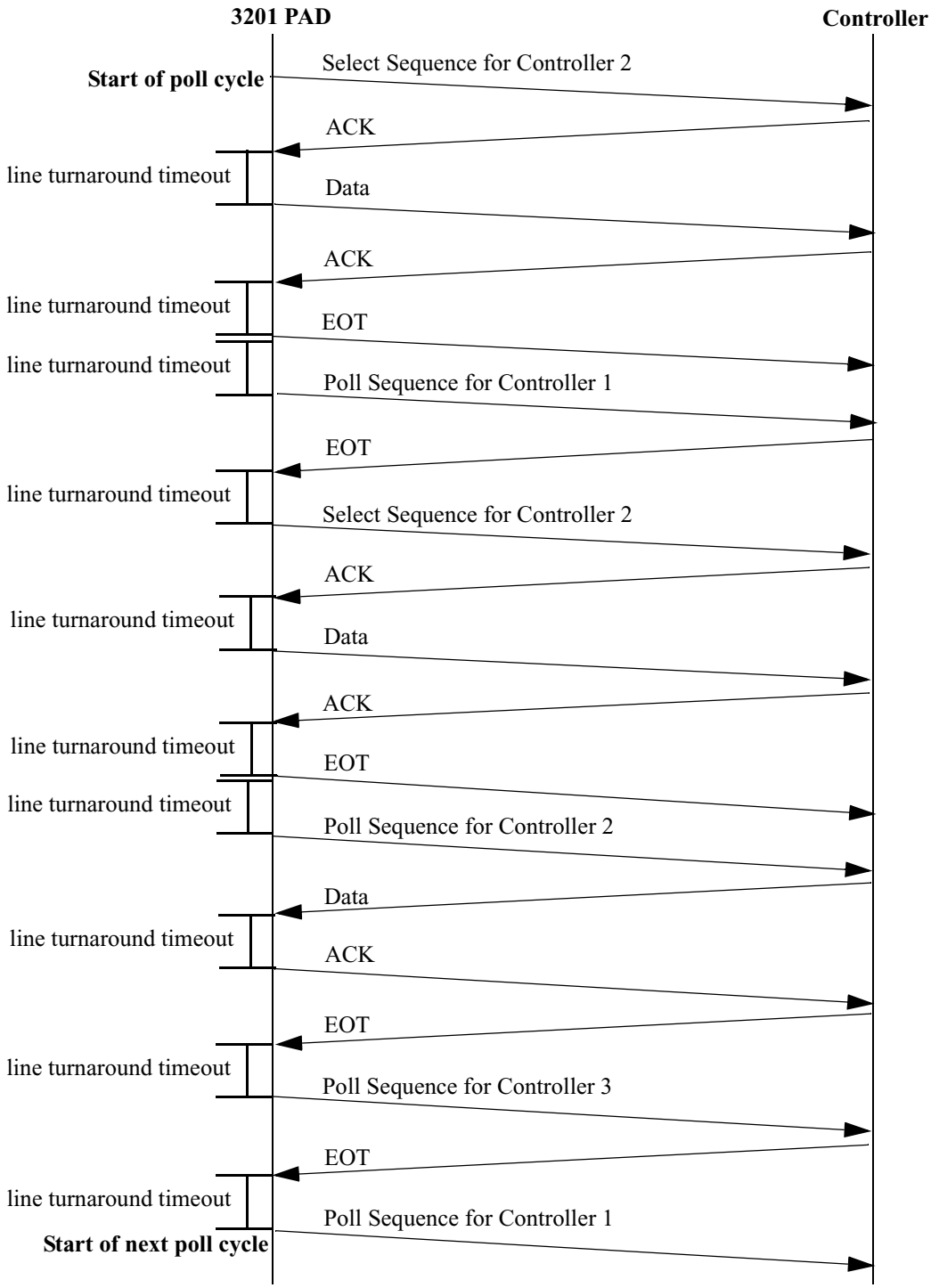
To provide time for the controllers to get off the multidrop line, after receiving a response from a controller, the PAD waits for a minimum of 50 ms before commencing transmission. This interval is referred to as the line turnaround timeout; it is not a configurable parameter.

The poll/select sequence for some situations is shown in Figures 1, 2, and 3.



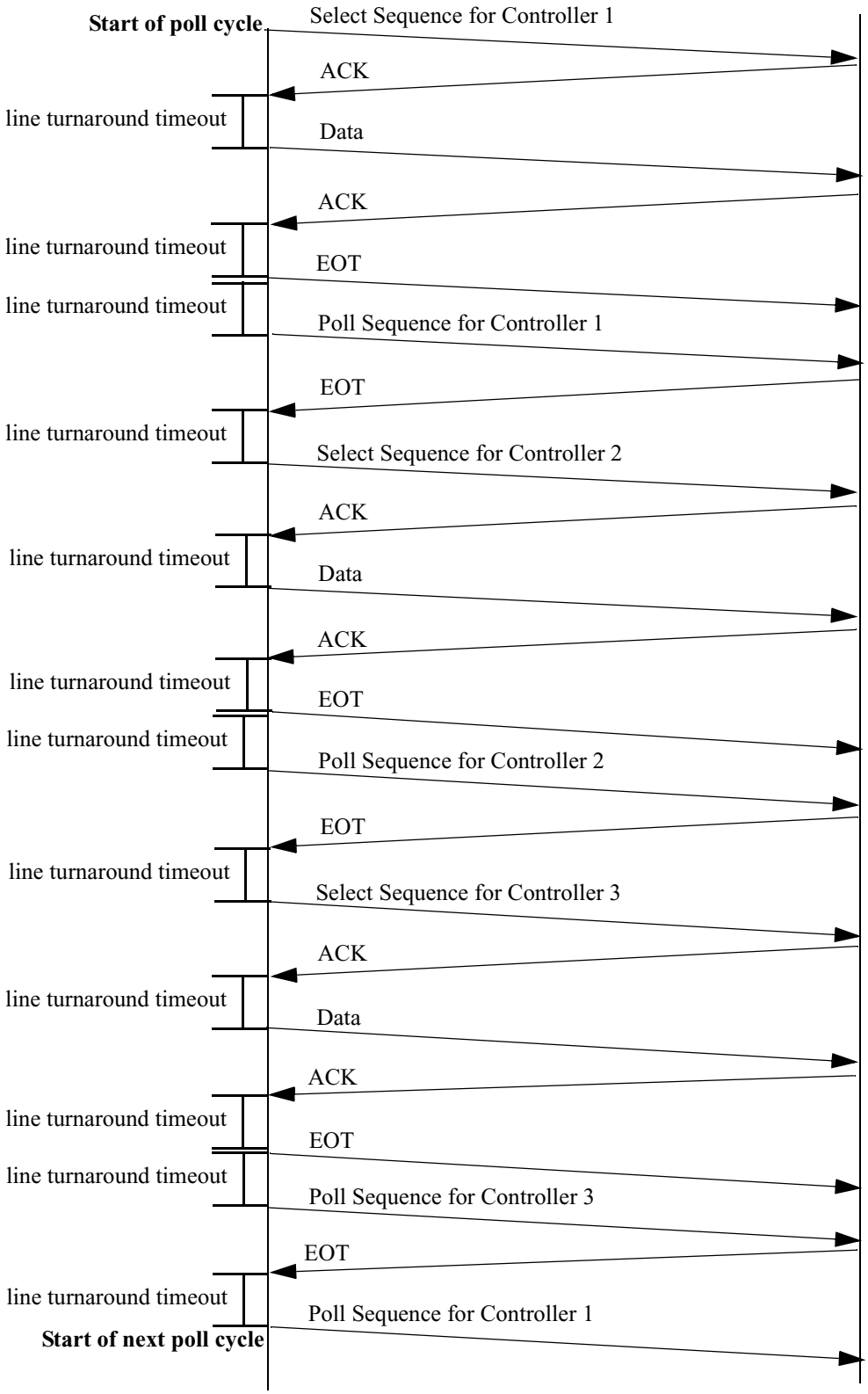
PAD does not have data messages queued for transmission to any of the Controllers.

Figure 1. Poll/Select Sequence for 3 Controllers - Part 1



PAD has 2 data messages queued for Controller 2.

Figure 2. Poll/Select Sequence for 3 Controllers - Part 2



PAD has 1 data message queued for each Controller.

Figure 3. Poll/Select Sequence for 3 Controllers - Part 3

PAD - Terminal Communication Protocol

The DP3201 Terminal-PAD protocol is described in Ref. [3]; sections of that document have been amplified and differences in the 3201 PAD implementation on Vanguard products (the 3201 PAD) are provided in the next sections.

Mode of Transmission

The 3201 PAD operates in SIMP mode and does not require any leads to be high. (Refer to Section 2.1 of Ref. [3].)

Handling of Response Timer

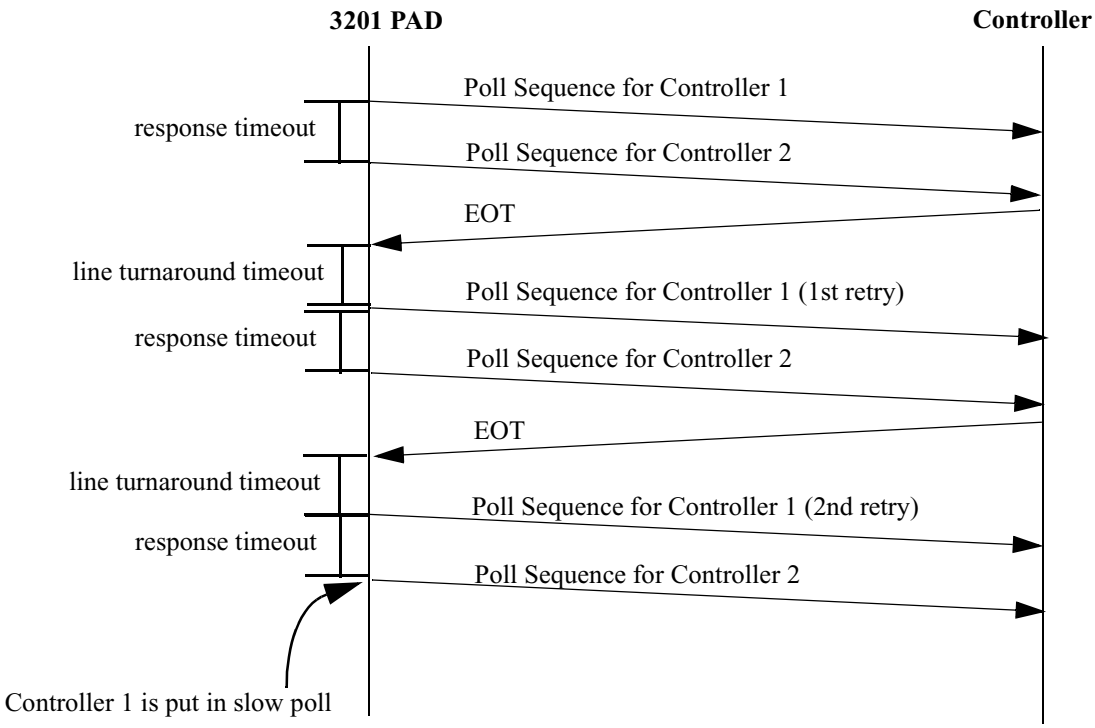
After completing a transmission for which it expects a response from the controller (i.e., any transmission other than EOT), the PAD starts its response timer. The response timer is stopped only when any of the protocol control characters ACK, DLE, ENQ, EOT, NAK, SOH, STX are received.

