

# PRELIMINARY

**Bell System Data Communications  
TECHNICAL REFERENCE**

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## **TRANSACTION NETWORK DIAL IN INTERFACE SPECIFICATION**

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**ENGINEERING MANAGER — DATA NETWORK SERVICES**



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NOTE - Since this technical reference covers three types of dial-in telephones and their controlling protocols, it has been arranged where possible for quick reference to any telephone as follows:

For all sections (except 1 & 2)

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- 2nd Subsection (.2) will always specify requirements applying to the voice response telephone
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## Dial-In Interface to the Transaction Network

### 1.0 Introduction

This technical reference describes the dial-in interface to the Transaction Network depicted in Figures 1 and 2. The interface is through the Switched Telecommunications Network (STN) and provides a communications network for short data messages of the inquiry-response type. The dial-in interface to the network allows short message inquiry-response transactions between the merchant located transaction type telephone and the financial or service vendor data processing center (DPC). The reader should refer to the Bell System Technical Reference "Transaction Network Service," PUB 41024, dated December 1975 for a description of the Transaction Networks (reference 1). The Transaction Network is capable of handling any sequence of single inquiry-single responses or multiple inquiry-single response messages from a dial-in telephone

An example of a typical single inquiry-single response credit transaction using the Transaction II Telephone and the data response protocol will be described. Initially, the merchant presses the "on" button and listens for dial tone. A dialing card, containing the telephone number of the Transaction Network and other data about the type of dial-in telephone responses, the DPC address, and merchant identification code for that DPC, is entered into the dial-in telephone. This information is on a magnetic stripe, and is read by a card reader in the telephone. The credit card of the customer that the merchant is checking is then passed through the card reader. The telephone number will automatically be dialed, while the rest of the information will be buffered and entered in the proper heading and text format specified by the Transaction Network. Additional information such as the amount of the sale can be entered from the manual entry pad. The END key is pressed when all the information has been entered. When the call is completed to the Transaction Network, a 1.5 sec 2025 Hz keyed answer tone (KAT) is generated and transmitted to the telephone. When the tone ends, the Transaction II Telephone transmits the information it has buffered and any subsequent information entered. All transmission from the Transaction II Telephone is TOUCH-TONE®. The Transaction Network checks the incoming inquiry message for proper format, text length (128 characters or less), reasonable values in the heading. If the message is correctly received by the Transaction Network, a positive acknowledgment (ACK) control sequence will be transmitted. The Transaction II Telephone will respond to the ACK sequence with an End of Transmission (EOT) sequence. The message is delivered to the DPC indicated in the heading information. The DPC processes the message and prepares

a response message. Once the response message is correctly received and acknowledged, the Transaction Network checks the heading information. If the heading information is correct, the Transaction Network transmits the response message. The Transaction II Telephone will receive this message in FSK at 150 BPS using the format and line protocol specified for the Transaction Network dial-in interface. The message is checked for format, parity and LRC. The Transaction II Telephone will send an ACK sequence if a message is properly received. The Transaction Network will respond to the ACK sequence, by sending an EOT sequence to the Transaction II Telephone. Since this ends the single inquiry-single response transaction, the Transaction II Telephone sends the disconnect control character sequence to the Transaction Network before actually disconnecting. The Transaction Network responds to the disconnect sequence by causing the 407A data set to return to the "on hook" state and await the next incoming call.

### 1.1 Use of Document

This technical reference is of use to equipment and system designers who will be responsible for the dial-in telephone which connects to a dial-in interface of the Transaction Network. It is assumed that the designer is thoroughly familiar with the contents of the Bell System Technical Reference "Transaction Network Service," 41024, dated December 1975. The dial-in telephone will be located on the customer premises and provides the means by which a transaction may be rapidly initiated and conducted with any authorized DPC via the Transaction Network.

### 1.2 Scope

The dial-in telephone-Transaction Network interface will be precisely defined as regards the transmission scheme and parameters, message and signaling formats, coding, and error control protocols. The actual transaction (the text portion of the response and inquiry messages) and the method of entering the transaction into the telephone are not defined, and will be determined by the customer and the DPC. This reference covers the three types of dial-in telephones that may be connected to the dial-in interface of the Transaction Network, each controlled by its assigned protocol. The dial-in telephones are referred to as the voice response telephone, the voice/KAT response telephone and the data response telephone and may be distinguished by the following characteristics.

1.2.1 The simplest type of dial-in telephone is referred to as the voice response telephone. The voice response

telephone is essentially the standard TOUCH-TONE telephone in which signaling and inquiry messages are entered via a 12 button keyboard capable of transmitting the 2 out of 8 TOUCH TONE frequency pairs shown in Table 1.1. Response messages consist of Automatic Voice Answerback (AVA) phrases received over the standard handset which must be removed "off-hook" before signaling and communications take place. Message transfers shall take place in accordance with the voice response protocol specified in subsection 7.2. The Transaction Network will enable the voice response protocol when it recognizes that the first character of an inquiry message is not a "b" TOUCH-TONE character. There are no requirements which prevent the designer from including card reader inputs and/or an "on or off hook" feature. However, a dial-in telephone type subfield is not included in the message format to inform the DPC of these facts. If these features are desired, the designer is referred to the voice/KAT response telephone.

1.2.2 The voice/KAT response telephone shall be capable of transmitting the sixteen 2 out of 8 TOUCH-TONE frequency pairs shown in table 1.1. The Transaction Network interrogates the dial-in telephone type subfield depicted in Table 2 to determine that the voice/KAT response telephone has addressed the correct port (since the voice/KAT response telephone and the data response telephone employ identical formats). Output from the Transaction Network may be in the form of AVA phrases and/or keyed answer tones (KAT) which enable devices for displaying information. The DPC will inform the Transaction Network whether to respond to the voice/KAT response telephone with KAT and/or audible messages. Message transfers shall take place in accordance with the voice/KAT response protocol specified in subsection 7.3.

1.2.3 The data response telephone shall be capable of transmitting the sixteen 2 out of 8 TOUCH-TONE frequency pairs shown in Table 1.4. Output from the Transaction Network shall be 150 Baud asynchronous FSK Transmission. Message transfers shall take place in accordance with the data response protocol specified in subsection 7.4.

## 2.0 Transmission Plan

Transmission shall be half duplex. Simultaneous transmission by the Transaction Network and the dial-in telephone is normally not permitted and is controlled by means of the protocol specified in Section 7.

## 2.1 Transaction Network Dial-In Terminal Interface

2.1.1 Customer owned manual originating and answering dial-in telephones shall interface with the Transaction Network via Data Access Arrangement CDT. Under this arrangement the telephone company retains responsibility for providing STN control signaling. Where TOUCH-TONE service is available, the dial-in telephone has the option to generate STN addressing tone signals for transmission through the Data Access Arrangement CDT. The remaining STN control signaling functions however, are still retained by the telephone company. Physical and electrical characteristics of the Data Access Arrangement CDT are specified in the Bell System Technical Reference "Data Access Arrangement CDT For Manual Originating and Answering Terminals," Publication Number 41801, dated May, 1973 (reference 3).

2.1.2 Customer owned automatic originating and answering dial-in telephones shall interface with the Transaction Network via Data Couplers CBS or CBT. The dial-in telephone may optionally generate address information via contact closures (CBT) or EIA voltages (CBS) to generate DC dial pulses or alternatively transmit tone signals in those locations where TOUCH-TONE service is available. Physical and electrical characteristics of the Data Access Arrangement CBS or CBT are specified in the Bell System Technical Reference "Data Couplers CBS and CBT For Automatic Terminals," Publication Number 41802, dated May, 1974 (reference 4).

## 2.2 Transmission Levels

The transmission level based on a 600 ohm termination at the dial-in telephone end of a loop connected to the STN shall be as follows:

2.2.1 -12 to -35 dBm for transmissions to the dial-in telephone (receiving).

2.2.2 As specified in the appropriate reference 3 or 4 for transmissions from the dial-in telephone (transmitting).

2.2.3 The transmitted signal from the dial-in telephone shall also conform to the requirement for out of band power as specified in the appropriate references 3 or 4. The reader may also refer to the Bell System Technical References, "Data Communications Using the Switched Telecommunications Network," Publication Number 41005, dated May, 1971 and "1969-1970 Switched Telecommunications

Network Connection Survey," Publication Number 41007, dated April, 1971, as regards transmission impairments encountered in the STN (references 5 and 6).

### 2.3 Transmission Mode

2.3.1 All transmissions from the voice response, voice/KAT response and data response telephones to the Transaction Network shall be TOUCH-TONE. STN addressing transmissions shall conform to the requirements specified in References 5 and 6. The data transmission shall in addition conform to the requirements specified in the Bell System Technical Reference, "Data Set 407A Interface Specification," Publication Number 41408, dated November, 1973 (reference 7).

2.3.2 Transmission from the Transaction Network to the voice response telephone will consist of AVA phrases.

2.3.3 Transmission from the Transaction Network to the voice/KAT response will consist of AVA phrases and/or KAT.

2.3.4 All data transmissions from the Transaction Network to the data response telephone will be asynchronous and employ frequency shift keying (FSK). Data is defined as the 10 bit characters defined in subsection 3.4 which comprise the the returned inquiry and response messages or control sequences. A space (Logic 0) will be represented by 2025 Hertz  $\pm$  .15% and a mark (Logic 1) by 2225 Hertz  $\pm$  .15% at the Transaction Network input to the dial-in interface. The frequency will stabilize within 1 millisecond of bringing up carrier. The space and mark frequencies are also referred to as the start and stop frequencies respectively. All transmissions will include a 20 millisecond minimum padding interval of carrier at the mark frequency before each character stream. The transmission rate to the data response telephone shall be 150 BPS  $\pm$  .1 percent.

### 3.0 Data Link Considerations

3.1 The data link characters which are transmitted by the dial-in telephone shall consist only of TOUCH-TONE characters. The format of the streams of characters which comprise addressing, inquiry message and control sequences is specified in sections 4, 5 and 6 respectively. Addressing sequences are distinguished from other transmissions only in that once a connection (call) has been established within the STN all further TOUCH-TONE characters are considered as part of inquiry messages or control sequences and passed on to the Transaction Network.

3.2 Response and error (error prompting and disconnect) messages to the voice response telephone consist only of AVA phrases which are transmitted like normal telephone voice communication. AVA alerting tones (frequency not yet specified) precede and follow all error prompting and disconnect error messages and are optional for response messages.

3.3 One type of response message and all error messages to the voice/KAT response telephone consist of AVA phrases and are transmitted like any other normal telephone voice communication. In addition responses may also consist of KAT of 1.5 or 3.0 second duration which at customer option may be followed by AVA phrases.

3.4 Response and error messages as well as control sequences transmitted asynchronously to the data response telephone shall consist of 10 bit characters which are defined as follows:

Bit 0	Start Bit	First bit transmitted - always a space/logic 0.
Bits 1-7	Information Bits	As defined by their appearance in the 7 bit ASCII Code Set - the least significant bit shall follow the start bit.
Bit 8	Parity Bit	Parity on the information bits - Parity sense is even.
Bit 9	Stop Bit	Last bit transmitted - always a mark/logic 1.

Control characters are used for data link control and to define or delimit message fields and subfields.

3.4.1 The following characters have been designated as Transaction Network data link control characters and in general have the same function as their ASCII counterparts. Unless otherwise specified, all characters shall be defined by their appearance in the ASCII code set (right most bit is the least significant bit):

ACK	(000 0110)	Positive Acknowledgment (no transmission error)
NAK	(001 0101)	Negative Acknowledgment (transmission error)
EOT	(000 0100)	Line turnaround (end of transmission)
ENQ	(000 0101)	Enquiry (repeat last control sequence)
DLE EOT	(001 0000) (000 0100)	disconnect
DLE ACK	(001 0000) (000 0110)	DLE ACK (Permission for multiple inquiries granted)
DLE NAK	(001 0000) (001 0101)	P-NAK (Permission for multiple inquiries denied, Interrupt)

3.4.2 The following characters have been designated as control characters used for message formatting and also have the same function as their ASCII counterparts unless otherwise specified. Unless otherwise specified all characters shall be defined by their appearance in the ASCII code set.

SOH	(000 0001)	Start of Heading
STX	(000 0010)	Start of Text
ETX	(000 0011)	End of Text
GS	(001 1101)	Group Separator
ENQ	(000 0101)	Premature Termination

### 3.4.3 Clock Synchronization

The character start bit always follows the stop bit of the preceding character or the padding interval of leading carrier at the mark frequency. A transition from a Logic 1 level to a Logic 0 level is, therefore, always available (after demodulation) at the start of a message or control sequence and at the start of each character for synchronizing the data response telephone receiving clock.