Retry Limits

The port parameter Number of Retries sets the retry limit for:

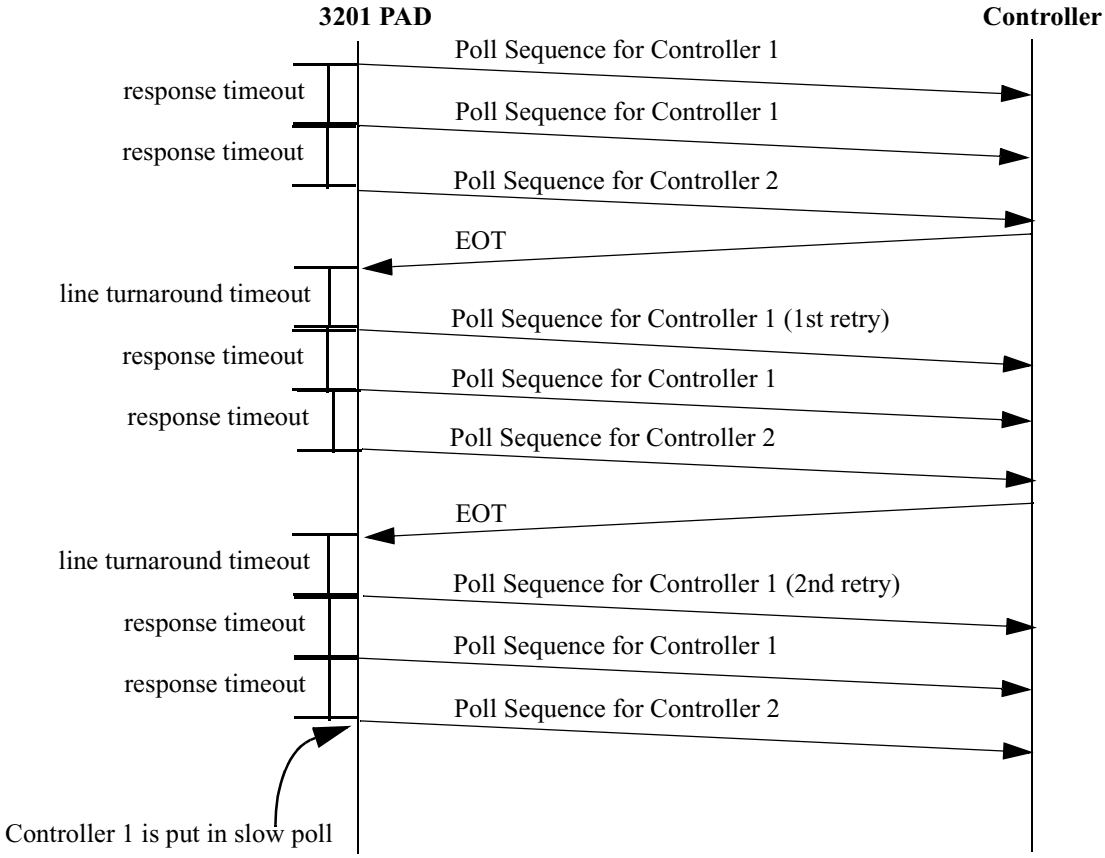
- NAKs sent/received.
- ENQs sent/received.
- Polls retransmitted on receiving an invalid response or no response.
- Selects retransmitted on receiving an invalid response or no response.

In case of response timeout on poll/select and NAK response to select, depending on the value of the port parameter Number of Consecutive Retries, some retry attempts are made immediately. This is as shown in Figures 4 and 5.



Number of Retries = 2, Number of Consecutive Retries = 0

Figure 4. Poll/Select Sequence for 2 Controllers - Part 1



Number of Retries = 2, Number of Consecutive Retries = 1

Figure 5. Poll/Select Sequence for 2 Controllers - Part 2

Handling No Response to Poll

After sending a poll, the PAD starts its response timer. The response timer stops only when any protocol control character is received. If the response timer times out it is treated as a “no response to poll” error. The re-poll attempts made depend on the values configured for “Number of Retries” and “Number of Consecutive Retries” parameters. Figures 4 and 5 depict the PAD behavior on response timeout for different values of “Number of Consecutive Retries”.

If all retry attempts fail, the controller is moved to the slow poll list and an ERROR message with error code 0x10 is sent to the Host if the connection to the Host is up. (Refer to Section 3.3 of Ref. [3].)

The PAD behavior in case of response timeout on poll is not as depicted in Figure 8.10 of Ref. [3]; to avoid polling a controller which is down repeatedly, the re-poll attempts are made in subsequent poll cycles.

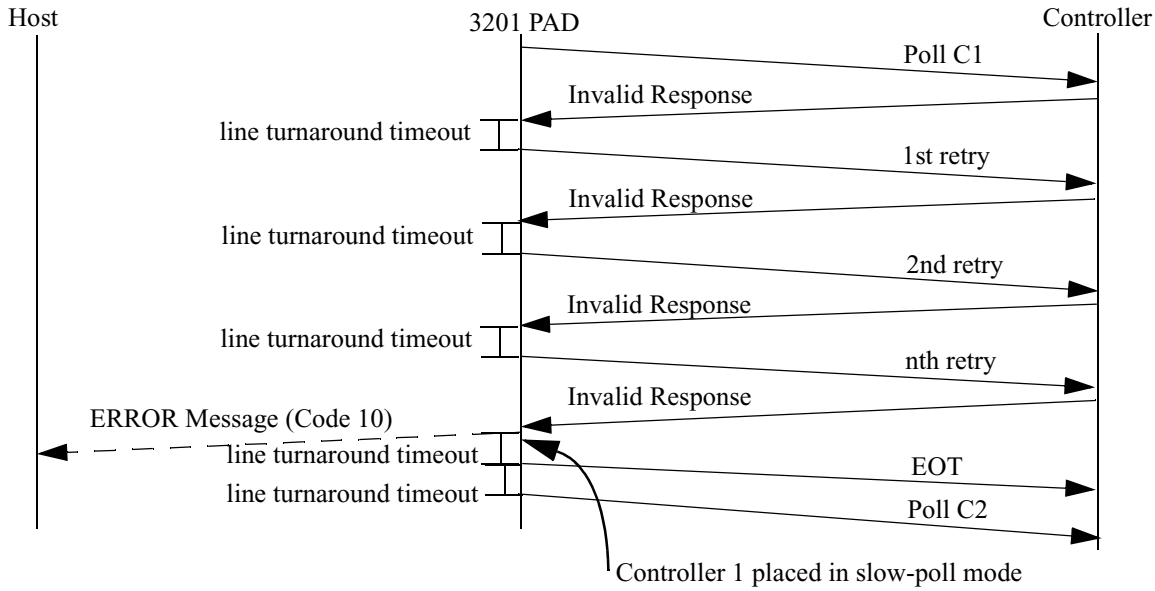
Handling Invalid Response to Poll

The PAD identifies a poll response from a controller as an invalid response in the following cases. All other errors are treated as data message errors and are NAK'd.

- The protocol control characters ACK, ENQ, or NAK are received in response to a poll.
- The message is received correctly but the poll code present in the header of the controller response does not match the poll code sent by the PAD.

On receiving an invalid response, the PAD retransmit the same poll after waiting for the line turnaround timeout. The number of retries is equal to the value configured for the "Number of Retries" parameter in the 3201 port. If all poll attempts fail, the controller is placed in slow poll mode and polling/selection of other controllers resumes. An ERROR message with error code 0x10 is sent to the Host, if the call to the Host is up. (Refer to Section 3.2, Figure 8.11 of Ref. [3].)

The PAD behavior varies from what is depicted in Figure 8.11 of Ref. [3] in that the poll is not retransmitted immediately on receipt of invalid response; the PAD waits for line turnaround timeout before retransmitting the poll. This is shown in Figure 6.



C1, C2 = Controller 1, Controller 2
n = Number of Retries configured for the 3201 Port

Figure 6. Handling Invalid Response to Poll

Handling Data Message Errors

The possible data message formats are as follows (refer to Section 5.2, 5.3 of Ref. [3]):

- (SOH Poll-Code Device Address) STX [TEXT] ETX BCC
  (For non-transparent A4 mode).
- (DLE SOH Poll-Code Device Address) DLE STX [TEXT] DLE ETX CRC1 CRC2. (For transparent D1 mode).

The header is used only when a terminal is a sender. The Poll-Code is one octet and the device address can be a maximum of 7 octets in length.

The data received by the PAD in response to a poll is in error if the message:

- format is not as shown above.
- has a parity error on any character.
- is received incorrectly (bad CRC/BCC).
- is incorrectly terminated (no ETX character).
- is longer than allowed size (after 252 bytes of data, an ETX should be received).
- has an inter-character period longer than the configured value.

The PAD discards the data received and send a NAK to the controller. The only valid messages expected from the controller in response to a NAK are a data message or <EOT> (if the controller's NAK retry limit is exceeded). Once the controller response to a NAK is received, the PAD may retransmit the NAK if the data is again received incorrectly.

The maximum number of times NAKs are resent is equal to the "Number of Retries" configured for the 3201 port; after these many attempts the PAD terminates the poll procedure by sending EOT (refer to Section 6.4, Figure 8.19 of Ref. [3]). After sending EOT, the PAD waits for line turnaround timeout before polling/selecting the next controller.

The ERROR message sent to the Host when NAK retries are exhausted have the error code set to one of the following (refer to Section 4.3 of Ref. [2]):

- If, on all attempts, receive timeout on NAK occurred (i.e., the inter-character timer expired while receiving the message), the error code is set to 0x17.
- If, on all attempts, the data was discarded on account of it being too long, the error code is set to 0x18.
- For all other cases, the error code is set to 0x12.

In case the NAK is sent because of inter-character timeout, the PAD retransmits the NAK immediately; in other cases (BCC/CRC error, parity error, etc.) the PAD waits for line turnaround timeout before transmitting the NAK.

The PAD behavior varies from what is depicted in Figure 8.14 of Ref. [3] in that the NAK is not retransmitted immediately on receipt of the erroneous data message; the PAD waits for line turnaround timeout before retransmitting the NAK (except in case of inter-character timeout).

Handling Invalid Response/No Response To ACK

The PAD sends an ACK to the controller to acknowledge that it has received the data from the controller correctly. The PAD queues the received data for forwarding to the Host only when it receives an EOT in response to its ACK. The only valid response expected by the PAD to an ACK is EOT or ENQ (which is sent by the terminal if it does not receive the ACK correctly). If any other response is received or if the response timer expires before the PAD receives a response to its ACK, the PAD sends EOT and discard the data received. After sending EOT, the PAD waits for line turnaround timeout before polling the next controller (refer to Figure 8.20 of Ref. [3]).

Handling Invalid Response/No Response To NAK

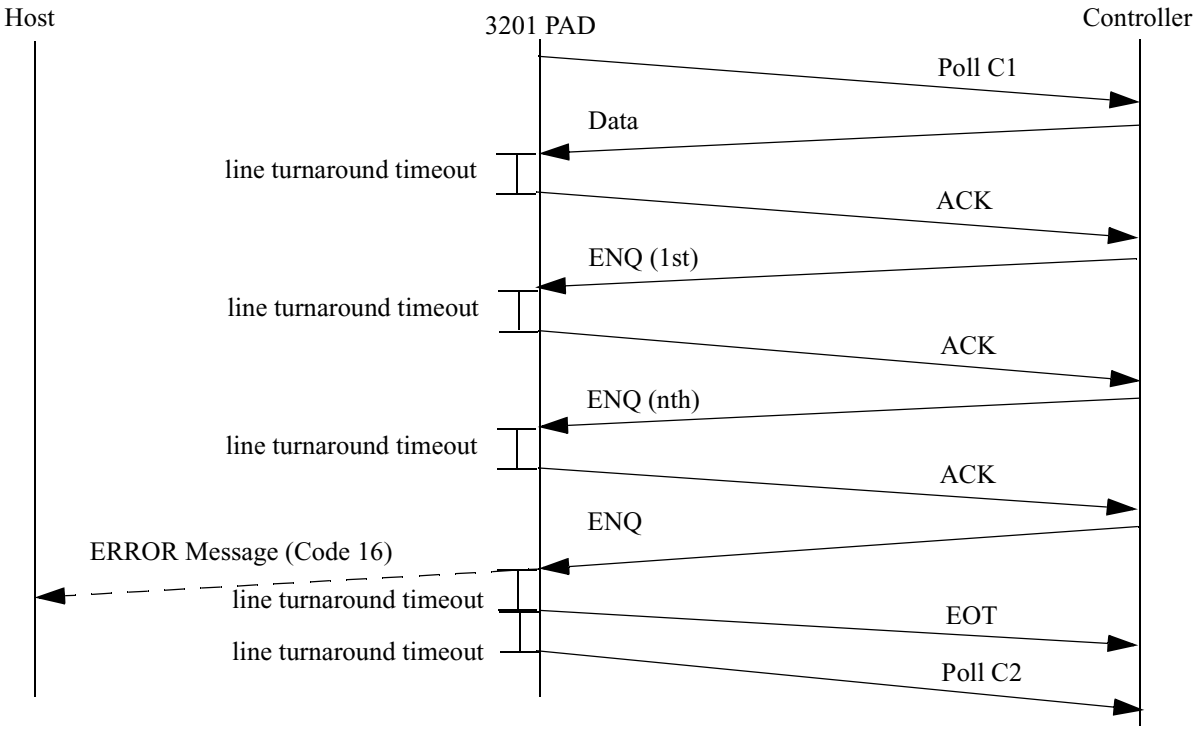
The PAD sends a NAK to the controller to inform the controller that the data message has been received incorrectly. The only valid response expected by the PAD to a NAK is a data message (retransmitted by the controller), EOT, or ENQ (which is sent by the terminal if it does not receive the NAK correctly). If any other response is received or if the response timer expires before the PAD receives a response to its NAK, the PAD sends EOT and discard the data received. After sending EOT, the PAD waits for line turnaround timeout before polling the next controller (refer to Figure 8.20 of Ref. [3]).

Handling ENQs

ENQs are sent by the sender of data when it receives no response or invalid response to data. If the PAD receives an ENQ in response to its ACK/NAK, the PAD retransmits the ACK/NAK. This continues until the number of ENQs received exceeds the "Number of Retries" configured for the 3201 port; the PAD then discards the data received and terminate the poll procedure by sending EOT. It then poll/selects the next controller once the line turnaround period is over.

A report is generated for ENQ retry exhausted as specified in Section 6.2 of Ref. [3]. An ERROR message with error code 0x16 is sent to the Host. (Refer to Section 6.7 of Ref. [3], Figure 8.18 of Ref. [3], and Section 4.3 of Ref. [2].)

The PAD behavior varies from what is depicted in Figure 8.18 of Ref. [3] in that the PAD waits for line turnaround timeout before responding to the ENQ. This is shown in Figure 7.



C1, C2 = Controller 1, Controller 2
n = Number of Retries configured for the 3201 Port

Figure 7. Handling ENQs

Handling No Response/Invalid Response to Select

The only valid responses employed by a controller to respond to a Select are ACK or NAK. If, in response to a Select, the PAD receives no response or an invalid response, the PAD re-attempts selection of the controller; the number of re-selection attempts made equals the “Number of Retries” configured for the 3201 port. If all selection attempts fail, the controller is moved to the slow poll list. The PAD discards the message (if the function code in the DATA message was set to 0x0000) or send an UNDELIVERED DATA message (if the function code in the DATA message was 0x0001 or 0x0011 or if the ACK bit was set). If the message is discarded, the PAD sends an ERROR message with error code 0x11 to the Host. (Refer to Sections 4.1, 4.3 of Ref. [2], Section 4.2 of Ref. [3], and Figures 8.12, 8.13 of Ref. [3].)

The PAD behavior in case of no response to Select is as depicted in Figure 8.12; the PAD response in case of an invalid response to Select varies from what is depicted in Figure 8.13 in that after receiving an invalid response, the PAD waits for line turnaround timeout before re-selecting. Also, when all retries are exhausted, the controller is put in slow poll mode. This is shown in Figure 8.

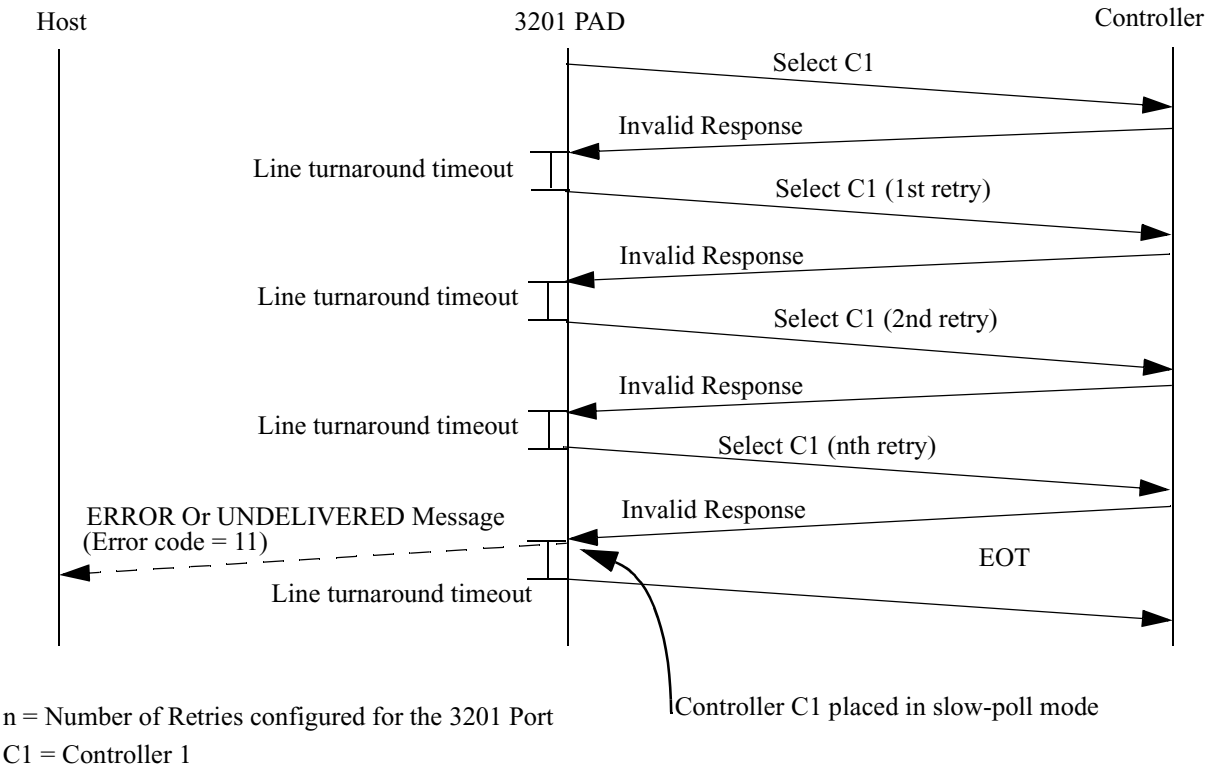
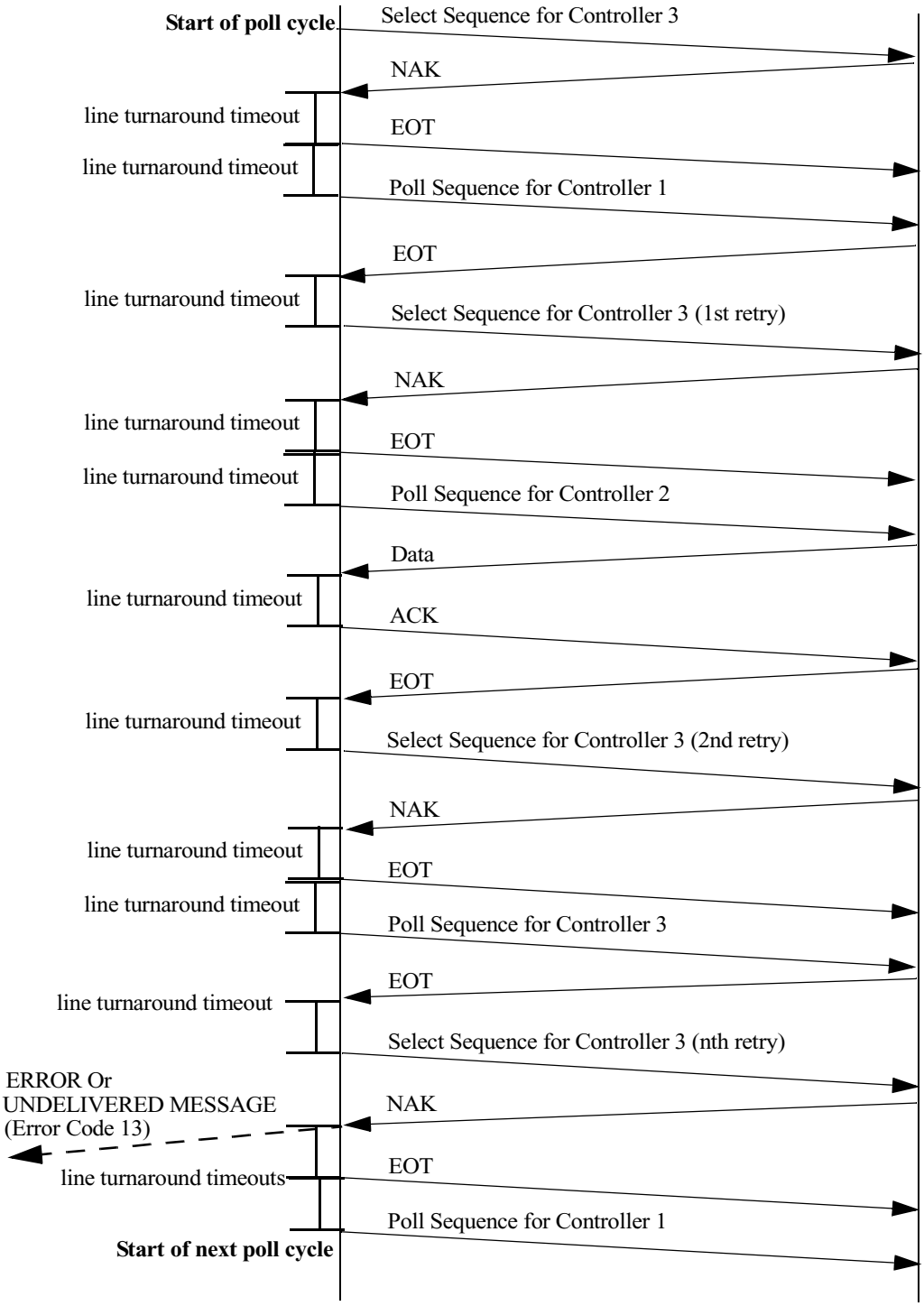