## 4.0 Addressing

4.1 The dial-in telephone shall address the Transaction Network in the same manner as any ordinary telephone (home or business telephone) addresses another telephone via the STN. The Transaction Network will not address a dial-in telephone (originate a call).

4.1.1 The manual originating and answering dial-in telephone must address the STN with the standard telephone set which is a part of the Data Access Arrangement CDT provided that TOUCH-TONE calling service is either not available or not subscribed to by the serving line. If TOUCH-TONE calling service is available and subscribed to by the serving line, the dial-in telephone has the option to generate the STN tone address signals. An automatic dial-in telephone however, may address the STN via internally generated dialing pulses or tone signals. The dial-in telephone is thus able to pass addressing information to the STN via a 7 or 10 digit telephone number. A call or connection is established by this means between the dial-in telephone and a port serving voice response and voice/KAT response telephones or a port serving data response telephones. A unique telephone number is assigned to each type of port (note this is not the called number contained in the heading of the first inquiry message).

4.1.2 The service objective will be achieved by engineering the STN line hunting group for 1 percent blocking for a time consistent busy hour of the average busy season.

4.1.3 Once the connection (call) is established, the Transaction Network notifies the dial-in telephone by transmitting to it a 2025 Hz answer tone for approximately 1.5 seconds.

4.1.4 At the end of the answer tone the dial-in telephone is free to communicate with the Transaction Network.

## 5.0 Messages

5.1 The Transaction Network and the dial-in telephone shall exchange messages. The requirements specified in this section are always on a per call basis.

5.1.1 Messages originated and transmitted by the dial-in telephone to a DPC (via the Transaction Network) are referred to as inquiry messages. All inquiry messages shall consist of streams of TOUCH-TONE characters. All inquiry messages will be directed to the same DPC.

5.1.2 Messages originated and transmitted by the dial-in telephone to the Transaction Network only are referred to as control sequences and shall consist of a two (2) TOUCH-TONE character sequence.

5.1.3 Messages originated and transmitted by a DPC to the dial-in telephone (via the Transaction Network) are referred to as response messages. Response messages may consist of AVA phrases, KAT, KAT followed by AVA phrases or streams of FSK characters.

5.1.4 Messages originated and transmitted by the Transaction Network to the dial-in telephone are referred to as error messages or control sequences. Error messages consist of AVA phrases or streams of FSK characters. Control Sequences consist of one or two FSK characters.

## 5.2 Voice Response Telephone Message Formats

5.2.1 The inquiry message shall consist of a heading and a text field.

5.2.1.1 The heading shall appear in the first inquiry message only and shall consist of the called number only. Subsequent inquiry messages shall not contain a heading. The called number will be made known to the customer and shall consist of 1, 2, 3 or 7 decimal digits as follows:

$D_1D_2D_3D_4D_5D_6D_7$

Where - D is any TOUCH-TONE character between 0-9 inclusive;

Where - ( $D_4$ - $D_7$ ) is any number from 0000-0998

Where - ( $D_1$ - $D_3$ ) is the serving Transaction Network number (nnx).

5.2.1.2 The start of text delimiter between the heading and text field is the TOUCH-TONE Character Sequence "#0".

5.2.1.3 The text field immediately follows the start of text delimiter and consists of the following:

$C_1 C_2$  -----  $C_n \#\#$

Where -  $C_i$  is any one of the TOUCH-TONE characters listed in Table 1.2 except that the "#" character must be entered as "#1" (the Transaction Network will strip the 1 character and translate it to an ASCII ":" character). The text field may be any length up to 128 characters inclusive after translation (not including the STX and ETX delimiters). The "#0" character sequence shall be used as a text subfield delimiter where required. The "#0" and the "#1" character sequences are each counted as one text character. There is no upper limit for the number of subfields contained in the text field. The Transaction Network is transparent to the text except as noted above. The contents and format of the text are determined by the Customer and the DPC.

Where - the TOUCH-TONE character sequence "\#\#" is the end of text delimiter.

5.2.1.4 There shall be no message status subfield in the heading of an inquiry message transmitted by the voice response telephone.

5.2.1.5 Any transmission by the voice response telephone to the Transaction Network (with exception of the control sequences specified in Subsection 6.2) will be treated as though it was an inquiry message.

5.2.1.6 Null subfields ("#0" follows "#0") and null text are acceptable in an inquiry message. The "#0" character sequence is counted as one text character. The following is acceptable as the first inquiry message: called number "#0" "\#\#" or for subsequent inquiry messages: "\#\#".

5.2.2 The response message will consist of AVA phrases specified by the DPC. The Transaction Network is transparent to the response message (with the exception of the DPC requests disconnect response message).

5.2.2.1 The response message may be preceded by an optional AVA alerting tone of XXXX and followed by an optional AVA ending tone. The Transaction Network is transparent to the AVA alerting and ending tones. Duration of the tones is also optional.

5.2.2.2 If both a response message and a disconnect error message happen to be ready for transmission to the TT telephone at the same time, the Transaction Network will deliver the error message and then disconnect. The response message with an "undeliverable response" message status in the heading is returned to the DPC.

5.2.2.3 A response message received after the call has been disconnected will be returned by the Transaction Network to the DPC with an "undeliverable response" message status in the heading.

5.2.2.4 A response message may be interrupted by the Transaction Network in order to deliver a disconnect error message. The response message will then be returned to the DPC with an "undeliverable response" message status in the heading.

5.2.3 The error message will consist of AVA phrases and will be preceded by an AVA alerting tone of .5 second duration and followed by an AVA ending tone of .5 second duration. The reader is cautioned that the contents (wording) of the error messages which follow may be subject to change. An error message may be one of two types:

A - Disconnect Error Message

B - Error Prompting Message

5.2.3.1 The disconnect error message precedes all disconnects initiated by the Transaction Network. All of the errors listed in Table 2.2 will cause the Transaction Network to initiate a disconnect. When the disconnect conditions have been satisfied, the Transaction Network will proceed with the disconnect immediately after voicing the disconnect error message. Disconnect error messages will not be repeated by the Transaction Network and only one (1) disconnect error message is transmitted by the Transaction Network per call. That message will specify the error with the highest priority within the error hierarchy shown in Table 2.2. If the Transaction Network detects a Priority 6 error on a previous inquiry message while receiving a following inquiry message, it will wait until transmission of the current inquiry message is completed. The Transaction Network will then issue the

disconnect message even though the current (last) inquiry message may have been received without error.

The disconnect error message will be as follows:

5.2.3.1.1 After the inquiry message "##" character sequence has been received, the Transaction Network checks the routing of the called number. If routing is impossible, one of the disconnect error messages listed below is transmitted to the voice response telephone:

A - "Called number changed. Please correct and try again."

B - "NO such called number. Please correct and try again."

5.2.3.1.2 After the inquiry message "##" character sequence has been received the Transaction Network checks for an attempt to access a DPC which does not service dial-in telephones. Any attempt will result in the following disconnect error message transmitted to the voice response telephone.

"Call not allowed. Please correct and try again."

5.2.3.1.3. If DPC equipment problems prevent the Transaction Network from forwarding the inquiry message, the following disconnect error message is transmitted to the voice response telephone.

"Called number unavailable. Please follow special instructions."

5.2.3.1.4. If DPC queueing problems prevent the Transaction Network from forwarding the inquiry message, the following disconnect error message is transmitted to the voice Response telephone:

"Called number busy. Please try again later."

5.2.3.1.5. A failure of the Transaction Network at any time will immediately result in the following disconnect error message transmitted to the voice response telephone.

"Network problem. Please follow special instructions."

5.2.3.1.6. As soon as a voice response telephone action type time out is invoked (see paragraph 7.2.2.1-7.2.2.3: Ti, Tc, Tm) the following disconnect error message is transmitted to the voice response telephone:

"Maximum inquiry time exceeded. Please try again."

5.2.3.1.7. The Transaction Network checks the translated inquiry message text length. As soon as the maximum number of characters allowed (128) is exceeded the Transaction Network will ignore any following characters. After "###" is received it transmits the following disconnect error message to the voice response telephone:

"Message too long. Please correct and try again."

5.2.3.1.8. As soon as the DPC response message time out is invoked (see paragraph 7.2.3.4: Tr) the following disconnect message is transmitted to the voice response telephone:

"Response time exceeded. Please try again."

5.2.3.1.9 The Transaction Network maintains a count of the use of the repeat control sequence for the same AVA response message. When the count exceeds one (1), the following disconnect error message is transmitted to the voice response telephone:

"Excessive Repeats. Please try again."

5.2.3.1.10 The Transaction Network maintains a count of the errors encountered in entering the heading or a text subfield either through error prompting messages or through the erase control sequence or both. If more than three (3) errors are encountered within the heading or any text subfield the following disconnect error message is transmitted to the voice response telephone.

"Excessive errors. Please correct and try again."

5.2.3.1.11 In some cases the DPC may request the Transaction Network to disconnect a call. Upon receiving a disconnect request, the Transaction Network will immediately transmit the following disconnect error message to the voice response telephone:

"Called number requested disconnect."

5.2.3.2 The Transaction Network will immediately interrupt an inquiry message transmission with an error prompting message whenever it detects in real time the types of errors indicated below. The error prompting message is a priority 1 error message. The Transaction Network will ignore any data transmitted between detection of the error and the ending tone which immediately follows the error

prompting message. The voice response telephone shall not transmit any data during the time interval defined by the alerting and ending tones.

5.2.3.2.1 The Transaction Network examines the called number (heading) of an inquiry message to determine that:

- a. It contains 1, 2, 3 or 7 characters (0-9).
- b.  $000 \leq D_4 - D_7 \leq 998$  (Range Check)

If any of the above conditions are not met, the following prompting message is transmitted to the voice response telephone:

"Error. Re-enter called number."

5.2.3.2.2 The Transaction Network examines the text subfields of an inquiry message to determine if the invalid use of control characters exist. If any are found, the invalid control character is replaced with an ASCII "DEL" character and the following error prompting message is transmitted to the voice response telephone:

"Error. Re-enter subfield N.

where N is a positive integer determined by counting "#0" delimiter sequences, modulo 10, contained in the text (including the #0 sequence denoting STX). The attendant using the voice response telephone will enter a "#2" TOUCH-TONE character sequence whenever he determines an error exists in the current subfield. The attendant will then re-enter the current subfield.

### 5.3 Voice/KAT Response Telephone Message Formats

5.3.1 The inquiry message shall consist of a heading field and a text field.

5.3.1.1 The heading field shall appear in the first inquiry message only. Subsequent inquiry messages shall not contain a heading field.

5.3.1.2 The heading field format is as follows:

$bD_1 D_2 b8D_3 D_4 D_5 D_6 D_7 D_8 D_9$

Where - The TOUCH-TONE Character "b" is the start of heading delimiter and is the first character transmitted.

Where -  $D_1D_2$  defines the dial-in telephone type subfield as specified in Table 2.1 (D is any TOUCH-TONE character between 0-9 inclusive)

Where - the TOUCH-TONE character sequence "b8" is a subfield delimiter.

Where -  $D_3-D_9$  is the called number ( $X_1-X_7$ ) which shall be made known to the customer during negotiations with the DPC and shall consist of 1, 2, 3 or 7 decimal digits. (D is any TOUCH-TONE character between 0-9 inclusive).  $D_6-D_9$  is any number from 0000-0998.  $D_3-D_5$  is the serving Transaction Network number (nnx).

5.3.1.3 There shall be no message status subfield in the heading field of an inquiry message.

5.3.1.4 The start of text delimiter between the heading field and the text field is the TOUCH-TONE character sequence "b9".

5.3.1.5 The text field immediately follows the start of text delimiter and consists of the following:

$C_1C_2 \dots C_n \#\#$

Where -  $C_i$  is any one of the TOUCH-TONE characters listed in Table 1.3 except that the "#" character must be entered as "#1" (the Transaction Network will strip the 1 character and translate it to an ASCII ":" character). The "#1" character sequence is counted as one character. The text field may be any length up to 128 characters inclusive after translation (not including the start and end of text delimiters). The Transaction Network is transparent to the text except as noted above. The content and format of the text is determined by the customer and the DPC.

Where - the TOUCH-TONE Character sequence "\#\#" is the end of text delimiter.

Where - "LRC" is a single "longitudinal redundancy check" character which shall be used for the detection of transmission errors. The "LRC" character is the "exclusive or" of the binary equivalent shown in Table 1.3 of each message character. LRC shall be initialized by the TOUCH-TONE character "b" (SOH) of the message

heading (or the TOUCH-TONE character sequence "b9" if the heading is not transmitted) which is accumulated and shall be accumulated on each succeeding message character through the TOUCH-TONE character sequence "##" which is also accumulated.

Where - "CC", the character count, is a single TOUCH-TONE character (any TOUCH-TONE character between 0-9 inclusive) which is also used for the detection of transmission errors. It represents the sum (modulo 10) of all of the transmitted characters in the inquiry message up to and including the "LRC" character.

5.3.1.6 Any transmission by the voice/KAT response telephone to the Transaction Network (with the exception of the control sequences specified in subsection 6.3) will be treated as though it was an inquiry message and subject to the same time out constraints.

5.3.2 The response message will consist of AVA phrases and/or KAT as specified by the DPC. There are four types of response messages:

- a - AVA only
- b - Green tone (KAT) only - A 1.5 second burst of 2025 Hz. The voice/KAT response telephone must respond with an "a" echo (transmit a TOUCH-TONE "a" character) within 2 seconds as determined by a timeout (Ta).
- c - Yellow tone (KAT) and wait for AVA - A 3.0 second burst of 2025 Hz. The voice/KAT response telephone must respond with a "b" echo (transmit a TOUCH-TONE "b" character) within 2 seconds as determined by a timeout timer (Ta). The voice/KAT response telephone will always follow the "b" echo with a "##" sequence to confirm that it is "off hook" ready to receive the AVA message.
- d - Disconnect requested by the DPC

5.3.2.1 The Transaction Network will accept a response message from the DPC only if it is received within the allowable time interval (Tr).

5.3.2.2 The Transaction Network is transparent to the response message except in the case of a disconnect requested by the DPC (d above).

5.3.3 The disconnect error message will always consist of AVA phrases and precedes all disconnects initiated by the Transaction Network. All of the errors listed in Table

2.3 will cause the Transaction Network to initiate a disconnect. When the disconnect conditions have been satisfied, the Transaction Network will proceed with the disconnect immediately after voicing the disconnect error message. This will occur even when a response message is not yet received from the data base for a preceding inquiry message. The reader is cautioned that the contents (wording) of the disconnect error messages which follow may be subject to change.

5.3.3.1 Disconnect error messages will not be repeated by the Transaction Network.

5.3.3.2 Only one (1) disconnect error message is transmitted by the Transaction Network per call. That message will specify the error with the highest priority within the error hierarchy shown in Table 2.3.

5.3.3.3 The Transaction Network will not transmit the disconnect error message during reception of the inquiry message from the voice/KAT response telephone. The Transaction Network will transmit the disconnect error message only after "##," "LRC" and "CC" have been received. The only exception to this rule occurs when Ti, Tc and/or Tm time outs are detected. In this case the disconnect error message is transmitted immediately on detection. The error reported will be the one with the highest priority.

5.3.3.4 If both a response message and a disconnect error message happen to be ready for transmission to the voice/KAT response telephone at the same time, the Transaction Network will deliver the error message and then disconnect. The response message with an "undeliverable response" message status in the heading is returned to the DPC.

5.3.3.5 A response message received after the call has been disconnected will be returned by the Transaction Network to the data base with "undeliverable response" message status in the heading.

5.3.3.6 A response message may be interrupted by the Transaction Network in order to deliver a disconnect error message. The response message will then be returned to the DPC with an "undeliverable response" message status in the heading field.

5.3.3.7 If the Transaction Network detects a priority 6 error on a previous inquiry message while receiving a following inquiry message, it will wait until transmission of the current inquiry message is completed. The

Transaction Network will then issue the disconnect error message even though the current (last) inquiry message may have been received without error.

5.3.3.8 The disconnect error messages will be as follows:

5.3.3.8.1 After the inquiry message "##" TOUCH-TONE character sequence has been received, the Transaction Network checks the routing of the called number. If routing is impossible, one of the disconnect error messages listed below is transmitted to the voice/KAT response telephone:

A - "Called number changed. Please correct and try again."

B - "No such number. Please correct and try again."

5.3.3.8.2 After the inquiry message "##" (ETX) TOUCH-TONE sequence has been received, the Transaction Network checks for an attempt to access a DPC which does not service dial-in telephones. Any attempt will result in the following disconnect error message transmitted to the voice/KAT response telephone.

"Call not allowed. Please correct and try again."

5.3.3.8.3 After the inquiry message "##" TOUCH-TONE character sequence has been received, the Transaction Network checks the range of the called number. for an invalid number. Failure of the range check will result in the following disconnect error message transmitted to the voice/KAT response telephone.

"Invalid called number. Please correct and try again."

5.3.3.8.4 If DPC equipment problems prevent the Transaction Network from forwarding the inquiry message the following disconnect error message is transmitted to the voice/KAT response telephone.

"Called number unavailable. Please follow special instructions."

5.3.3.8.5 If DPC queuing problems prevent the Transaction Network from forwarding the inquiry message the following disconnect error message is transmitted to the voice/KAT response telephone:

"Called number busy. Please try again later."

5.3.3.8.6 A failure of the Transaction Network at any time will immediately result in the following disconnect error message transmitted to the voice/KAT response telephone:

"Network problem. Please follow special instructions."

5.3.3.8.7 As soon as a voice/KAT response telephone action type time out is invoked (see paragraph 7.3.2.1-7.3.2.3: Ti, Tc, Tm) the following disconnect error message is transmitted to the voice/KAT response telephone:

"Maximum inquiry time exceeded. Please try again."

5.3.3.8.8 A mismatch in the LRC character or the character count (transmission error) will immediately result in the following disconnect error message transmitted to the voice/KAT response telephone

"Transmission problem. Please try again."

5.3.3.8.9 The Transaction Network checks the number of digits comprising the called number. Any number other than 1, 2, 3 or 7 will result in the following disconnect error message transmitted to the voice/KAT response telephone:

"Heading format error. Please correct and try again."

5.3.3.8.10 The Transaction Network checks the translated inquiry message text length. As soon as the maximum number of characters allowed (128) is exceeded, the Transaction Network will ignore any following characters. After "##", "LRC" and "CC" are received it transmits the following disconnect error message to the voice/KAT response telephone:

"Message too long. Please correct and try again."

5.3.3.8.11 The Transaction Network checks the inquiry message for the appearance of control characters in the called number or in the text. Upon detecting improper use of control characters the Transaction Network transmits the following disconnect error message to the voice/KAT response telephone:

"Improper use of control characters. Please correct and try again."

5.3.3.8.12 As soon as the data base response message time out is invoked (see paragraph 7.3.2.4: Tr) the following

disconnect message is transmitted to the voice/KAT response telephone:

"Response time exceeded. Please try again."

5.3.3.8.13 The Transaction Network maintains a count in real time of the use of the repeat control sequence for the same AVA response message. When the count exceeds one (1), the following disconnect error message is transmitted to the Voice/KAT Response Telephone:

"Excessive Repeat. Please try again."

5.3.3.8.14 An "a" or "b" echo not received before Tu times out (see paragraph 7.3.3.5) will result in the following disconnect error message transmitted to the voice/KAT response telephone:

"Telephone malfunction. Please try again."

5.3.3.8.15 An "off hook" Signal not received before Toh times out will immediately result in the following disconnect error message transmitted to the voice/KAT response telephone:

"Off hook Time exceeded. Please try again."

5.3.3.8.16 In some cases the DPC may request the Transaction Network to disconnect a call. Such a disconnect request is indicated to the Transaction Network in the header of a response message and the text portion must be null. Upon receiving a disconnect request the Transaction Network will immediately transmit the following disconnect error message to the voice/KAT response telephone:

"Called number requested disconnect."

#### 5.4 Data Response Telephone Message Formats

5.4.1 The inquiry message shall consist of a heading field and a text field. The heading field shall appear in the first inquiry message only.

5.4.1.1 The heading format is as follows:

bD<sub>1</sub> D<sub>2</sub> b8D<sub>3</sub> D<sub>4</sub> D<sub>5</sub> D<sub>6</sub> D<sub>7</sub> D<sub>8</sub> D<sub>9</sub>

Where - The TOUCH-TONE character "b" is the start of heading delimiter and is the first character transmitted.

where -  $D_1D_2$  defines the dial-in telephone type as specified in Table 2 (D is any TOUCH-TONE character between 0-9 inclusive).

Where - The TOUCH-TONE character sequence "b8" is a subfield delimiter.

Where -  $D_3-D_9$  is the called number ( $X_1-X_7$ ) which shall be made known to the customer during negotiations with the DPC and shall consist of 1, 2, 3 or 7 decimal digits. (D is any TOUCH-TONE character between 0-9 inclusive).  $D_6-D_9$  is any number from 0000-0998.  $D_3-D_5$  is the serving Transaction Network number (nnx)

5.4.1.2 There shall be no message status subfield in the heading field of an inquiry message.

5.4.1.3 The start of text delimiter between the heading and the text field is the TOUCH-TONE character sequence, "b9".

5.4.1.5 The text field immediately follows the start of text delimiter and consists of the following

$C_1C_2 \dots C_n \#\#$

Where -  $C_i$  is any one of the TOUCH-TONE characters listed in Table 1.4 except that the "#" character must be entered as "#1" (the Transaction Network will strip the 1 character). The text field may be any length up to 128 characters (not including the STX and ETX delimiters). The Transaction Network is transparent to the text except as noted above. The content and format of the text is determined by the customer and the DPC.

Where - the TOUCH-TONE character sequence "##" is the end of text delimiter. The "##" character sequence is always followed by the "LRC" and "CC" Characters:

Where - "LRC" is a "longitudinal redundancy check character which shall be used for the detection of transmission errors. The "LRC" character is the "exclusive or" of the binary equivalent shown in the Table 1.1 of each message character. LRC shall be initialized by the "b" TOUCH-TONE character of the message heading (or the "b9" TOUCH-TONE character sequence if

the heading is not transmitted) which is accumulated and shall be accumulated on each succeeding message character through the "##" TOUCH-TONE character sequence which is accumulated.

where - "CC" is a single TOUCH-TONE character (any TOUCH-TONE character between 0-9 inclusive) which is also used for the detection of transmission errors. It represents the sum (modulo 10) of all of the transmitted characters in the inquiry message up to and including the "LRC" character.

5.4.1.5 Any transmission by the data response telephone to the Transaction Network (with the exception of the control sequences specified in subsection 6.4) will be treated as though it was an inquiry message subject to the same timeout constraints.

5.4.2 The response message will consist of a text field only. The Transaction Network is transparent to the text except as noted below.

5.4.2.1 The text field format is as follows

STX C<sub>1</sub>C<sub>2</sub> ..... C<sub>n</sub> ETX

Where - STX denotes the start of text and consists of the ASCII - "STX" Character as specified in paragraph 3.4.2.

Where - C<sub>i</sub> will be any ASCII character except the "SOH, STX, ETX, EOT, ENQ, ACK, DLE and NAK" characters. The text field may be any length up to 128 characters (not including the "ETX" and "STX" delimiters). There is no limit to the number of subfields contained in the text field and the "FS," "GS" and "RS" ASCII characters may be used as text subfield delimiter as required. The data response telephone shall interpret the appearance of the "ENQ" character in the text as a premature termination. The content and format of the text field is determined by the customer and the DPC.

Where - "ETX" denotes the end of text and consists of the ASCII - "ETX" character is specified in paragraph 3.4.2.

The "ETX" character is always followed by the "LRC" Character:

Where - "LRC" is a "longitudinal redundancy check" character which shall be used for the detection of transmission errors. The "LRC" character is the "exclusive or" of each message character. LRC will be initialized by the appearance of the "STX" character and accumulated on each succeeding message character (not including STX) through the "ETX" character which is also accumulated.

5.4.2.2 A response message received after the call has been disconnected will be returned by the Transaction Network to the DPC with an "undeliverable response" message status in the heading.

5.4.2.3 A response message may be interrupted by the Transaction Network in order to deliver a disconnect error message. The response message will then be returned to the DPC with an "undeliverable response" message status in the heading.