Figure 8. Handling Invalid Response To Select

Handling NAK Response to Select

On receiving a NAK from the controller, the controller to be polled/selected next is chosen depending on the “Number of Consecutive Retries” configured for the 3201 port; if this parameter is set to 0 the PAD sends EOT and then poll/select other controllers on the port before re-selecting this controller. If this parameter is set to 1, the PAD re-selects the controller once after each NAK before selecting/polling the other controllers. The total number of re-selection attempts (excluding consecutive retries) made is equal to the “Number of Retries” configured for the 3201 port.

If all re-selection attempts fail the PAD discards the message (if the function code in the DATA message was set to 0x0000) or send an UNDELIVERED DATA message (if the function code in the DATA message was 0x0001 or 0x0011). If the message is discarded, the PAD sends an ERROR message with error code 0x13 to the Host. (Refer to Sections 4.1, 4.3 of Ref. [2], Section 4.3 of Ref. [3].) This is shown in Figure 9.



n = Number of Retries; Number of Consecutive Retries = 0.
PAD has 1 data message queued for Controller 3

Figure 9. Handling NAK Response to Select

Handling ACK/NAK to Data

If the PAD receives an ACK from the controller in response to Data, the PAD transmits an EOT after line turnaround timeout. After sending the EOT, the PAD again waits for line turnaround timeout before polling/selecting the next controller. (Refer to Section 5.2 of Ref. [3].)

If a NAK is received in response to Data, the PAD transmits the data again. If the number of NAKs received in response to the data retransmission equals the "Number of Retries" configured for the 3201 port, the PAD terminates the procedure by sending EOT. The PAD discards the message (if the function code in the DATA message was set to 0x0000) or send an UNDELIVERED DATA message (if the function code in the DATA message was 0x0001 or 0x0011). If the message is discarded, the PAD sends an ERROR message with error code 0x13 to the Host. (Refer to Sections 4.1, 4.3 of Ref. [2], Section 5.2 of Ref. [3], Figure 8.15 of Ref. [3].) After sending EOT, the PAD waits for line turnaround timeout before polling/selecting the next controller.

The PAD behavior varies from what is depicted in Figure 8.15 of Ref. [3] - on receiving a NAK it waits for line turnaround timeout before retransmitting the data.

Handling Message Abort (EOT)

When the PAD receives an EOT in response to data, it sends an ERROR message with error code 0x14 to the Host. (Refer to Figure 8.16 of Ref. [3].)

If the PAD receives an EOT in response to a select, it is treated as a message abort and an ERROR message with error code 0x14 to the Host.

Handling Invalid Response/No Response to Data

The only valid responses expected by the PAD in response to Data are ACK, NAK or EOT.

If an invalid response is received to data, the PAD transmits an ENQ after line turnaround timeout and restart the response timer.

If no response is received to Data (i.e., the response timer expires) the PAD immediately sends an ENQ and restart the response timer.

If invalid response/no response continues, the PAD continues sending ENQ until the number of ENQs sent equals the "Number of Retries" configured for the 3201 port. The PAD then terminates the procedure by sending EOT. The PAD discards the message (if the function code in the DATA message was set to 0x0000) or send an UNDELIVERED DATA message (if the function code in the DATA message was 0x0001 or 0x0011). If the message is discarded, the PAD sends an ERROR message with error code 0x15 to the Host. (Refer to Sections 4.1, 4.3 of Ref. [2], Section 6.2 of Ref. [3], Figure 8.17 of Ref. [3].)

Termination Procedure

As mentioned previously, the 3201 PAD operates in SIMP connection mode; as DCD is not monitored, the procedure described in Section 5.4 of Ref. [3] is not applicable.

3201 PAD - Host Functionality

PAD - Host Communication Protocol

The Point of Sale (POS) End-To-End Protocol has been described in Ref. [2]; sections of that document have been amplified and differences in the implementation on Vanguard products (referred to as the 3201 PAD) have been listed in the following sections.

Multiple User Circuits

The multiple user circuit feature is not supported. (Refer to Section 3.1.1.2 of Ref. [2].) All messages applicable to MUCs are treated as invalid messages.

Call Establishment

For Terminal PAD-initiated calls, call establishment is as depicted in the Sequence Response Diagram 5.1. On receiving data from a controller in response to a poll, the PAD attempts to call the Host using the mnemonic configured in the Station record. The data received from the controller is buffered and forwarded to the Host once the connection is established. Polling of the controller is suspended until this connection is established. If the mnemonic string configured for this controller cannot be parsed correctly, no autocall attempts are made. If the station is re-initialized (node/port/station boot, port/station disable/enable) when autocall attempts are being made, the data received from the controller is discarded, the autocall attempts ceases, and polling of the controller resumes.

For Host-initiated calls, call establishment is as depicted in the Sequence Response Diagram, Figure 5.3 of Ref. [2]. Polling of a controller is started on receipt of a valid call request packet.

As only one end (TPAD or Host) is configured to initiate calls, the Call Collision procedures described in Section 3.1.3 of Ref. [2] are not supported.

Handling of Additional Information Field

The additional information field may be present in data messages sent by the Host. This field is removed from the message by the PAD before the message is forwarded to a controller. If the message cannot be delivered and it has the function code field set to 0001 or 0011, or if the ACK bit is set, then the DATA message is returned to the Host along with the additional information field. (Refer to Sections 3.2.3, 4.1.2 of Ref. [2].)

Parameter Manipulation Procedures

The READ message is used by the Host to probe statistical data maintained by the PAD. If a counter overflows, it is maintained at its maximum value until reset by the READ operation. (Refer to Section 3.2.4 of Ref. [2].)

On the 3201 PAD, the statistical counters can be reset through the CTP menu and through SNMP. A counter is reset by the READ message only if an overflow has occurred on it and it is being maintained at its maximum value.

End-To-End Acknowledgment

If a DATA message received from the Host by the PAD has the ACK bit set, the PAD returns an ACKNOWLEDGE message to the Host once an ACK is received from the controller to which this message was sent. If this message cannot be sent, the PAD sends an UNDELIVERED DATA message, irrespective of the value of the Function Code in the DATA message. (Refer to Section 3.2.6 of Ref. [2].)

Call Termination

If a station is configured for PAD-initiated calling, the PAD does not stop polling the device when it receives an INVITATION TO CLEAR message from the Host. If the PAD is holding data from the Host which needs to go out to the controller, the PAD follows the sequence shown in figure 5.9 of Ref. [2] but resumes polling once the call is cleared. On receiving data from the controller, the PAD re-establishes the call to the Host. If the PAD is holding data from the controller for forwarding to the Host when Invitation to Clear is received, it clears the call and once the call is cleared it re-establishes the connection to the Host as if the data was just received. (Refer Section 3.3.1 of Ref. [2].)

If the station is configured for Host-initiated calling, the PAD ceases polling the controller on receiving the INVITATION TO CLEAR message from the Host. If the PAD is holding data from the Host which needs to go out to the controller, the PAD follows the sequence shown in figure 5.9 of Ref. [2]; polling of the controller resumes only when the Host re-establishes the connection.

Sequence Number Handling

The sequence number handling mechanism is specified in Section 3.5.4 of Ref. [2]. After transmission of an ERROR or UNDELIVERED DATA message to the Host, the PAD expects the next message from the Host to have the same sequence number as that of the failed message. Any data messages which were received from the Host before the transmission of the ERROR or UNDELIVERED DATA message (and were queued by the PAD for forwarding to the controller) is discarded. If the sequence number of the DATA message received from the Host is not the same as that of the failed message, the PAD treats it as an out-of-sequence message and initiate a Circuit Reset.

If the PAD receives an out-of-sequence message, it initiate a Circuit Reset procedure and wait for a matching CIRCUIT RESET from the Host; all messages from the Host received before the matching Circuit Reset are discarded. Also the PAD does not transmit any messages to the Host until the matching Circuit Reset is received.

Circuit Reset Procedures

The Circuit Reset procedures are described in Section 3.5.5 of Ref. [2]. These procedures have been amplified as follows (note that the data messages queue referred to in this Section is the data retransmission queue described in Section 5.3 of this document).

- Call Setup: The PAD sends a CIRCUIT RESET message with reason code 00 if it wants to use the sequence numbers from the previous call. In case of station re-initialization, the PAD sends a CIRCUIT RESET with reason code F5 asking the sequence numbers to be reset to 0. The Host response and the PAD behavior on receiving the Circuit Reset response from the Host is shown in the following table. The PAD ignores all data messages received from the Host until the Circuit Reset response is received.

Circuit Reset Exchange After Call Setup

Circuit Reset From PAD	*Host Circuit Reset Response*	*PAD Response/Action*
Reason Code 00 (PAD is using sequence numbers from previous call)	Reason Code = 00 Sequence numbers are same.	Data transfer begins using the sequence numbers exchanged.
	Reason Code = 00 Device message sequence number is different.	If the device message requested by the Host is present in the retransmission queue the PAD transfers data from that message. Otherwise, the PAD sends Circuit Reset with reason code F2 and flush its queue. On receiving a Circuit Reset from the Host, the PAD transfers data using sequence numbers 00, 00.
	Reason Code = 00 Host message sequence number is different.	The PAD send Circuit Reset with reason code F2 and flush its retransmission queue. On receiving a Circuit Reset from the Host, the PAD transfers data using sequence numbers 00, 00.
	Other reason codes	The PAD flush its retransmission queue and begins data transfer using sequence numbers 00, 00.
Reason Code F5 (PAD is resetting sequence numbers because of re-initialization)	Any reason code.	The PAD begins data transfer using sequence numbers 00, 00. (The retransmission queue would have been flushed during re-initialization.)

- Data Transfer State— Host-initiated Circuit Reset Procedure: Once in data transfer state, a Circuit Reset procedure may be initiated by the Host in various situations - the Host may wish to know the sequence numbers currently being used by the PAD or it may have received a device message with a wrong sequence number and would like the sequence numbers reset. The PAD response is shown in the next table.

Host-initiated Circuit Reset Procedure

Circuit Reset from Host	*PAD Circuit Reset Response*	*PAD Response/Action*
Reason Code 00, Sequence numbers are same as what is expected by PAD.	Reason Code = 00 Same sequence numbers.	Data transfer continues using the sequence numbers exchanged.
Reason Code 00, Host message sequence number is different from what is being expected by the PAD.	Reason Code = 00 Host Message sequence number is set to the value expected by the PAD.	The PAD expects the Host to retransmit the lost message(s).
Reason Code 00, Device message sequence number is different from what is expected by the PAD.	Reason Code = 00 Device Message sequence number is set to the value expected by the Host.	The PAD does this if the device message requested by the Host is still present in its retransmission queue. Data transfer begins from that message.
	Reason Code = F2 Message sequence numbers is reset to 0.	The PAD does this if the device message requested by the Host is not present in its retransmission queue. The retransmission queue is flushed and data transfer begins using sequence numbers 00, 00.
Reason Code F2, F3, F4, F5	Reason Code = F1. Message sequence numbers is reset to 0.	The PAD flushes its retransmission queue and begins data transfer using sequence numbers 00, 00.
Reason Code F1	Reason Code F1. Message sequence numbers is set to the values currently being used by the PAD.	The PAD continue data transfer using its current sequence numbers.

- Data Transfer State — PAD-initiated Circuit Reset Procedure: If in data transfer state the PAD receives a data message from the Host with a sequence number different from what the PAD is expecting, the PAD sends a CIRCUIT RESET message with the sequence numbers expected by it. The possible values for the CIRCUIT RESET response from the Host and the PAD behavior on receiving the Circuit Reset response after call setup is as shown in the table for Circuit Reset procedure.
- After X.25 Reset — On receiving an X.25 reset packet, the PAD sends a CIRCUIT RESET with reason code 00 and the sequence numbers expected by it. The possible values for the CIRCUIT RESET response from the Host and the PAD behavior on receiving the Circuit Reset response after call setup is as shown in the table for Circuit Reset procedure.

After sending a CIRCUIT RESET to initiate a Circuit Reset procedure, the PAD waits for 180 seconds for a CIRCUIT RESET response from the Host. If the response is not received within this time, the PAD retransmits the CIRCUIT RESET.

Data Message Format

Certain fields of the DATA message have been explained below. Refer to Section 4.1 of Ref. [2].

- The XPR bit (bit 2) in the Control octet of the DATA message is set to 0 when the message does not contain transparent line code.
- Special retry procedures on Function Code 0011 are not supported.
- The Select Code field contains the device address; the device address obtained in the header of a data message from a controller is sent to the host in the Select code field.

ERROR INDICATION Message

Certain fields of the ERROR INDICATION message have been explained below. Refer to Section 4.3 of Ref. [2].

- The error code 0x30 is generated if any message received from the Host is less than 2 bytes in length.
- The error code 0x31 is generated if the Message Code is not either of Invitation To Clear (0x00), Error (0x05), Read (0x04), or Circuit Reset (0x21).
- The error code 0x32 is generated when the reference number count in the READ message does not match the actual number of reference numbers present.
- The error code 0x33 generated for non-integral number of octets is not applicable for the 3201 PAD.
- After call establishment and X.25 reset, the PAD expects CIRCUIT RESET messages to be exchanged. If an INVITATION TO CLEAR is received before the CIRCUIT RESET procedure is complete, an ERROR message with error code 0x36 is generated.
- Error code 0x37 is generated if the reason code in CIRCUIT RESET in not known or if any message contains additional undefined bytes.
- Error code 0x40 is generated when the data field in a DATA message is longer than 252 bytes.
- Error code 0x42 is generated if the DATA message has bit 0 of byte 0 as 1, bits 0 and 1 of byte 1 are not zero, the function code is not 0000, 0001, or 0011, and the select code field length is greater than 7.

READ Message

The READ message does not reset the statistics counters unless a counter is being maintained at its maximum value because an overflow has occurred on it. You can choose to reset the statistics through the CTP or SNMP.

The PAD behavior in the case of READ messages varies from what is specified in the standards in that the READ message does not normally cause resetting of counters. (Refer to Sections 4.5 and 6.9 of Ref. [2].)

Use of D-Bit for Error Recovery

The use of D-bit as specified in Sections 6.5 and 6.6 of Ref. [2] is not applicable for this implementation.

Parameter Indication Codes

Codes sent in a PARAMETER INDICATION message in response to a READ message are described in Section 6.1 of Ref. [2].

Codes 03, 04, 06, 10, 11, and 12 are never generated in this implementation.

Data Buffering

Transmit Buffer

For each controller, a buffer to hold data messages received from the Host for transmission to the controller is maintained. This buffer has a blocking threshold of 15 messages; when the number of messages in this buffer reaches 15, the adjacent X.25 channel is blocked; unblocking is done when the buffer size drops to 10 messages. As the X.25 Packet Window has a maximum value of 15, this buffer holds a maximum of 30 messages; in other words, discarding of messages is done from the 31st message. This buffer is flushed in the following cases:

- When the station is re-initialized (node/port/station boot, port/station disable/enable).
- When the station is in slow poll mode.

The data messages in the buffer is discarded or returned to the Host (depending on the Function Code/ACK bit in the DATA message; refer to Section 3.5.1 of Ref. [2]).

Data messages from the Host received when the controller is in slow poll mode are discarded or returned to the Host without any selection attempts being made. The code in the ERROR or UNDELIVERED DATA message is set to 0x11 (Select Retry Exhausted).

The transmit buffer is not flushed if a CIRCUIT RESET exchange causes the message sequence numbers to be reset to 0; however, if these messages cannot be sent to the controller, they are discarded without sending an ERROR or UNDELIVERED DATA message to the Host. This is done because the sequence numbers associated with these messages are no longer valid (after the reset).

Receive Buffer

Data messages received from the controller for transmission towards the Host are immediately forwarded to the Host. This queue has a blocking threshold of 5 and poll/select operation is suspended when this threshold is reached.

Retransmission Queue

For each controller, the PAD maintains a queue to store the last ten data messages sent to the Host. This buffer is used when CIRCUIT RESETs are exchanged (after call setup, after X.25 reset, or during data transfer when the Host sends a CIRCUIT RESET to find out the message sequence numbers the PAD is using currently) to allow for possible recovery of lost data messages. This queue is flushed when the Node, PAD, or Station is booted and when the message sequence numbers are reset to 0.

Typical Application

Introduction

Figure 10 illustrates a sample 3201 setup.

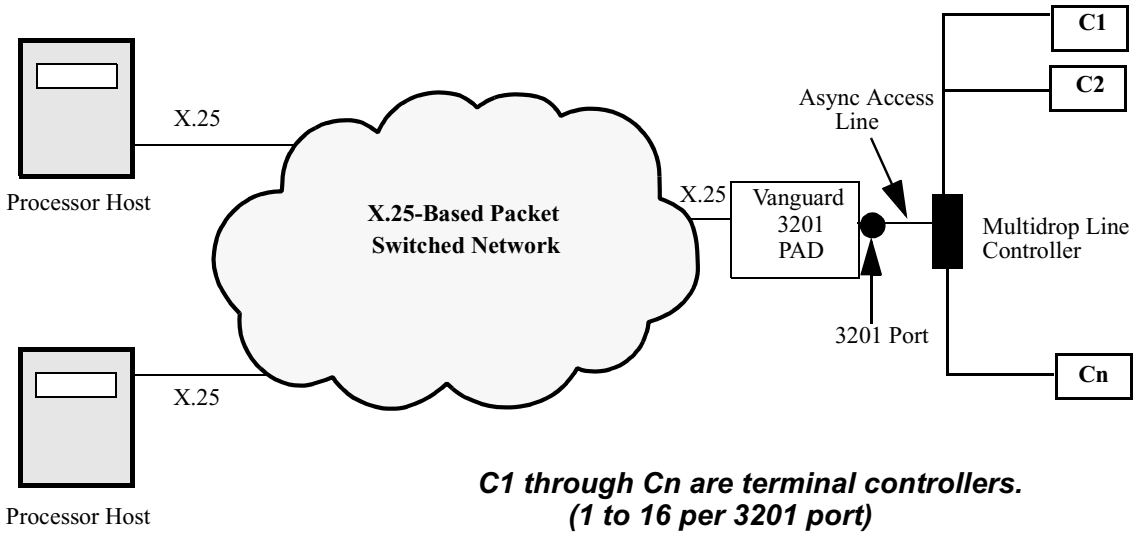


Figure 10. 3201 System Block Diagram

Configuring the 3201 PAD

Introduction

To configure your 3201 PAD:

Step	Action
1	Select **Configure** from the Main Menu of the CTP.
2	Select **Software Key Table** from the Configure menu (as shown in Figure 11), and activate the 3201 CSK.
3	Select **Port** from the Configure menu (as shown in Figure 11).
4	Enter the number of the port to configure.
5	Select **3201** as the Port Type.
6	Configure your 3201 port using the parameters listed following Figure 11.

Enabling the 3201 Custom Software Key (CSK)

A CSK enables the 3201 protocol feature on a per node basis. CSK numbers are provided by your sales representative when you purchase certain optional Vanguard Applications Ware features.

To enable your CSK:

Step	Action
1	Select **Configure** from the Main Menu of the CTP.
2	Select **Software Key Table** from the Configure menu.
3	Press the **Return** key to access the Key Value field and enter the CSK number provided. Enter a semicolon (;) to save the entry.
4	Boot the node to complete the configuration.

Figure 11 shows the location of the Software Key Table within the Configure menu.

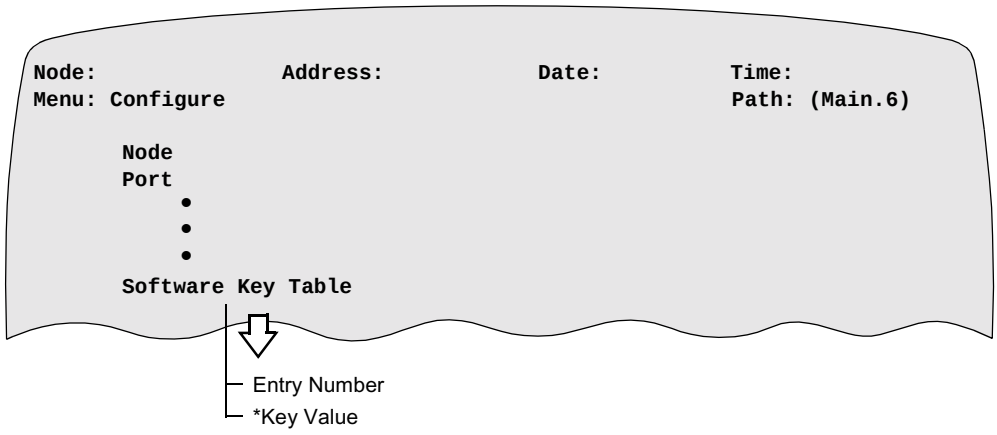


Figure 11. Configuring the Software Access Key

CSK Parameters

These parameters are associated with entering the 3201 CSK.