5.4.3 The disconnect error message consists of a returned inquiry message.

5.4.3.1 Any inquiry message which encounters telephone company or customer equipment irregularities not covered by the data response protocol upon being transmitted through the Transaction Network will be returned to the calling number (data response telephone) as a disconnect error message. The message status subfield will contain an indication of the specific irregularity encountered. The error message, therefore, refers to a current or immediately preceding inquiry message from the data response telephone. The Transaction Network will wait until transmission of a current inquiry message has been properly concluded (data response Protocol satisfied) before transmitting the disconnect error message except when an initial, intercharacter or message timeout occurs (refer to paragraph 7.4.7). In this case the Transaction Network Service will transmit the appropriate disconnect error message immediately upon detection of the time out.

5.4.3.2 All of the errors listed in Table 2.4 (excluding the transmission errors which are handled by the data response Protocol) will cause the Transaction Network to initiate a disconnect when the disconnect conditions have been satisfied, the Transaction Network will proceed with the disconnect immediately after transmitting the disconnect

error message. This will occur even when a response message is not yet received from the DPC for a preceding inquiry message.

5.4.3.3 If the Transaction Network detects a Class 6 error on a previous inquiry message while receiving a following inquiry message, it will wait until transmission of the current inquiry message is completed. The Transaction Network will then transmit the disconnect error message even though the current (last) inquiry message may have been received without error.

5.4.3.4 Only one (1) disconnect error message is transmitted by the Transaction Network per call. That message will specify the error with the highest priority within the error hierarchy shown in Table 2.4.

5.4.3.5 If both a response message and a disconnect error message happen to be ready for transmission to the data response telephone at the same time, the Transaction Network will deliver the disconnect error message and then disconnect. The response message with an "undeliverable response" message status in the heading is returned to the DPC.

#### 5.4.4 Disconnect Error Format

5.4.4.1 The disconnect error message will consist of both a heading and a text field where possible or only a heading field. The data response telephone shall recognize a disconnect error message by the presence of a heading field. When the termination control sequence (terminates protocol associated with transmission of disconnect error message) is received from the Transaction Network, the data response telephone will automatically disconnect (the Transaction Network will not transmit a disconnect control sequence).

5.4.4.2 Disconnect error messages will include a portion (first two characters if possible) of the original inquiry message text. The message format is as follows:

SOH-Called Number -GS-Message Status(X,Y)-STX-Truncated Text-ETX-LRC

Where - all of the delimiters and subfields have been previously defined with the exception of the message status subfield which is specified below. LRC is initialized by the appearance of the SOH character (SOH is not accumulated).

Where - the Transaction Network will left justify and insert space characters where necessary in the

called number subfield in order to pad it out to seven characters.

5.4.4.3 The message status subfield will be inserted only into the disconnect error message heading field to show irregularities. All data response telephones must accept the message status subfield as part of the data link message format specification. Subsequent usage of the information contained in the subfield is customer dependent.

5.4.4.4 The message status entries apply solely to the accompanying message. The subfield is not used to cover errors under the data link protocol for which a negative acknowledgment (NAK) is ordinarily sent.

5.4.5 Irregularities reported will be identified by two characters of the form X, Y (X transmitted first, followed by Y) for all messages handled by the Transaction Network. X and Y represent any of the digits zero through nine.

5.4.5.1 The first digit, X, indicates the generic class of the irregularity encountered while the second digit, Y, describes the specific irregularity. The irregularities have been classified according to the first digits, X, so that when multiple irregularities,  $X_1, \dots, X_n > 0$ , occur for a particular message, then  $X_{\min} = \min(X_1, \dots, X_n)$  will be the only message status reported, it being the first encountered anomaly. For example, if irregularities  $(X,Y) = (1,3)$  and  $(4,1)$  are encountered, then  $(1,3)$  will be the message status reported.

If status indications  $(X,Y) = (5,Y_1)$  and  $(5,Y_2)$  are encountered then the Y field value corresponding to the most severe error, will be inserted into the delivered message.

5.4.5.2 Five generic classes of message status are defined: Class\_0 - normally handled messages (X=0). This class is not reported over the dial-in interface.

5.4.5.3 Class\_1 - Irregularities encountered during message transmission to the Transaction Network (X=1,2).

5.4.5.4 Class\_2 - Irregularities encountered by the Transaction Network routing algorithms while attempting to determine the DPC (X=3). (X=4 is reserved for future uses of this type).

5.4.5.5 Class\_3 - Irregularities encountered by the TRANSACTION Network which prevented forwarding the message to the DPC.

5.4.5.6 Class 4 - Irregularities encountered during attempted forwarding of message (X=7). (X=6 is reserved for future uses of this type.) (X=9 is reserved for future use of all classes.)

5.4.5.7 The above classes follow sequential actions in transferring a message through the Transaction Network. An irregularity encountered in Classes 1 through 3 will prevent the next sequential step in the message transfer process and cause the message to be returned to the telephone.

5.4.6 Reception Irregularities (Class 1) - Class 1 Status subfields (X=1) indicate seeming data link protocol acceptance of a message, i.e., a positive acknowledgment was transmitted, with subsequent detection of an error in the received message which precludes it from any further processing for delivery through the TRANSACTION Network System.

5.4.6.1 Heading format error - Class 1 status subfields with (X,Y) = (1,0) indicate an error in the specified heading format. Such errors include no heading, required heading subfield missing, and incorrect heading subfield length.

5.4.6.2 Maximum Text Length Exceeded - Class 1 status subfields with (X,Y) = (1,1) indicate that the tariff-specified maximum character count for the text field has been exceeded.

5.4.6.3 Improper Use of Characters - Class 1 status subfields with (X,Y) = (1,2) indicate an illegal character, such as a data link control character improperly inserted into the heading or text fields.

5.4.6.4 Maximum Inquiry Time Exceeded - Class 1 Status subfields with (X,Y) = (1,3) indicate that the message entry time exceeded the specified maximum duration.

5.4.6.5 Protocol Error - Class 1 status subfields with (X,Y) = (1,4) indicate an error in the data link protocol. For example, the status could apply to a message for which a positive acknowledgment has been sent but for which the remainder of the protocol was not successfully concluded.

5.4.6.6 Invalid Calling Number - Class 1 status subfields with (X,Y) = (1,5) indicate the call was received on the wrong port.

5.4.6.7 Excessive Inquiry Retransmission - Class 1 status subfields with  $(X,Y) = (1,7)$  indicate the inquiry message has been retransmitted an excessive number of times.

5.4.6.8 Maximum Response Wait Exceeded - Class 1 status subfields with  $(X,Y) = (2,0)$  indicate that the response time has been exceeded.

5.4.7 Routing Irregularities (Class 2) - Class 2 status subfields  $(X=3)$  indicate a message that was successfully received but that cannot be routed to the DPC.

5.4.7.1 No Such Number - Class 2 status subfields with  $(X,Y) = (3,0)$  indicate that no such called number is presently assigned within the Transaction Network.

5.4.7.2 Number Changed - Class 2 status subfields with  $(X,Y) = (3,1)$  indicate that the called number is no longer assigned within the Transaction Network. The called number had once been assigned to a DPC and a new number has now been assigned to that DPC.

5.4.7.3 Improper Class of Service - Class 2 status subfields with  $(X,Y) = (3,2)$  indicate an improper class-of-service identification. For example, this status applies to an attempt by a data response telephone to communicate with a DPC which will not service dial-in telephones.

5.4.7.4 Invalid Called Number - Class 2 status subfields with  $(X,Y) = (3,3)$  indicate a called number out of range.

5.4.8 Non Existent of Forward Path (Class 3) - Class 3 status subfields  $(X=5)$  indicate that the message was not delivered because of an anomaly encountered in the forward path.

5.4.8.1 Called Station Unavailable - Class 3 status subfields with  $(X,Y) = (5,0)$  indicate the called DPC is not currently accepting messages. The unavailability of a called DPC can be caused by hardware failures in the forward path or by request of that DPC. For a called DPC with a message forwarding arrangement, receipt of this status indicates, in addition, that the specified alternate delivery point is also unavailable.

5.4.8.2 Called Station Queue Overflow - Class 3 status subfields with  $(X,Y) = (5,1)$  indicate an overflow of the message queues for the called DPC within the Transaction Network. For a called DPC with the message-forwarding option, receipt of this status indicates, in addition, that the allowable alternate delivery point is unavailable.

5.4.8.3 Network Trouble - Class 3 status subfields with  $(X,Y) = (5,3)$  indicate that the message cannot be forwarded due to trouble in the Transaction Network.

5.4.9 Forwarding Irregularities (Class 4) - Class 4 status subfields  $(X=7)$  indicate an irregularity encountered in delivery of the message. This irregularity does not prevent the message from being delivered.

5.4.9.1 DPC Requested Disconnect - Class 4 status subfields with  $(X,Y) = (7,3)$  indicate that the DPC has requested a disconnect.

5.4.9.2 Excessive Response Retransmission - Class 4 status subfields with  $(X,Y) = (7,4)$  indicate that the response message has been retransmitted an excessive number of times.

## 6.0 Control Sequences

6.1 A control sequence shall be a short transmission consisting of a maximum of two characters. The dial-in telephone shall transmit control sequences to support all protocols. The Transaction Network will transmit control sequences only to support the data response protocol.

6.2 The voice response protocol includes two control sequences which are transmitted by the voice response telephone. The control sequences are Repeat and Disconnect.

6.2.1 The repeat control sequence hereinafter referred to as repeat consists of a two (2) TOUCH-TONE character sequence, "#9". The voice response telephone shall transmit "#9" only when the customer desires a repeat of an AVA response message. Repeat is an acceptable control sequence only if it is the first character received following an AVA response message, otherwise, the Transaction Network will reject it and transmit the following error message;

"Error. Re-enter field N"

The "#9" shall be transmitted by the voice response telephone within the  $T_i$  and  $T_c$  timing constraints respectively (see paragraph 7.2.2.1-B and 7.2.2.2-A). If the Transaction Network receives more than one (1) repeat for a given AVA message it will disconnect the call after voicing the appropriate disconnect message. The Transaction Network will not repeat a disconnect message.

6.2.2 The disconnect control sequence herein after referred to as Disconnect consists of a two (2) TOUCH-TONE character

sequence, "##". The voice response telephone shall transmit "##" if it wishes to initiate a disconnect. The voice response telephone shall then request the data access arrangement to terminate the call. Upon receiving "##" the Transaction Network will implement a disconnect at the Transaction Network end of the line. The voice response telephone should not transmit "##" when the AVA is voicing a message since the Transaction Network may not detect the transmission.

6.3 The voice/KAT response protocol includes two control sequences which are transmitted by the voice/KAT response telephone. The control sequences are Repeat and Disconnect.

6.3.1 The repeat control sequence hereinafter referred to as repeat consists of a two (2) TOUCH-TONE character sequence, "##". The voice/KAT response telephone shall transmit "##" only when the customer desires a repeat of an AVA response message. Repeat is an acceptable control sequence only if it is the first character received following an AVA Message.

The "##" character sequence shall be transmitted by the voice/KAT response telephone within the  $T_i$  and  $T_c$  timing constraints respectively (see paragraphs 7.3.2.1-B and 7.3.2.2-A). If the Transaction Network receives more than one (1) repeat for a given AVA message it will disconnect the call after voicing the appropriate disconnect message. The Transaction Network will not repeat a disconnect message.

6.3.2 The disconnect control sequence hereinafter referred to as disconnect consists of a two (2) TOUCH-TONE character sequence, "##". The voice/KAT response telephone shall transmit "##" if it wishes to initiate a disconnect. The voice/KAT response telephone shall then request the data access arrangement to terminate the call. Upon receiving "##" the Transaction Network will implement a disconnect at the Transaction Network end of the line. The voice/KAT response telephone shall not transmit "##" when the AVA is voicing a message since the Transaction Network may not detect the transmission.

6.4 The data response protocol includes the capability for message acknowledgment. Five control sequences are transmitted by the data response telephone which are the ACK Reply, NAK Reply, Request, End of transmission and Disconnect. The protocol also includes seven control sequences which are transmitted by the Transaction Network. The control sequences are the ACK Reply, NAK Reply, ACK

Permission Reply, NAK Permission Reply, End of Transmission, Enquiry and Disconnect.

6.4.1 A reply control sequence shall be used to positively or negatively acknowledge receipt of a message. The "negative or positive acknowledgment" reply control sequence transmitted by the data response telephone shall consist of the two (2) TOUCH-TONE character sequence "#3" or "#4" respectively. The "negative or positive acknowledgment" reply control sequence transmitted by the Transaction Network will consist of a single ASCII control character "NAK" or "ACK" respectively.