Entry Number:

Range:	1 to 20
Default:	1
Description:	This is not a configurable parameter. It is the reference number for the individual option that is being enabled. You must configure a separate entry for each software option enabled for the node. A node can have up to 20 options enabled at one time.

*Key Value:

Range:	0 to 20 alphanumeric characters
Default:	(blank)
Description:	This is the Software Access Key supplied for the node. If you change the SAK number or enter the wrong one by mistake, the option is disabled. **Note** The space bar erases the setting. Enter a semicolon (;) to save the entry. **Note** You must perform a Node boot for changes to this parameter to take affect.

3201 Port Configuration

Figure 12 shows the location of the 3201 PAD Port record under the Configure menu.

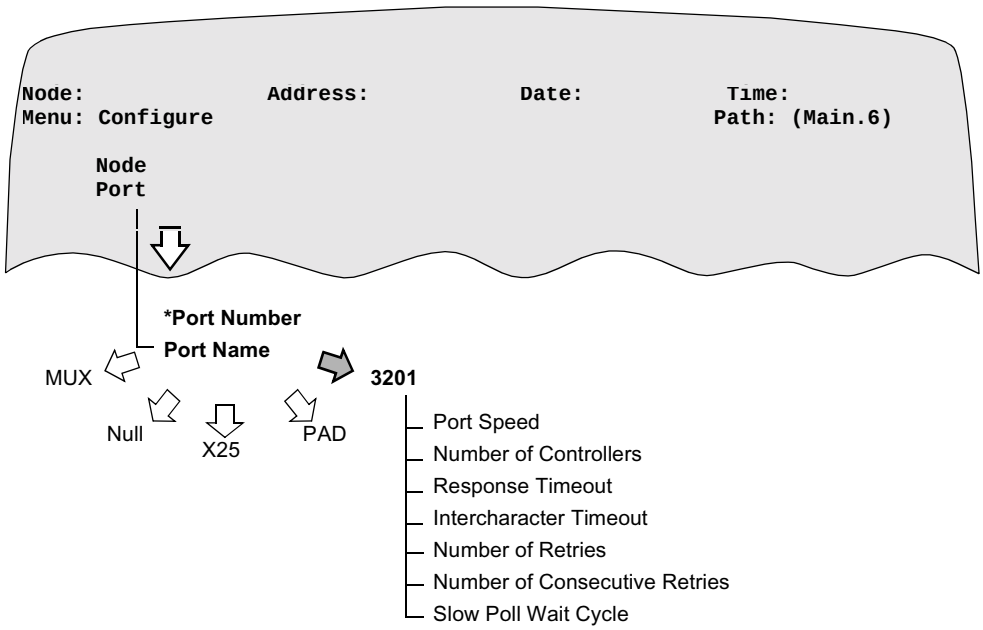


Figure 12. 3201 Port Configuration

3201 Port Configuration Parameters

These are the 3201 Port Record parameters:

Note

Unless otherwise indicated, you must perform a Port boot for changes to these parameters to take affect.

Port Number:

Range:	1 to 54
Default:	1
Description:	This number corresponds to the physical port position at the rear of the unit and is the port record reference number.
Boot Type:	N/A

Port Type:

Range:	X25, PAD, MUX, 3201, NULL
Default:	X25
Description:	This is the port type. Select 3201.
Boot Type:	Node

Port Speed:

Range:	300, 600, 1200, 1800, 2400, 4800, 7200, 9600, 19200
Default:	1200
Description:	This specifies the port speed in bits per second.

Number of Controllers:

Range:	1 to 16
Default:	1
Description:	Specifies the number of controllers being polled by this PAD.
Boot Type:	Node

Response Timeout:

Range:	5 to 255
Default:	5
Description:	Specifies the time (in 1/20 of a second increments) that the PAD waits for a response from a controller. A value of 5 gives a response timeout of 1000 ms.

Intercharacter Timeout:

Range:	1 to 255
Default:	2
Description:	This is the maximum time (in 1/20 of a second increments) that the PAD waits between two characters when receiving data from the attached devices before detecting a line problem. A value of 2 gives an intercharacter timeout of 100 ms.

Number of Retries:

Range:	1 to 255
Default:	3
Description:	This specifies the retry limit for polls/selects sent, NAKs sent/ received, and ENQs sent/received. In case of polls and selects, the controller is placed in slow poll mode on reaching this limit.

Number of Consecutive Retries:

Range:	0 to 5
Default:	0
Description:	Specifies the number of retries that are be made immediately in case of response timeout on poll, response timeout on select, or NAK response to select. The next controller in the list is polled/selected only after this many retries are made for the non-responding controller. **Note** All consecutive retries are counted as one retry attempt.

Slow Poll Wait Cycle:

Range:	1 to 255
Default:	16
Description:	This specifies the number of poll cycles to active controllers before a poll is sent to one controller in the slow poll list.

3201 Station Configuration Parameters

These 3201 Station record parameters. Every port can have up to 16 stations configured, and each station is associated with a controller.

Note

Unless otherwise indicated, you must perform a Station boot for changes to these parameters to take affect.

Station Number:

Range:	1 to 16
Default:	1
Description:	This number corresponds to the station number of the controller that is attached to the unit, and is the station record reference number. It is dependent on the “Number of Controllers” specified in the port configuration.
Boot Type:	N/A

Controller Address:

Range:	20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 2A, 2B, 2C, 2D, 2E, 2F, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 4A, 4B, 4C, 4D, 4E, 4F, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 6A, 6B, 6C, 6D, 6E, 6F
Default:	20
Description:	Specifies the address of the controller.

Autocall Mnemonic:

Range:	0 to 8 alphanumeric characters
Default:	blank
Description:	Specifies the mnemonic used by the PAD to place calls to the Host for this controller. Host-initiated calls are accepted only if this field is blank.

Autocall Timeout:

Range:	5 to 255
Default:	30
Description:	Specifies the time (in seconds) between call attempts.

Maximum Number of Autocall Attempts:

Range:	0 to 255
Default:	0
Description:	This specifies the number autocall attempts that can be made. For unlimited attempts, set to zero (0).

X.25 Address:

Range:	0 to 15 decimal digits
Default:	blank
Description:	Specifies the X.25 address inserted in the calling address field of the call packet sent by the PAD to the Host. This address identifies the controller to the Host.

Billing Records:

Range:	OFF, ON
Default:	OFF
Description:	This controls whether billing (accounting) records are created for calls on this station.

Reports

3201 Port Reports

All 3201 port reports have the general format shown below:

<Node Name> <Date> <Time> <Port Type>-<Port Number> - <REPORT TEXT>

Example:

Node_A 31-MAY-1996 09:13:31 3201-1 - PORT BOOT COMPLETE

The possible values for <report text> are listed below.

Alarm/Reports	*Priority*	*Explanations*	*Action*
PORT BOOT COMPLETE	HIGH	Port boot was successful.	None
PORT BOOT FAILURE - <cause string >	HIGH	Port boot failed as specified in the cause string are explained here:	
		NO CONFIGURATION RECORD: A record for this port does not exist.	Configure and store a record for this port and then boot the port.
		PORT TYPE CHANGED: The record indicates that this port is not of type 3201.	If the port type is to be changed, a node boot has to be performed; otherwise, configure this port as a 3201 port and then boot the port.
		# CONTROLLERS HAS CHANGED: The parameter Number of Controllers has been changed.	A change to this parameter needs a node boot to take effect; otherwise, configure this parameter to the original value and then boot the port.
		PORT DISABLED	Enable the port.
PORT DISABLED	HIGH	The port has been disabled	None
PORT ENABLED	HIGH	The port has been enabled	None
PORT DISABLE FAILURE - < cause string >	HIGH	The port disable operation failed as explained in the cause string.	None
PORT ENABLE FAILURE - <cause string >	HIGH	The port enable operation has failed.	None
PORT STATUS WARNING - <cause string>	HIGH	This report is a warning about the port status as explained in the cause string.	
3201 INIT FAILED		3201 initialization failed. because possible insufficient memory or absence of modules necessary to form3201 protocol stack.	No action is possible.

3201 Station Reports

All 3201 Station reports have the general format shown below:

<Node Name> <Date> <Time> <Port Type>-<Port Number>s<Station Number> - <REPORT TEXT>

Example:

Node_A 31-MAY-1996 13:01:24 3201-1s1 - STATION BOOT COMPLETE

The possible values for <report text> are listed below:

Alarm/Reports	*Priority*	*Explanations*	*Action*
STATION UP	HIGH	The controller associated with this station is active (i.e., responding normally to polls)	None
STATION DOWN	HIGH	The controller associated with this station is not active (i.e., not responding properly to polls)	None
STATION BOOT COMPLETE	HIGH	Station boot was successful.	None
STATION BOOT FAILURE - < cause string >	HIGH	Station boot failed as specified in the cause string. The cause string is one of the following:	
		NO CONFIGURATION RECORD: record for this station does not exist.	
		STATION DISABLED	
STATION DISABLED	HIGH	The station is disabled	None
STATION ENABLED	HIGH	The station is enabled	None
STATION DISABLE FAILURE - < cause string >	HIGH	The station disable operation failed as specified in the cause string.	None
STATION ENABLE FAILURE - < cause string >	HIGH	The station enable operation failed as specified in the cause string.	None
STATION STATUS WARNING - <cause string>	HIGH	This report is a warning about the station status as explained in the cause string.	Enable the station.

Alarm/Reports (continued)	Priority	Explanations	Action
STATION INHIBITED - <Controller Address> - ADDR CONFLICT	HIGH	This report is a warning that the station is not polled because the station's <Controller Address> is the same as that of another station on this port.	Two controllers on the same port cannot have the same controller address. If the station <station number> should be active, set the <Controller Address> parameter for station <station number> to a different value and boot the station.
STATION POLL SUSPENDED - <cause string>	LOW	The polling of this controller has been suspended as described in one of these cause strings: BLOCKED: (polling suspended because of flow control). INTR: (polling suspended because an interrupt packet has been received from the Host). CONN: (polling suspended until the connection to the Host is established). ITC: (Received Invitation to Clear).	None
STATION POLL RESUMED	LOW	Polling of this controller has been resumed.	None
STATION MNEMONIC ERROR	HIGH	An error occurred while parsing the Host mnemonic string.	Check the mnemonic configured for the Autocall Mnemonic parameter for this station and also check the entry in the Mnemonic Table. In case of an error in the Autocall Mnemonic parameter, enter the correct value and boot the station. In case of an error in the Mnemonic Table entry, enter the correct value and perform a Tables Boot.
AUTOCALL ATTEMPTS EXHAUSTED	HIGH	All autocall attempts have been unsuccessful, no more call attempts are made.	Check if a route exists to the Host for this station. The station has to be booted to restart operation.

Reports for ERROR INDICATION Messages Transmitted

The ERROR INDICATION messages sent by the 3201 PAD to the Host(s) are described in Section 4.3 of Ref. [2]. The following reports are generated when these ERROR messages are sent:

All 3201 line protocol reports have the general format shown below:

<Node Name> <Date> <Time> <Port Type>-<Port Number><Station Number>- <report text>-<error code>-<error string>

The possible values for <report text> are listed below.