The Transaction Network and the Data Response telephone shall transmit a reply control sequence upon receipt of an inquiry message or a response/disconnect error message respectively. A negative acknowledgment indicates the message was received with transmission errors (parity error and/or LRC mismatch and/or CC mismatch) or an "ENQ" control character was detected. A positive acknowledgment indicates that none of the above errors were detected. The Transaction Network will transmit a reply control sequence to the data response telephone upon receipt of an inquiry message provided no error message is waiting to be forwarded to the data response telephone. The Transaction Network will transmit a P-NAK control sequence in place of reply control sequence if an error message is waiting to be forwarded to the data response telephone. The data response telephone shall transmit a reply control sequence to the Transaction Network upon receipt of a response message. Both the Transaction Network and the data response telephone shall retransmit the response/error and inquiry message respectively upon receipt of a reply control sequence containing a "NAK" control character. The reply control sequence is hereinafter referred to as a ACK or NAK reply.

6.4.2 The termination control sequence shall be used to indicate the end of the data link protocol by means of which a single inquiry, response or disconnect error message was transmitted. The termination control sequence transmitted by the data response telephone shall consist of a two (2) TOUCH-TONE Character sequence "#5". The termination control sequence transmitted by the Transaction Network System will consist of a single ASCII "EOT" control character (end of transmission). The data response telephone will transmit a termination control sequence to the Transaction Network when it has successfully received an ACK reply control sequence (either from the Transaction Network acknowledging receipt of the inquiry message. The Transaction Network will transmit two (2) termination (EOT) control sequences back to back to the data response

telephone when it has successfully received an ACK reply control sequence from the telephone acknowledging receipt of the response message. The termination control sequence is hereinafter referred to as a termination and is also referred to as a "line turn around".

6.4.3 The Request control sequence shall be used in place of a termination by the data response telephone only for the purpose of requesting permission from the Transaction Network to transmit another inquiry message. The request control sequence transmitted by the data response telephone shall consist of a two (2) TOUCH-TONE Character sequence "#6". The request control sequence is hereinafter referred to as a request.

6.4.4 The permission reply control sequence will be used by the Transaction Network to acknowledge receipt of a request from the data response telephone and to grant or withhold permission to transmit a subsequent inquiry message. The "permission granted" reply control sequence transmitted by the Transaction Network will consist of the two (2) ASCII control character sequence "DLE ACK". The "permission denied" reply control sequence transmitted by the Transaction Network will consist of the two (2) ASCII Control Character sequence "DLE NAK". The permission reply control sequence is hereinafter referred to as a P-ACK reply or a P-NAK reply. The Transaction Network will transmit two (2) P-ACK replies back to back to indicate that the request has been honored and that the data response telephone may transmit another inquiry message. A single P-NAK reply is transmitted if the request cannot be honored because a response or disconnect error message is waiting for transmission to the data response telephone.

The data response telephone shall always interpret receipt of a P-NAK reply as an indication that the current inquiry message has been discarded by the Transaction Network and that it must turn the line around by transmitting a termination.

6.4.5 An enquiry control sequence will be transmitted only by the Transaction Network to request a retransmission of the last control sequence sent by a telephone. The enquiry control sequence transmitted by the Transaction Network will consist of a single ASCII "ENQ" control character. The enquiry control sequence is hereinafter referred to as an enquiry.

6.4.6 A disconnect control sequence shall be transmitted by the data response telephone to notify the Transaction Network of its intention to disconnect (terminate the

call). The Transaction Network will normally notify the data response telephone of its intention to initiate a disconnect (terminate the call) by means of a disconnect control sequence unless otherwise specified by the data response Protocol. The disconnect control sequence transmitted by the data response telephone shall consist of the two (2) TOUCH-TONE character sequence "##". The disconnect control sequence transmitted by the Transaction Network will consist of the two (2) ASCII control character sequence "DLE,EOT". The disconnect control sequence is hereinafter referred to as a disconnect.

## 7.0 Error Control Protocol

7.1 Positive control over the call and the dial-in telephone shall be maintained by the specification that data transmissions and error control procedures are initiated from the Transaction Network System in accordance with a fixed protocol.

## 7.2 Voice Response Protocol

7.2.1 The voice response Protocol is used with voice response telephones which generate only the twelve (12) TOUCH-TONE Characters shown in Figure 1.2.

7.2.1.1 The Transaction Network identifies a voice response telephone when the inquiry message does not start with the "b" TOUCH-TONE character.

7.2.1.2 The Transaction Network Station will not transmit keyed answer tones (KAT) to a voice response telephone.

7.2.1.3 No capability for acknowledgement by the Transaction Network or the voice response telephone exists in the voice response protocol.

7.2.1.4 The voice response telephone shall immediately follow "##" with a disconnect after transmitting an inquiry message which does not require a response.

7.2.1.5 The voice response protocol will be capable of handling any number, sequence or combination of inquiry and response messages with only one exception:

7.2.1.5.1 The voice response protocol will not support reception of multiple responses from the data base. Multiple response are defined as the reception of two responses that are not separated in time by the reception of at least one inquiry message.

7.2.1.5.2 The voice response protocol will, therefore, support a series of  $n$  inquiries followed by a single response where  $n \geq 1$ . When  $n=1$  the transaction is considered as the single inquiry, single response type. The first inquiry message of a new transaction must not be transmitted before receiving the response message for the previous transaction.

7.2.1.6 Paragraphs 7.2.1.5.1 and 7.2.1.5.2 above are implemented as follows: The response timer (Tr) is activated by the Transaction Network only on receipt of "##" from the voice response telephone. If the response message is received before Tr times out it is accepted by the Transaction Network and Tr is deactivated. The Transaction Network will not accept a response message unless Tr is activated.

7.2.1.7 The voice response protocol will not limit the overall number of inquiry messages accepted per call, however, it will initiate a disconnect at the request of the DPC.

7.2.1.8 The voice response protocol will allow only one (the first) inquiry message per call to contain a heading. This implements the rule that all inquiry messages must be directed to only one DPC for a given call since only the heading contains the called number. If subsequent inquiry messages contain a heading field, the Transaction Network will regard such a heading as text characters and forward them to the DPC.

7.2.1.9 Data or control characters will not be accepted by the Transaction Network while transmitting an AVA message.

7.2.2 The Transaction Network will implement the voice response protocol with a number of timers which trigger various actions.

7.2.2.1 Initiation Timer (Ti) times out @ 15 seconds.

A - The Transaction Network resets and activates Ti when it has completed transmitting the answer tone (see paragraph 4.1.4). If the voice response telephone has completed transmission of the first character of the inquiry message heading before Ti times out, then the Transaction Network deactivates Ti and activates Tc and Tm.

B - The Transaction Network resets and activates Ti when it has completed transmitting the response message.

If the voice response telephone has completed transmission of the first character of a subsequent inquiry message (without heading) or of a Repeat Control Sequence (entered correctly or incorrectly) before  $T_i$  times out, then the Transaction Network deactivates  $T_i$  and activates  $T_c$  and  $T_m$ . If the Repeat Control Sequence was entered incorrectly, then the response message can not be repeated. The Transaction Network will transmit the following error prompting message if it receives any two TOUCH-TONE character sequence beginning with the "#" character other than "#2," "#9," "#0," and "##:"

"Error. Re-enter subfield one."

- C - If  $T_i$  times out the Transaction Network will transmit the appropriate disconnect error message and then initiate a disconnect.

#### 7.2.2.2 Intercharacter Timer ( $T_c$ ) - times out @ 13 seconds.

- A - The Transaction Network initially resets and activates  $T_c$  when it has received the first character of an inquiry message or a control sequence. If the voice response telephone has completed transmission of the next character before  $T_c$  times out then the Transaction Network resets and reactivates  $T_c$  to time the arrival of the next character.
- B - If  $T_c$  times out the Transaction Network will transmit the appropriate disconnect error message and initiates a disconnect.

#### 7.2.2.3 Message Time ( $T_m$ ) - times out @ 2 minutes.

- A - The Transaction Network resets and activates  $T_m$  when it has received the first character of an inquiry message or a control sequence or any character (even if accidental) received after "##" of the preceding inquiry message. If the voice response telephone completes transmission of the inquiry message ("##" received) before  $T_m$  times out the Transaction Network deactivates  $T_m$ .
- B - If  $T_m$  times out the Transaction Network will transmit the appropriate disconnect error message and then initiate a disconnect.

#### 7.2.2.4 Response Timer ( $T_r$ ) - times out @ 20 seconds.

- A - The Transaction Network resets and activates Tr only when it has received "##" (ETX) of an inquiry message. If a response is received from the DPC before Tr times out the Transaction Network deactivates Tr.
- B - If Tr times out and Tm is deactivated (subsequent inquiry message not started), the Transaction Network will transmit the appropriate disconnect error message and initiates a disconnect. If Tr times out but Tm is activated (subsequent inquiry message started) the call is maintained, however, the Transaction Network will not accept a response message from the DPC until the end of the subsequent inquiry message. If both Tr and Tm are activated any response message from the DPC will be accepted by the Transaction Network and transmitted immediately to the voice response telephone interrupting any current inquiry message.

### 7.3 Voice/KAT Response Protocol

7.3.1 The voice/KAT response protocol is used with voice/KAT response telephones which generate the sixteen (16) TOUCH TONE characters shown in Table 1.3.

7.3.1.1 The Transaction Network identifies a voice/KAT response telephone by the presence of a "b" character as the first received character.

7.3.1.2 The voice/KAT response protocol will be capable of handling any number, sequence or combination of inquiry and response messages with only one exception:

7.3.1.2.1 The voice/KAT response protocol will not support reception of multiple responses from the DPC. Multiple responses are defined as the reception of two responses that are not separated in time by the reception of at least one inquiry message.

7.3.1.2.2 The voice/KAT response protocol will, therefore, support a series of n inquiries followed by a single response where  $n \geq 1$ . When  $n=1$  the transaction is considered as the single inquiry, single response type. The first inquiry message of a new transaction must not be transmitted before receiving the response message for the previous transaction.

7.3.1.3 Paragraphs 7.3.1.2.1 and 7.3.1.2.2 above are implemented as follows: The response timer (Tr) is activated by the Transaction Network only on receipt of "##" from the voice/KAT response telephone. If the response message

is received before Tr times out it is accepted by the Transaction Network and Tr is deactivated. The Transaction Network will not accept a response message unless Tr is activated.

7.3.1.4 The voice/KAT response protocol will not limit the overall number of inquiry messages accepted per call, however, it will initiate a disconnect at the request of the DPC.

7.3.1.5 The voice/KAT response protocol will allow only one (the first) inquiry message per call to contain a heading. This implements the rule that all inquiry messages must be directed to only one DPC for a given call since only the heading contains the called number. If subsequent inquiry messages contain a heading field, the Transaction Network will regard the heading as text characters and forward them to the DPC.

7.3.1.6 Data or control characters will not be accepted by the Transaction Network while transmitting an AVA message.

7.3.1.7 No capability for acknowledgement by the Transaction Network or the voice/KAT response telephone exists in the Protocol with the exception of "Off Hook" and the "a" and "b" echoes.

7.3.2 The Transaction Network will implement the voice/KAT response protocol with a number of timers which trigger various actions.

7.3.2.1 Initiation Timer (Ti) - times out @ 15 seconds.

- A - The Transaction Network activates Ti when it has completed transmitting the answer tone (see paragraph 4.1.4). If the voice/KAT response telephone has completed transmission of the first character of the inquiry message heading before Ti times out, then the Transaction Network deactivates Ti and activates Tc and Tm.
- B - The Transaction Network activates Ti when it has completed transmitting the response message. If the voice/KAT response telephone has completed transmission of the first character of a subsequent inquiry message (without heading) or of a Repeat Control Sequence before Ti times out, then the Transaction Network deactivates Ti and activates Tc and Tm.

- C - If  $T_i$  times out the Transaction Network will transmit the appropriate disconnect error message and then initiate a disconnect.

7.3.2.2 Intercharacter Time ( $T_c$ ) - times out @ 13 seconds.

- A - The Transaction Network initially resets and activates  $T_c$  when it has received the first character of an inquiry message or a control sequence. If the voice/KAT Response telephone has completed transmission of the next character before  $T_c$  times out then the Transaction Network resets and reactivates  $T_c$  to time the arrival of the next character.
- B - If  $T_c$  times out the Transaction Network will transmit the appropriate disconnect error message (see paragraph and then initiate a disconnect.

7.3.2.3 Message Timer ( $T_m$ ) - times out @ 2 minutes.

- A - The Transaction Network resets and activates  $T_m$  when it has received the first character of an inquiry message or a control sequence. If the voice/KAT response telephone completes transmission of the inquiry message ("##" "LRC" and "CC" received) before  $T_m$  times out the Transaction Network deactivates  $T_m$ .
- B - If  $T_m$  times out the Transaction Network will transmit the appropriate disconnect error message and then initiate a disconnect.

7.3.2.4 Response Timer ( $T_r$ ) - times out @ 20 seconds.

- A - The Transaction Network resets and activates  $T_r$  only when it has received an inquiry message. If a response is received from the DPC before  $T_r$  times out the Transaction Network deactivates  $T_r$ .
- B - If  $T_r$  times out and  $T_m$  is deactivated (subsequent inquiry message not started), the Transaction Network will transmit the appropriate disconnect error message and then initiate a disconnect. If  $T_r$  times out but  $T_m$  is then activated (subsequent inquiry message started) the call is maintained, however, the Transaction Network will not accept a response message from the DPC until the end of the subsequent inquiry message. If both  $T_r$  and  $T_m$  are activated any response message from the DPC will be accepted by the Transaction Network and transmitted to the voice/KAT

response telephone after "###", "LRC" and "CC" are received for the current inquiry message.

7.3.3.5 Automatic Timer (Ta) times out at 2 seconds.

- A - The Transaction Network resets and turns on Ta when at the end of the 1.5 or 3.0 second KAT which it transmitted to the voice/KAT response telephone. The voice/KAT response telephone must respond to this KAT with an "a" or "b" Echo respectively (transmits an "a" or "b" TOUCH-TONE character). If an "a" or "b" Echo is received from the voice/KAT responses telephone before Ta times out, the Transaction Network deactivates Ta.
- B - If Ta times out the Transaction Network will transmit the appropriate disconnect error message and then initiate a disconnect. The Transaction Network will also inform the DPC that the response was undeliverable.

7.3.3.6 "Off Hook" Timer (Toh) times out at 10 seconds.

- A - The Transaction Network resets and activates Toh when it receives a "b" Echo from the voice/KAT response telephone. The voice/KAT response telephone shall follow with an "off hook" signal which consists of the two (2) TOUCH-TONE character sequence ("##") after the "off hook" occurs. If an "off hook" signal is received from the voice/KAT response telephone before Ta times out the Transaction Network deactivates Ta off.
- B - If Ta times out the Transaction Network will transmit the appropriate disconnect error message and then initiate a disconnect. The Transaction Network will also inform the DPC that the response was undeliverable.

#### 7.4 Data Response Protocol

7.4.1 The data response protocol is used with data response telephones equipped with a receiver capable of accepting a FSK signal as defined in subsection 3.4. The data response telephone is also capable of generating the sixteen (16) TOUCH-TONE characters shown in Table 1.4.

7.4.1.1 The Transaction Network recognizes a telephone of this type by means of the telephone type Subfield as shown in Table 2.1.

7.4.1.2 The Transaction Network will not transmit keyed answer tones (KAT) to the data response telephone.

7.4.1.3 Positive control over the dial-in interface and the data response telephone shall be maintained by the specification that data transmissions and error control procedures are initiated from the Transaction Network in accordance with a fixed protocol.

#### 7.4.2 Data Transmission

Simultaneous transmission over the half-duplex local loop is prevented by specifying that all transmissions from the data response telephone shall follow commands, either messages or control sequences, issued from the Transaction Network. Once a call has been established these commands shall implement the data link protocol by providing for the following normal sequence of transmissions: message transfer with appropriate acknowledgment and termination procedures. Unauthorized transmissions from the data response telephone shall cause the data link protocol to abort.

#### 7.4.3 Error Control

Error control is basically maintained through the transmission of positive or negative acknowledgments to the transfer of messages. Error recovery shall be achieved by retransmission of garbled transmissions. An inquiry and response message retry count and a control sequence retry count will be maintained by the Transaction Network and shall be considered disjoint.

7.4.3.1 The Transaction Network will maintain all timeouts specified in paragraph 7.4.4 with respect to protocol errors. The data response telephone shall remain responsible for implementation of the data link protocol, irrespective of any time-out considerations, until the receipt of a termination from the Transaction Network.

7.4.3.2 A maximum of three retransmissions shall be allowed per garbled transmission.

7.4.3.3 Messages which cannot be delivered to the data response telephone due to unrecoverable failure of the protocol will be returned to the originator as undelivered messages. In all cases of unrecoverable protocol failure, the Transaction Network will institute diagnostic and maintenance procedures.

7.4.4 The data response protocol will be capable of handling any number, sequence or combination of inquiry and response messages with only one exception:

7.4.4.1 The data response protocol will not support reception of multiple responses from the data base. Multiple responses are defined as the reception of two responses that are not separated in time by the reception of at least one inquiry message.

7.4.4.2 The data response protocol will, therefore, support a series of  $n$  inquiries followed by a single response where  $n \geq 1$ . When  $n=1$  the transaction is considered as the single inquiry, single response type. The first inquiry message of a new transaction must not be transmitted before receiving the response message for the previous transaction.

7.4.4.3 Paragraphs 7.4.4.1 and 7.4.4.2 above are implemented as follows: The response timer ( $Tr$ ) is activated by the Transaction Network only upon receipt of EOT from the data response telephone. If a response message is received before  $Tr$  times out it is accepted by the Transaction Network and  $Tr$  is deactivated. The Transaction Network will not accept a response message unless  $Tr$  is activated.

7.4.4.4 The data response protocol will not limit the overall number of inquiry messages accepted per call, however, it will initiate a disconnect at the request of the DPC.

7.4.4.5 The data response protocol will allow only one (the first) inquiry message per call to contain a heading. This implements the rule that all inquiry messages must be directed to only one DPC for a given call since only the heading contains the called number.

7.4.4.6 The receipt of an "ENQ" character in a returned inquiry (disconnect error) or response message (after SOH with heading or STX without heading but before ETX) is defined as a premature termination.

7.4.4.7 The receipt of the two (2) TOUCH-TONE character sequence, "#d" in an inquiry message is defined as a premature termination.

7.4.5 The Transaction Network will implement the data response protocol with a number of timers which trigger various actions.

7.4.5.1 Initiation Timer (Ti) - times out @ 15 seconds.

- A - The Transaction Network activates Ti when it has completed transmitting the answer tone (see paragraph 4.1.4). If the data response telephone has completed transmission of the first character of the inquiry message heading before Ti times out, then the Transaction Network deactivates Ti and activates Tc and Tm.
- B - The Transaction Network activates Ti when it has completed transmitting the response message. If the data response telephone has completed transmission of the first character of a subsequent inquiry message (without heading) before Ti times out, then the Transaction Network deactivates Ti and activates Tc and Tm.
- C - If Ti times out the Transaction Network will transmit the appropriate disconnect error message and then initiate a disconnect.

7.4.5.2 Intercharacter Timer (Tc) - times out @ 13 seconds.

- A - The Transaction Network initially resets and activates Tc when it has received the first character of an inquiry message or a control sequence. If the Data Response telephone has completed transmission of the next character before Tc times out then the Transaction Network resets and reactivates Tc to time the arrival of the next character.
- B - If Tc times out the Transaction Network will transmit the appropriate disconnect error message and then initiate a disconnect.

7.4.5.3 Message Timer (Tm) - times out @ 2 minutes.

- A - The Transaction Network resets and activates Tm when it has received the first character of an inquiry message or a control sequence. If the data response telephone completes transmission of the inquiry

message before Tm times out, the Transaction Network deactivates Tm.

- B - If Tr times out and Tm is deactivated (subsequent inquiry message is not started), the Transaction Network will transmit the appropriate disconnect error message and then initiate a disconnect. If Tr times out but Tm is activated (subsequent inquiry message is started), the call is maintained, however, the Transaction Network will not accept a response message from the DPC until the end of the subsequent inquiry message. If both Tr and Tm are activated, any response message from the DPC will be accepted by the Transaction Network and transmitted to the data response telephone after transmission of the current inquiry message.

#### 7.4.5.4 Response Timer (Tr) - times out @ 20 seconds.

- A - The Transaction Network resets and activates Tr only when it has received a termination ("#5") or a request ("#6") Control sequence. If a response is received from the data base before Tr times out, the Transaction Network deactivates Tr.
- B - If Tr times out, the Transaction Network will transmit the appropriate disconnect error message and initiates a disconnect.

#### 7.4.5.5 Automatic Timer (Ta) times out @ 2 seconds

- A - The Transaction Network resets and activates Tu each time it has completed an action which requires an answering control sequence or a retransmission of the inquiry message from the data response telephone. If a control sequence or the start of header delimiter ("b") start of text delimiter ("b9") of the retransmitted inquiry message is received from the data response telephone before Ta times out, the Transaction Network deactivates Ta.
- B - If Ta times out, the Transaction Network will repeat the action which required the answering control sequence or retransmission of the inquiry message.

7.4.6 The protocol associated with the normal transmission of an inquiry message is as follows:

7.4.6.1 Upon receiving two (2) P-ACK replies or an answer tone or following the end of a response message, the data

response telephone shall transmit the inquiry message to the Transaction Network within the timing constraints specified in paragraph 7.4.5.1.

7.4.6.2 Upon receiving the inquiry message without detecting a transmission error or a "#d" TOUCH-TONE character sequence (premature termination), the Transaction Network will transmit an ACK reply to the data response telephone.

7.4.6.3 Upon receiving the reply, the data response telephone shall transmit a termination to the Transaction Network within the timing constraints specified in paragraph 7.4.5.5 provided it has no further inquiry messages to transmit and will await a response message.

7.4.6.4 Upon receiving the termination, the Transaction Network will forward the inquiry message to the DPC and activate Tr.

7.4.6.5 If upon receiving the ACK reply the data response telephone has a subsequent inquiry message to transmit, it shall transmit a request within the timing constraints specified in paragraph 7.4.5.5.

7.4.6.6 Upon receiving the request the Transaction Network will transmit two (2) P-ACK replies (back to back) to the data response telephone provided it has no response or error message waiting to be transmitted to the data response telephone.

7.4.6.7 Upon receiving the two P-ACK replies the data response telephone shall proceed as outlined in 7.4.6.1 above.

7.4.6.8 If upon receiving the ACK reply the data response telephone has no further inquiry message to transmit and is not expecting a response message from the Transaction Network, it shall transmit a request. If the Transaction Network transmits two (2) P-ACK replies (back to back), the data response telephone then transmits a disconnect.

7.4.7 The protocol associated with an abnormal transmission of the inquiry message and/or related control sequences is as follows:

7.4.7.1 Premature Termination by the data response telephone - The Transaction Network receives an inquiry message with a transmission error and/or which includes a "#d" TOUCH-TONE character sequence (premature termination). The Transaction Network will transmit a

negative acknowledgment (NAK reply) to the data response telephone provided it does not have an error message waiting to be forwarded to the telephone. The data response telephone will retransmit the inquiry message within the timing constraint of paragraph 7.4.5.5. If the Transaction Network has an error message waiting to be forwarded it will transmit a P-NAK reply to the data response telephone. The data response telephone shall respond with a termination within the timing constraints of paragraph 7.4.5.5. The Transaction Network will then transmit the error message and initiate a disconnect.

7.4.7.2 The end of text delimiter is not detected by the Transaction Network - The Transaction Network receives an inquiry message with the "##" character sequence either garbled or deleted (the Transaction Network does not recognize the end of an inquiry message). The Transaction Network will continue to look for characters and will subsequently timeout (Tc or Tm timeout). The data response telephone may protect itself against this error condition by means of a premature termination. If the data response telephone fails to receive an ACK, NAK P-ACK or P-NAK within the Ta interval after completing transmission of the inquiry message, it transmits an "#d" TOUCH-TONE character sequence. Upon receiving a NAK reply from the Transaction Network, the data response telephone shall retransmit the inquiry message within the timing constraints outlined in paragraph 7.4.5.5.

7.4.7.3 Ti, Tc or Tm Timeout - The Transaction Network detects a Ti, Tc or Tm time out during transmission of an inquiry message by the data response telephone. The Transaction Network will transmit a P-NAK reply immediately upon detection of any of the above timeouts. The data response telephone shall transmit a termination within the timing constraints of paragraph 7.4.5.5 provided it detects the reply. The Transaction Network will retransmit P-NAK if and when Ta times out. A total of three (3) P-NAK replies will be transmitted and if a termination is not received from the data response telephone, the Transaction Network will initiate a disconnect.