LOCAL ERR - Local Communication Error

This report is generated when any of the local communication error conditions listed in Section 4.3 of Ref. [2] occur. The <error code> is as specified in the standard, and the <error string> is one of the following:

Alarm/Reports	*Priority*	*Explanations*	*Action*
POLL	MED	Retry exhausted on no response/invalid response to poll	None
SELECT	MED	Retry exhausted on select	None
NAK SENT	MED	Retry exhausted on NAK sent	None
NAK RECEIVED	MED	Retry exhausted on NAK received	None
MSG ABORT	MED	Message aborted as controller sent EOT in response to DATA	None
ENQ SENT	MED	Retry exhausted on ENQ sent	None
ENQ RECEIVED	MED	Retry exhausted on ENQ received	None
NAK TIMEOUT	MED	Receive timeout on NAK	None
MSG TOO LONG	MED	Message exceeds 252 bytes	None

DQ ERR - Invalid DQ Message Error

This report is generated when any of the invalid DQ message error conditions listed in Section 4.3 of Ref. [2] occur. The <error code> is as specified in the standard, and the <error string> is one of the following:

Alarm/Reports	Priority	Explanations	Action
SHORT MSG	MED	Message received from the Host is less than 16 bits	None
MSG CODE	MED	Unrecognized message code	None
PAR FIELD	MED	Parameter field format error	None
READ REF	MED	Invalid READ Reference number	None
UCN	MED	User Circuit Number is not 0	None
CONTEXT	MED	Message received out of context	None
FORMAT	MED	Invalid format	None

DATA ERR - Data Message Error

This report is generated when any of the DATA Message error conditions listed in Section 4.3 of Ref. [2] occur. The <error code> is as specified in the standard, and the <error string> is one of the following:

Alarm/Reports	Priority	Explanations	Action
MSG TOO LONG	MED	Message exceeds 252 bytes	None
NIL MSG	MED	No data bytes	None
FORMAT	MED	Format error	None
N/A	MED		None
UCN	MED	User Circuit Number is not 0	None

Reports for ERROR INDICATION Messages Received

These reports are generated when the PAD receives an ERROR INDICATION message from the Host. The format is:

<Node Name> <Date> <Time> <Port Type>-<Port Number>s<Station Number> - RECEIVED ERROR MSG - <error code>

The <error code> is set to the value in the received ERROR message.

3201 Line Protocol Reports

All 3201 line protocol reports have the general format shown below:

<Node Name> <Date> <Time> <Port Type>-<Port Number> - <report text>

The possible values for <report text> are listed below.

Alarm/Reports	*Priority*	*Explanations*	*Action*
LINE DOWN	HIGH	All the controllers on the port are down.	None
LINE OPERATIONAL	HIGH	The first controller on the port is operational.	None

Statistics

3201 Port Statistics

Statistics for the 3201 port can be viewed by selecting the “Detailed Port Statistics” option in the Statistics menu through CTP. Figure 13 is an example of the Statistics for the 3201 port.

```
Node:              Address:            Date:            Time:

Detailed 3201 Port Statistics:

Port Number : 2    Port Type: 3201          Port Utilization In : 0%
Port Status: Up    Port Speed: 1200         Port Utilization Out: 0%

Line Status: DOWN

Data Summary:                              Transmit            Receive
   Characters                              10322               11789
   Messages                                65                  57
   Polls                                   3378                N/A
   Selects                                 1221                N/A
   ACKs                                    119                 187
   NAKs                                    154                 132
   ENQs                                    116                 129

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

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

Figure 13. Detailed 3201 Port Statistics

Screen Terms

This table describes the screen terms found in the 3201 Port Statistics screen.

Term	*Description*
Port Number	Physical port number.
Port Status	Operational status of the port (3201 port is Up or Disabled).
Port Type	Indicates the type of access protocol for this port.
Port Speed	Port speed in bits per second.
Port Utilization In	Indicates the port utilization for the line to port direction.
Port Utilization Out	Indicates the port utilization for the port to line direction.
Line Status	Indicates the line status. (Up if one or more controllers are responding to polls, Down if no controllers are responding or garbage is being received.)

Term	Description (continued)
EIA Summary	Indicates the current status of RS232 control lead (such as: H - High, L- Low) and State of the EIA connection type (such as: Idle, Connected, Disconnected).

3201 Station Statistics Screen 1

Statistics for stations on the 3201 port can be viewed by selecting the "Detailed 3201 Station Stats" option in the Statistics menu though CTP. (See Figures 14 to 17.)

```
Node:              Address:            Date:           Time:

Detailed 3201 Station Statistics:  Port Number:2,Station Number:2 Page 1 of 4

Controller Address: 6F          Station State: Not Responding

Call Summary:
    Current Status: Calling
    Number of Autocall Attempts: 199
    Time Until Next Autocall Attempt: 0 seconds
    Last Clear Cause Code : DTE
    Last Clear Diagnostic Code: No Information
    Last Inbound Call:
       Called Address: 99990298
       Calling Address: 99990295
       Facilities:
       CUD: 0100000
    Last Outbound Call:
       Called Address: 99990298
       Calling Address: 99990295
       Facilities:
       CUD: 0100000

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

Figure 14. Detailed 3201 Station Statistics - Page 1

Screen Terms - Screen 1

This table describes the screen terms found in screen 1 of the Detailed 3201 Station Statistics.

Term	Description
Port Number	Physical port number.
Station Number	Entry number of this station.
Controller Address	Indicates the controller address configured for this station.
Station State	• Normal - when responding to polls • Not Responding - when not responding to polls but before tries expire; Down - when tries have expired and controller is in slow poll; Suspended - when polling has been stopped by Host; Blocked - when polling has been stopped because the X.25 channel is blocked.
Current Status	Calling - when it is awaiting call accept from Host Connected - when the connection to the Host has been accepted; Idle - when it is waiting for autocall timeout (to send call request again).
Number of Autocall Attempts	Indicates the number of attempts made to establish connection to the Host. This is reset to 0 when a connection is established.
Time Until Next Autocall Attempt	Indicates the time (in seconds) after which the station is place autocall to the Host.
Last Clear Cause Code	Indicates the cause code received in the last clear packet.
Last Clear Diagnostic Code	Indicates the diagnostic code received in the last clear packet.
Called Address	Indicates the called address in the last call request packet sent by this station.
Calling Address	Indicates the calling address in the last call request packet sent by this station.
Facilities	Indicates the facilities in the last call request packet sent by this station.
CUD	Indicates the data in the Call User Data field in the last call request packet sent by this station.

3201 Station Statistics Screen 2

Figure 15 illustrates the second Station Statistics screen.

```
Node:              Address:            Date:            Time:

Detailed 3201 Station Statistics:  Port Number:2,Station Number:2 Page 2 of 4

Packet Summary:

                   Transmit                 Receive
Data                 1969                     1984
Call Request         13                       0
Call Accept          0                        10
Clear Request        0                        3
Clear Confirm        0                        0
Reset Request        0                        7
Reset Confirm        7                        0
Window Closed        2                        1


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

Figure 15. Detailed 3201 Station Statistics - Page 2

Screen Terms - Screen 2

The **Packet Summary** section details information on X.25 packets transferred; the Transmit column gives the count of the packets sent out over the X.25 link by the station and the Receive column gives the count of the packets received by the station over the X.25 link.

This table describes the screen terms found in screen 2 of the Detailed 3201 Station Statistics.

Term	*Description*
Data	Count of data packets transmitted/received
Call Request	Count of call request packets transmitted/received
Call Accept	Count of call accept packets transmitted/received
Clear Request	Count of clear request packets transmitted/received
Clear Confirm	Count of clear confirm packets transmitted/received
Reset Request	Count of reset request packets transmitted/received
Reset Confirm	Count of reset confirm packets transmitted/received
Window Closed	The “Transmit Window Closed” counts the number of times the 3201 station could not send data to the adjacent channel because of flow control. “Receive Window Closed” is incremented every time the 3201 station removes data out of its queue towards the terminal and the number of messages queued is greater than 15.

3201 Station Statistics Screen 3

Figure 16 illustrates the third Station Statistics screen.

```
Node:              Address:            Date:            Time:

Detailed 3201 Station Statistics:  Port Number:2,Station Number:2 Page 3 of 4

3201 Summary:

                                Transmit            Receive
Data Bytes                       1221                875
Data Messages                    5                   5
Data Messages Per Hour           1                   1
Average Message Length           84                  67
Messages NAKed                   3                   2
Messages Aborted (EOT)            N/A                3
Inter-character Timeout          N /A                2
Receive Timeout                  N/A                 1
Parity Errors On Control         N/A                 4
Polling Suspended By Host        2                   N/A


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

Figure 16. Detailed 3201 Station Statistics - Page 3

Screen Terms - Screen 3

This table describes the screen terms found in screen 3 of the Detailed 3201 Station Statistics.

Term	Description
Data Bytes	The number of data bytes transmitted/received
Data Messages	The number of data messages transmitted/received
Data Messages Per Hour	The number of data messages transmitted/received per hour
Average Message Length	The average length of the data messages transmitted/ received
Messages NAKed	The number of data messages for which NAKs were transmitted/received
Messages Aborted	The number of data messages to the controller that were aborted by the controller (by sending EOT)
Intercharacter Timeout	The number of times intercharacter timeout occurred while receiving data from the controller
Receive Timeout	The number of times the controller did not respond to a ACK or NAK before response timeout
Polling Suspended By Host	The number of times polling was suspended on account of receiving an interrupt packet from the Host