7.4.7.4 P-ACK not detected by the data response telephone - The data response telephone transmits a request to transmit a subsequent inquiry message. The Transaction Network responds by transmitting two (2) P-ACK replies (back to back). The replies are garbled (unrecognizable) or lost due to transmission errors. The data response telephone failing to receive the arrival (P-ACK) cannot transmit the inquiry message and eventually Ta times out. The Transaction Network will transmit a P-NAK reply. The

data response telephone shall respond to the P-NAK reply with a line turnaround (EOT-Termination) within the timing constraints specified in paragraph 7.4.5.5. The Transaction Network will then transmit an error message which will be acknowledged by the data response telephone (ACK or NAK reply) within the timing constraints specified in paragraph 7.4.5.5. The Transaction Network upon receiving the reply will transmit two (2) terminations back to back and then initiates a disconnect (but does not transmit a disconnect control sequence).

7.4 The protocol associated with the normal transmission of a response message is as follows:

7.4.1 Upon receiving a response message from the DPC the Transaction Network will check it for format and parity errors. When it has ascertained its validity, the Transaction Network will transmit the response message as soon as any current inquiry message transmission is completed (data response protocol satisfied).

7.4.2 Upon receiving the response message without detecting a transmission or format error or a premature termination, the data response telephone shall transmit a positive acknowledgment (ACK reply) to the Transaction Network within the timing constraints specified in paragraph 7.4.5.5.

7.4.3 Upon receiving the reply the Transaction Network will transmit a two (2) EOT Terminations back to back to the data response telephone.

7.4.4 Upon receiving a termination from the Transaction Network (see paragraph 7.4.3 above) the data response telephone shall transmit a disconnect if it has no subsequent inquiry message to transmit and then requests the Data Access Arrangement to terminate the call.

7.4.9 When the Transaction Network transmits an ACK reply to the data response telephone, it expects in return a termination or a request. If a recognizable termination or request is not received before  $T_a$  times out (control sequence was garbled or deleted) the Transaction Network will re-transmit the ACK reply. The Transaction Network will follow the above procedure three (3) times before transmitting a disconnect. A disconnect error message is not transmitted before the disconnect is implemented.

7.4.10 When the Transaction Network transmits a P-NAK reply to the data response telephone, it expects in return a termination. If a recognizable termination is not

received before  $T_a$  times out (control sequence was garbled or deleted) the Transaction Network will re-transmit the P-NAK reply. The Transaction Network will follow the above procedure three (3) times before transmitting a disconnect. A disconnect error message is not transmitted before the disconnect is implemented.

When the Transaction Network transmits a response message to the data response telephone, it expects in return an ACK or NAK reply. If a recognizable reply is not received before  $T_a$  times out (control sequence was garbled or deleted), the Transaction Network will transmit an ENQ control sequence. The data response telephone shall retransmit the last control sequence it transmitted. The Transaction Network will follow the above procedure three (3) times before transmitting a disconnect. A disconnect error message is not transmitted before the disconnect is implemented.

7.4.11 The Transaction Network will maintain two counters for protocol error control. One counter indicates the number of times a response or inquiry message has been retransmitted by the Transaction Network or the data response telephone respectively. The counter is reset when a positive acknowledgment (ACK) is received. It is also reset if the count reaches three (3) at which time Transaction Network initiates a disconnect. The second counter indicates the number of times a particular control sequence (ENQ, NAK, ACK or P-NAK) has been retransmitted by the Transaction Network. This counter is reset when the desired control sequence is received from the data response telephone, upon the initiation of a inquiry or response message transfer or if the count reaches three (3) the latter resulting in a disconnect initiated by the Transaction Network.

## 8.0 References

- 8.1 Reference 1      Bell System Technical Reference  
                         "Transaction Network Service" PUB  
                         41024, dated December, 1975.
- 8.2 Reference 2      Bell System Technical Reference  
                         "Switched Network Transaction Telephone  
                         System" PUB 41804 dated June, 1975  
                         (Preliminary).
- 8.3 Reference 3      Bell System Technical Reference "Data  
                         Access Arrangement CDT for Manual  
                         Originating and Answering Terminals"  
                         PUB 41801 dated May 1973

- 8.4 Reference 4 Bell System Technical Reference "Data Couplers CBS and CBT for Automatic Terminals" PUB 41802 dated May 1974
- 8.5 Reference 5 Bell System Technical Reference "Data Communications Using the Switched Telecommunications Network," PUB 41005 dated May, 1971.
- 8.6 Reference 6 Bell System Technical Reference "1969-1970 Switched Telecommunication Network Connection Survey," PUB 41007 dated April, 1971.
- 8.7 Reference 7 Bell System Technical Reference "Data Set 407A Interface Specification," PUB 41408 dated November, 1973.

TRANSACTION NETWORK SYSTEM-TOUCH-TONE CHARACTER TO ASCII  
CHARACTER CONVERSION

TABLE 1.1

TEXT TOUCH-TONE CHARACTER TRANSMITTED BY THE DIAL-IN TERMINAL

<u>TOUCH-TONE CHARACTER</u>	<u>2 OUT 8 FREQUENCY PAIRS (Hz) TRANSMITTED</u>	<u>EQUIVALENT BINARY REPRESENTATION†</u>	<u>TRANSACTION NETWORK SYSTEM TRANSLATES TO ASCII CHARACTER (HEXADECIMAL)</u>
		$2^3/2^2/2^1/2^0$	
0	941/1336	0 0 0 0	0 (30)
1	697/1209	0 0 0 1	1 (31)
2	697/1336	0 0 1 0	2 (32)
3	697/1477	0 0 1 1	3 (33)
4	770/1209	0 1 0 0	4 (34)
5	770/1336	0 1 0 1	5 (35)
6	770/1477	0 1 1 0	6 (36)
7	852/1209	0 1 1 1	7 (37)
8	852/1336	1 0 0 0	8 (38)
9	852/1477	1 0 0 1	9 (39)
#††	941/1477	1 0 1 0	: (3A)
a†††	697/1633	1 0 1 1	; (3B)
*	941/1209	1 1 0 0	< (3C)
b†††	770/1633	1 1 0 1	= (3D)
c†††	852/1633	1 1 1 1	> (3E)
d†††	941/1633	1 1 1 1	? (3F)

† used to generate the "LRC" character and the heading field-dial-in telephone type subfield.

†† must be entered as the two (2) TOUCH-TONE character sequence "#1". The Transaction Network strips the "1" character and translates to an ASCII ":".

††† not generated by the voice response telephone.

CONTROL CHARACTERS TRANSMITTED  
BY THE VOICE RESPONSE TELEPHONE

TABLE 1.2

<u>TOUCH-TONE</u> <u>CHARACTER</u> <u>SEQUENCE</u>	<u>FUNCTION</u>	<u>TRANSLATED TO</u> <u>ASCII</u> <u>CHARACTER</u>
--	-----------------	--

CONTROL CHARACTERS

#0	Start of text	STX
#0	subfield Separator (in text)	=
##	End of text	ETX
#2	Erase	DEL

CONTROL SEQUENCES

**	Disconnect
#9	Repeat

TOUCHTONE CHARACTER  
REPERTOIRE

1 2 3  
4 5 6  
7 8 9  
\* 0 #

CONTROL CHARACTERS TRANSMITTED BY  
THE VOICE/KAT RESPONSE TELEPHONE

TABLE 1.3

<u>TOUCH-TONE</u> <u>CHARACTER</u> <u>SEQUENCE</u>	<u>FUNCTION</u>	<u>TRANSLATED TO</u> <u>ASCII</u> <u>CHARACTER</u>
--	-----------------	--

CONTROL CHARACTERS

b	Start of heading	SOH
b	subfield separator (in text)	=
b9	Start of text	STX
b8	group separator	GS
##	End of text	ETX

CONTROL SEQUENCES

**	Disconnect
##	Repeat, Off Hook
a	Green Tone echo
b	Yellow tone echo

TOUCHTONE CHARACTER  
REPertoire

1	2	3	a
4	5	6	b
7	8	9	c
*	0	#	d

CONTROL CHARACTERS TRANSMITTED  
BY THE DATA RESPONSE TELEPHONE

TABLE 1.4

<u>TOUCH-TONE CHARACTER SEQUENCE</u>	<u>FUNCTION</u>	<u>TRANSLATED TO ASCII CHARACTER</u>
--	-----------------	--

CONTROL CHARACTERS

b	start of heading	SOH
b	Subfield separator (in text)	=
b9	start of text	STX
b8	Group Separator	GS
##	End of text	ETX
#d	Premature Termination	

CONTROL SEQUENCES

#3	Negative acknowledgment (transmission error)	
#4	Positive acknowledgment (no transmission error)	
#5	End of transmission (line turn around)	
#6	Request to transmit multiple inquiries	
**	Disconnect	

TOUCHTONE CHARACTER  
REPertoire

1	2	3	a
4	5	6	b
7	8	9	c
*	0	#	d

DIAL-IN TELEPHONE TYPE SUBFIELD

TABLE 2.1

2nd & 3rd TOUCH-TONE Characters of an Inquiry Message  
(for VOICE/KAT RESPONSE AND DATA RESPONSE TELEPHONES only)

<u>TOUCHTONE</u> <u>CHARACTER</u>	<u>EQUIVALENT</u> <u>BINARY REPRESENTATION</u>			
	<u>2<sup>3</sup></u>	<u>2<sup>2</sup></u>	<u>2<sup>1</sup></u>	<u>2<sup>0</sup></u>
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

Bit 0 (2<sup>0</sup>) of Character 1 †  
Bit 1 (2<sup>1</sup>) of Character 1 †  
Bit 2 (2<sup>2</sup>) of Character 1 †  
Bit 3 (2<sup>3</sup>) of Character 1 †

bit 0 (2<sup>0</sup>) of Character 2 †  
bit 1 (2<sup>1</sup>) of Character 2 †  
bit 2 (2<sup>2</sup>) of Character 2 †  
bit 3 (2<sup>3</sup>) of Character 2 †

0 = Voice Response    1 = FSK Response

† not interrogated by the Transaction Network

TABLE 2.2  
VOICE RESPONSE PROTOCOL ERROR HIERARCHY

<u>PRIORITY 6</u> (highest priority)	<u>PRIORITY 5</u>	<u>PRIORITY 4</u>	<u>PRIORITY 3</u>
<u>ROUTING</u> <u>ERRORS</u>	<u>TIMEOUTS</u>	<u>TRANSMISSION</u> <u>ERRORS</u>	<u>RECEPTION</u> <u>ERRORS</u>
(1) No such number	(1) Maximum Inquiry time exceeded		(1) Heading error
(2) Number changed			(2) Maximum text length exceeded
(3) Improper Class of service	(2) DPC requests disconnect		(3) Improper use of characters
(4) Involved Called Number			(4) Response Timeout (Tr)
			(5) Excessive repeats
<u>NONEXISTING FORWARD PATH</u>			(6) Excessive errors in entering subfields
(5) Called station unavailable			
(6) Called station queue overflow			
(7) Network trouble			

NOTE - The first error detected by the Transaction Network within a particular class of error will be the error representing that class. Any further errors detected by the Transaction Network within that class will be ignored.