3201 Station Statistics Screen 3

Figure 17 illustrates the third Station Statistics screen.

```
Node:              Address:            Date:            Time:

Detailed 3201 Station Statistics:  Port Number:2,Station Number:2 Page 4 of 4

3201 Summary:

                                Transmit            Receive
Polls                            10322               N/A
Poll Timeout                     N/A                 1
Selects                          3378                N/A
Select Timeout                   N/A                 2
Select Retry Exhausted           0                   N/A
Selects NAKed                     N/A                1
Invalid Response To Select        N/A                1
NAK Retry Exhausted              1                   2
ENQs                             5                   5
ENQ Retry Exhausted              1                   1


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

Figure 17. Detailed 3201 Station Statistics - Page 4

Screen Terms - Screen 4

This table describes the screen terms found in screen 4 of the Detailed 3201 Station Statistics.

Term	Description
Polls	The number of polls transmitted to this controller
Poll Timeout	The number of times the controller did not respond to poll before response timeout
Selects	The number of selects transmitted to this controller
Select Timeout	The number of times the controller did not respond to select before response timeout
Select Retry Exhausted	The number of selects to this controller for which all attempts failed
Selects NAKed	The number of selects for which NAKs were received from the controller
Invalid Response To Select	The number of selects for which an invalid response was received
NAK Retry Exhausted	The number of times the NAK sent/received retry limit was crossed
ENQs	The number of ENQs transmitted/received
ENQ Retry Exhausted	The number of times the ENQ sent/received retry limit was crossed

Management

Control Operations

The Boot, Enable and Disable operations are supported for the 3201 port and for stations on the 3201 port.

SNMP Management

SNMP management is provided for the 3201 Configuration and Statistics parameters. Resetting of 3201 statistics and control operations for the 3201 port and stations through SNMP is also provided. Setting of configuration through SNMP is not supported.

The objects in the 3201 MIB are listed below:

- Port Configuration Objects
  - cdx6500_3201PortCfgPortNumber
  - cdx6500_3201PortCfgPortType
  - cdx6500_3201PortCfgPortSpeed
  - cdx6500_3201PortCfgNoOfControllers
  - cdx6500_3201PortCfgResponseTimeout
  - cdx6500_3201PortCfgInterChrTimeout
  - cdx6500_3201PortCfgNoOfRetries
  - cdx6500_3201PortCfgNoOfConsecRetries
  - cdx6500_3201PortCfgSlowPollWaitCycle
- Station Configuration Objects
  - cdx6500_3201StnCfgStnNumber
  - cdx6500_3201StnCfgControllerAddress
  - cdx6500_3201StnCfgAutocallMnemonic
  - cdx6500_3201StnCfgAutocallTimeout
  - cdx6500_3201StnCfgMaxAutocallAttempts
  - cdx6500_3201StnCfgX.25Address
  - cdx6500_3201StnCfgBillingRecords
- Port Statistics Objects
  - cdx6500_3201PortStatPortNumber
  - cdx6500_3201PortStatPortStatus
  - cdx6500_3201PortStatPortType
  - cdx6500_3201PortStatPortSpeed
  - cdx6500_3201PortStatPortUtilizationIn
  - cdx6500_3201PortStatPortUtilizationOut
  - cdx6500_3201PortStatLineStatus
  - cdx6500_3201PortStatTxChars
  - cdx6500_3201PortStatTxMessages
  - cdx6500_3201PortStatTxPolls
  - cdx6500_3201PortStatTxSelects
  - cdx6500_3201PortStatTxAcks
  - cdx6500_3201PortStatTxNaks

- cdx6500_3201PortStatTxEnqs
- cdx6500_3201PortStatRxChars
- cdx6500_3201PortStatRxMessages
- cdx6500_3201PortStatRxAcks
- cdx6500_3201PortStatRxNaks
- cdx6500_3201PortStatRxEnqs

• Station Statistics Objects

/* Call Summary Statistics Objects */

- cdx6500_3201StnStatPortNumber
- cdx6500_3201StnStatStnNumber
- cdx6500_3201StnStatControllerAddress
- cdx6500_3201StnStatStnState
- cdx6500_3201StnStatCurrentStatus
- cdx6500_3201StnStatNoOfAutocallAttempts
- cdx6500_3201StnStatTimeUntilNxtAutocallAtmpt
- cdx6500_3201StnStatLastClearCauseCode
- cdx6500_3201StnStatLastClearDiagCode
- cdx6500_3201StnStatLastInCalledAddress
- cdx6500_3201StnStatLastInCallingAddress
- cdx6500_3201StnStatLastInCallFacilities
- cdx6500_3201StnStatLastInCallCUD
- cdx6500_3201StnStatLastOutCalledAddress
- cdx6500_3201StnStatLastOutCallingAddress
- cdx6500_3201StnStatLastOutCallFacilities
- cdx6500_3201StnStatLastOutCallCUD

/* Packet Summary Statistics Objects */

- cdx6500_3201StnStatTxData
- cdx6500_3201StnStatTxCallRequest
- cdx6500_3201StnStatTxCallAccept
- cdx6500_3201StnStatTxClearRequest
- cdx6500_3201StnStatTxClearConfirm
- cdx6500_3201StnStatTxResetRequest
- cdx6500_3201StnStatTxResetConfirm
- cdx6500_3201StnStatTxWindowClosed
- cdx6500_3201StnStatRxData
- cdx6500_3201StnStatRxCallRequest
- cdx6500_3201StnStatRxCallAccept
- cdx6500_3201StnStatRxClearRequest
- cdx6500_3201StnStatRxClearConfirm
- cdx6500_3201StnStatRxResetRequest
- cdx6500_3201StnStatRxResetConfirm
- cdx6500_3201StnStatRxWindowClosed

/* 3201 Summary Statistics Objects */
- cdx6500_3201StnStatTxPolls
- cdx6500_3201StnStatTxSelects
- cdx6500_3201StnStatTxDataBytes
- cdx6500_3201StnStatTxDataMsgs
- cdx6500_3201StnStatTxDataMsgsPerHour
- cdx6500_3201StnStatTxAvgMsgLength
- cdx6500_3201StnStatTxMsgsNAKed
- cdx6500_3201StnStatTxSelectRetryExhausted
- cdx6500_3201StnStatTxNAKRetryExhausted
- cdx6500_3201StnStatTxENQs
- cdx6500_3201StnStatTxENQRetryExhausted
- cdx6500_3201StnStatTxPollingSuspendedByHost
- cdx6500_3201StnStatRxDataBytes
- cdx6500_3201StnStatRxDataMsgs
- cdx6500_3201StnStatRxDataMsgsPerHour
- cdx6500_3201StnStatRxAvgMsgLength
- cdx6500_3201StnStatRxMsgsNAKed
- cdx6500_3201StnStatRxMsgsAborted
- cdx6500_3201StnStatRxSelectsNAKed
- cdx6500_3201StnStatRxInvalidResponseToSelect
- cdx6500_3201StnStatRxNAKRetryExhausted
- cdx6500_3201StnStatRxENQs
- cdx6500_3201StnStatRxENQRetryExhausted
- cdx6500_3201StnStatRxInterChrTimeout
- cdx6500_3201StnStatRxPollTimeout
- cdx6500_3201StnStatRxSelectTimeout
- cdx6500_3201StnStatRxReceiveTimeout
- cdx6500_3201StnStatRxParityErrorsOnCntrl
- cdx6500_3201StnStatTimeOfLastStatsReset

• Control Objects
- cdx6500_3201PortBoot
- cdx6500_3201PortEnable
- cdx6500_3201PortDisable
- cdx6500_3201PortResetStats
- cdx6500_3201StnBoot
- cdx6500_3201StnEnable
- cdx6500_3201StnDisable
- cdx6500_3201StnResetStats

Diagnostic Tests

V.54 Loopback tests for 3201 ports are provided.

Standards Compliance

Conformance To Protocol Standards

This 3201 implementation conforms to the protocol standards documented in Ref. [1], Ref. [2] and Ref. [3] except for the variations documented in Sections 2, 3, and 4. These variations have been summarized into the following table.

Title	*Reference*	*Standards Specification*	*Implementation*
NCR 721 Protocol Support	Ref. [1] - Sections 2C, 8	Support for this protocol was provided in earlier implementations.	NCR 721 is not supported.
Transmission Speeds	Ref. [1] - Section 2B	1200 or 2400 bps, 4-wire, half-duplex	300 - 19200 bps, 4-wire, full-duplex
Call Initiation	Ref. [1] - Section 9	Call setup can be done by the Terminal, Host, or by both. In case of call collision, the terminal-initiated call takes priority.	Only one end (Terminal or Host) should be configured to originate calls.
MUC Feature	Ref. [1] - Section 9	Supported	Not supported.
Resetting of Counters by READ	Ref. [2] - Section 3.2.4	The READ operation causes resetting of statistics counters.	Resetting of statistics counters is done only through CTP or SNMP operations. The READ operation causes a reset of a counter only if counter overflow has occurred and the counter is being maintained at its maximum value.
Handling of Invitation To Clear	Ref. [2] - Section 3.3.1	The PAD stops polling the controllers on receiving the Invitation To Clear message.	If the PAD is configured for Terminal-initiated calls, polling is not stopped when Invitation To Clear is received.
Circuit Reset Procedures	Ref. [2] - Section 3.5.5	Refer to Ref. [2] - Section 3.5.5	Refer to Section 4.1.8 of this document.
Use of X.25 RRs, D-bit Error recovery procedures	Ref. [2] - Section 3.5.5.1, 6.5, 6.6	X.25 RRs are end-to-end significant since D-bit procedures are assumed to be provided.	D-bit procedures are not supported; hence, X.25 RRs only have local significance and cannot be treated by the PAD as credits for outstanding messages.
Data Messages - Special Retry On Function Code 0x0011	Ref. [2] - Section 4.1.2	Supported.	Not Supported.

Title	Reference	Standards Specification	Implementation (continued)
Resetting of statistics on READ	Ref. [2] - Sections 4.5, 6.9	READ causes the statistics counters to be reset.	Statistics counters are not reset by READ.
Parameter Indication Codes	Ref. [2] - Section 6.1, Table 1	Supported.	Codes 03, 04, 06, 10, 11, 12 is never generated.
Transmission Mode	Ref. [3] - Section 2.1	PAD expects the link to have DSR and CTS asserted.	The PAD operates in SIMP mode and does not expect any signals to be high.
No Response To Poll	Ref. [3] - Section 3.3, Figure 8.10	All retry attempts are made immediately.	The number of immediate retries is configurable. Noise is treated as no response.
Invalid Response To Poll	Ref. [3] - Section 3.2, Figure 8.11	Re-poll is made immediately on receiving an invalid response.	Non-matching poll code is treated as an invalid response. Re-poll is done after line turnaround timeout.
Transmission of NAKs by the PAD	Ref. [3] - Section 6.4, Figure 8.14	Does not specify a line turnaround interval before transmission of NAKs	The PAD waits for line turnaround timeout before transmitting the NAK (except when the NAK is being sent on response timeout or intercharacter timeout)
ENQ Handling	Ref. [3] - Section 6.7, Figure 8.18	The PAD responds immediately to ENQ.	The PAD waits for line turnaround timeout before responding to ENQ
No Response To Select	Ref. [3] - Section 4.2, Figure 8.12	The controller is not put in slow-poll mode when re-selection attempts are exhausted.	The controller is put in slow-poll mode when re-selection attempts are exhausted.
Invalid Response To Select	Ref. [3] - Section 4.2, Figure 8.13	Re-selection is done immediately on receiving an invalid response. The controller is not put in slow-poll mode when re-selection attempts are exhausted.	Re-selection is done after line turnaround timeout. The controller is put in slow-poll mode when re-selection attempts are exhausted.
NAK Response To Select	Ref. [3] - Section 4.3	Re-selection is done immediately.	The PAD polls/selects other terminals before re-selecting the controller (which sent the NAK) if the “Number of Consecutive Retries” parameter is set to 0.

Title	Reference	Standards Specification	Implementation (continued)
NAK Response To Data	Ref. [3] - Section 5.2, Figure 8.15	Retransmission of Data is done immediately.	The PAD retransmits the Data after line turnaround timeout.
Invalid Response To Data	Ref. [3] - Section 6.2	Transmission of ENQ is done immediately on receiving an invalid response.	ENQ is transmitted after line turnaround timeout.
Termination Procedure	Ref. [3] - Section 5.4	Applicable	Not applicable as the PAD operates in SIMP mode and does not monitor any signals.
Force Dropping of Input Carrier	Ref. [3] - Figures 8.2, 8.3, 8.4, 8.5.	Applicable	Not applicable as the PAD does not monitor the line.

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