TABLE 2.3  
VOICE/KAT RESPONSE PROTOCOL ERROR HIERARCHY

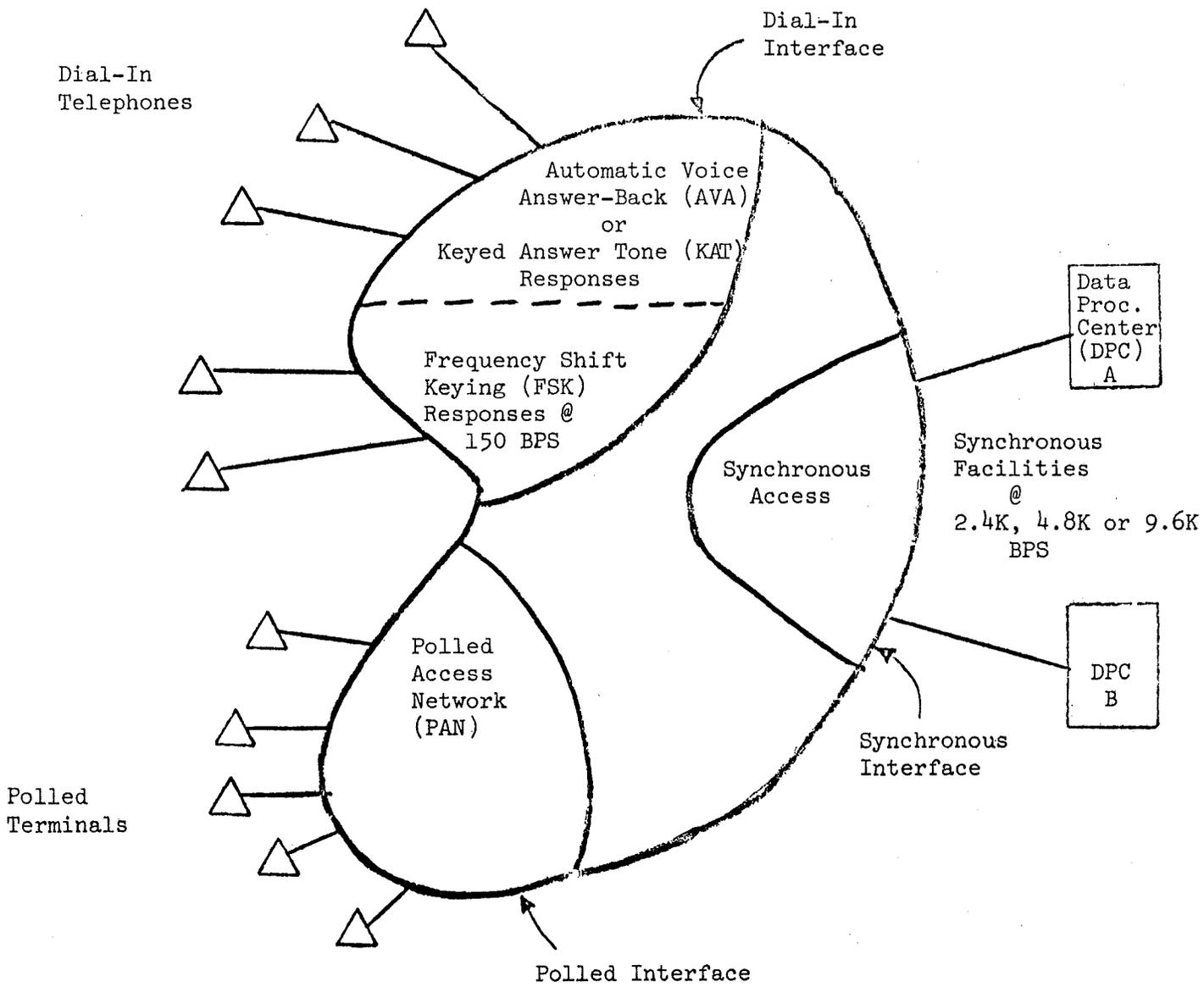
<u>PRIORITY 6</u> (highest priority)	<u>PRIORITY 5</u>	<u>PRIORITY 4</u>	<u>PRIORITY 3</u>
<u>ROUTING</u> <u>ERRORS</u>	<u>TIMEOUTS</u>	<u>TRANSMISSION</u> <u>ERRORS</u>	<u>RECEPTION</u> <u>ERRORS</u>
(1) No such number	(1) Maximum inquiry time exceeded	(1) LRC Mismatch	(1) Heading format error
(2) Number changed	(2) DPC requests disconnects	(2) Character Count mismatch	(2) Maximum text length exceeded
(3) Improper class of service			(3) Improper use of characters
(4) Invalid called number			(4) Response Timeout (Tr)
<u>NONEXISTING</u> <u>FORWARD PATH</u>			(5) Excessive repeats
(5) Called station unavailable			(6) Echo timeout (Ta)
(6) Called station queue overflow			(7) "Off Hook" Timeout (Toh)
(7) Network trouble			

NOTE - The first error detected by the Transaction Network within a particular class of error will be the error representing that class. Any further errors detected by the Transaction Network within that class will be ignored.

TABLE 2.4  
DATA RESPONSE PROTOCOL ERROR HIERARCHY

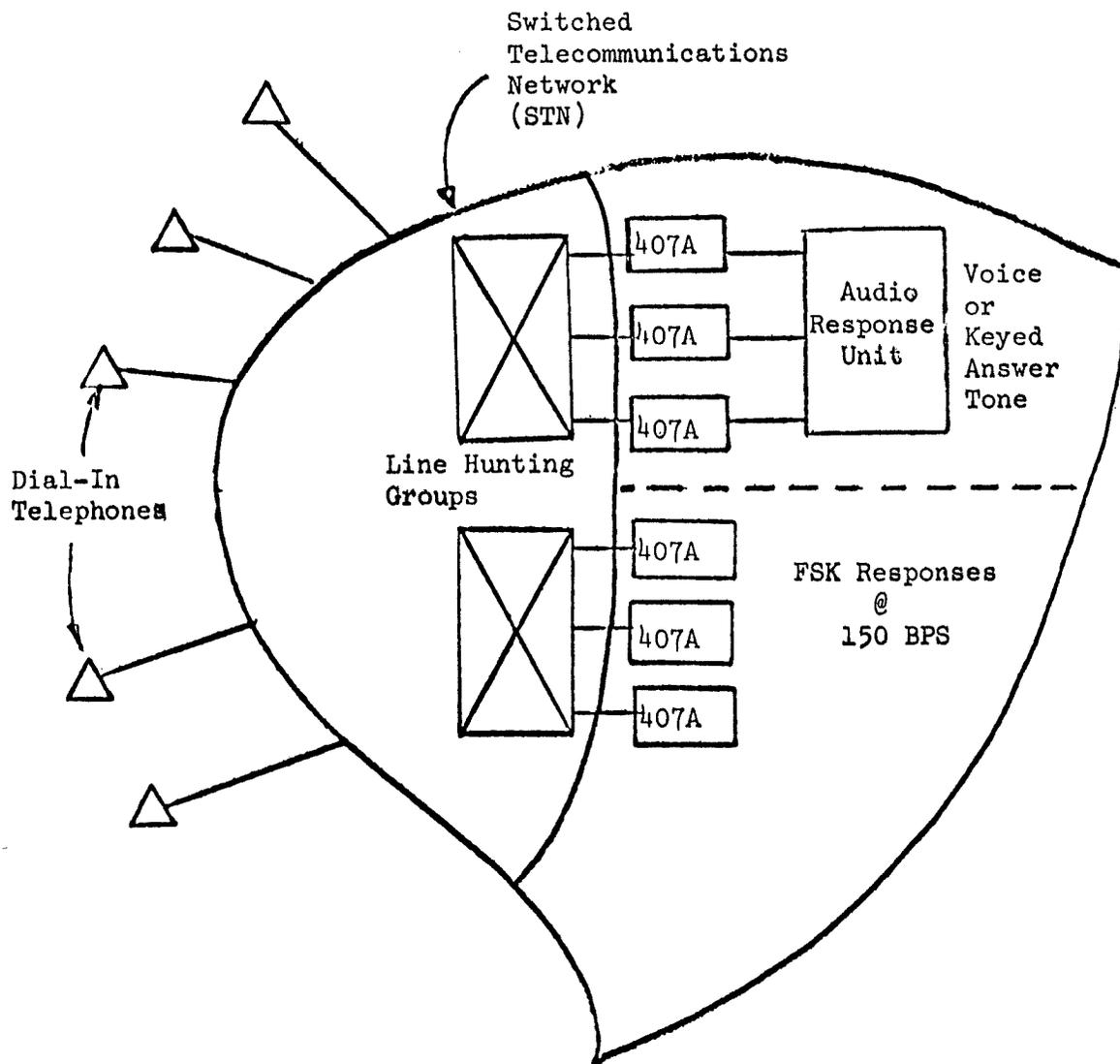
<u>PRIORITY 6</u> (highest priority)	<u>PRIORITY 5</u>	<u>PRIORITY 4</u>	<u>PRIORITY 3</u>
<u>ROUTING</u> <u>ERRORS</u>	<u>TIMEOUTS</u>	<u>TRANSMISSION</u> <u>ERRORS</u>	<u>RECEPTION</u> <u>ERRORS</u>
(1) No such number	(1) Maximum Inquiry time exceeded		(1) Heading format error
(2) Number changed			(2) Maximum test length exceeded
(3) Improper Class of service	(2) DPC requests disconnect		(3) Improper use of characters
(4) Invalid called number			(4) Response Timeout (Tr)
<u>NONEXISTING</u> <u>FORWARD PATH</u>			(5) Excessive message retransmission (counter exceeded max value)
(5) Called station unavailable			
(6) Called station queue overflow			
(7) Network trouble			

NOTE - The first error detected by the Transaction Network within a particular class of error will be the error representing that class. Any further errors detected by the Transaction Network within that class will be ignored.



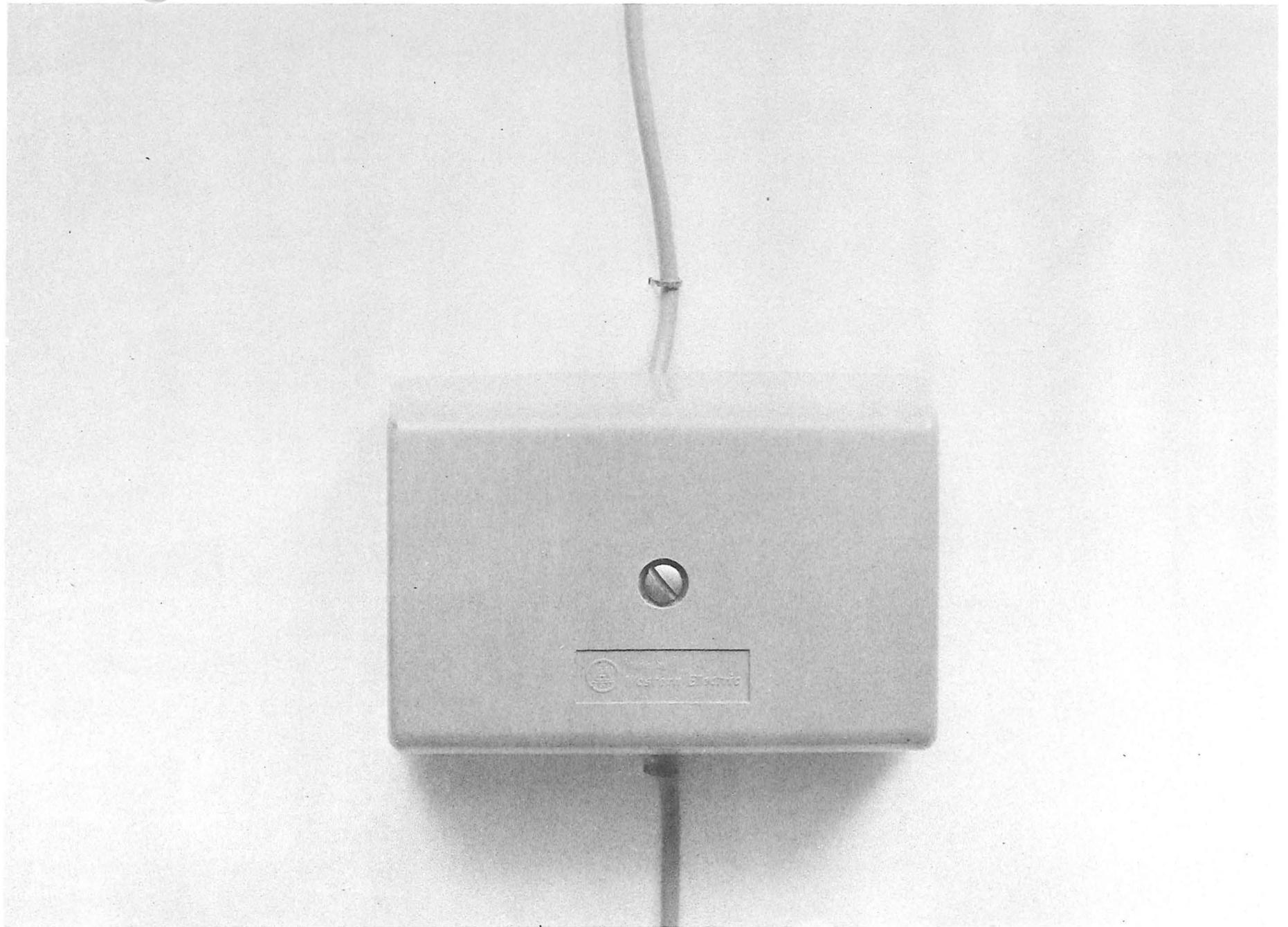
Transaction Network

FIGURE 1



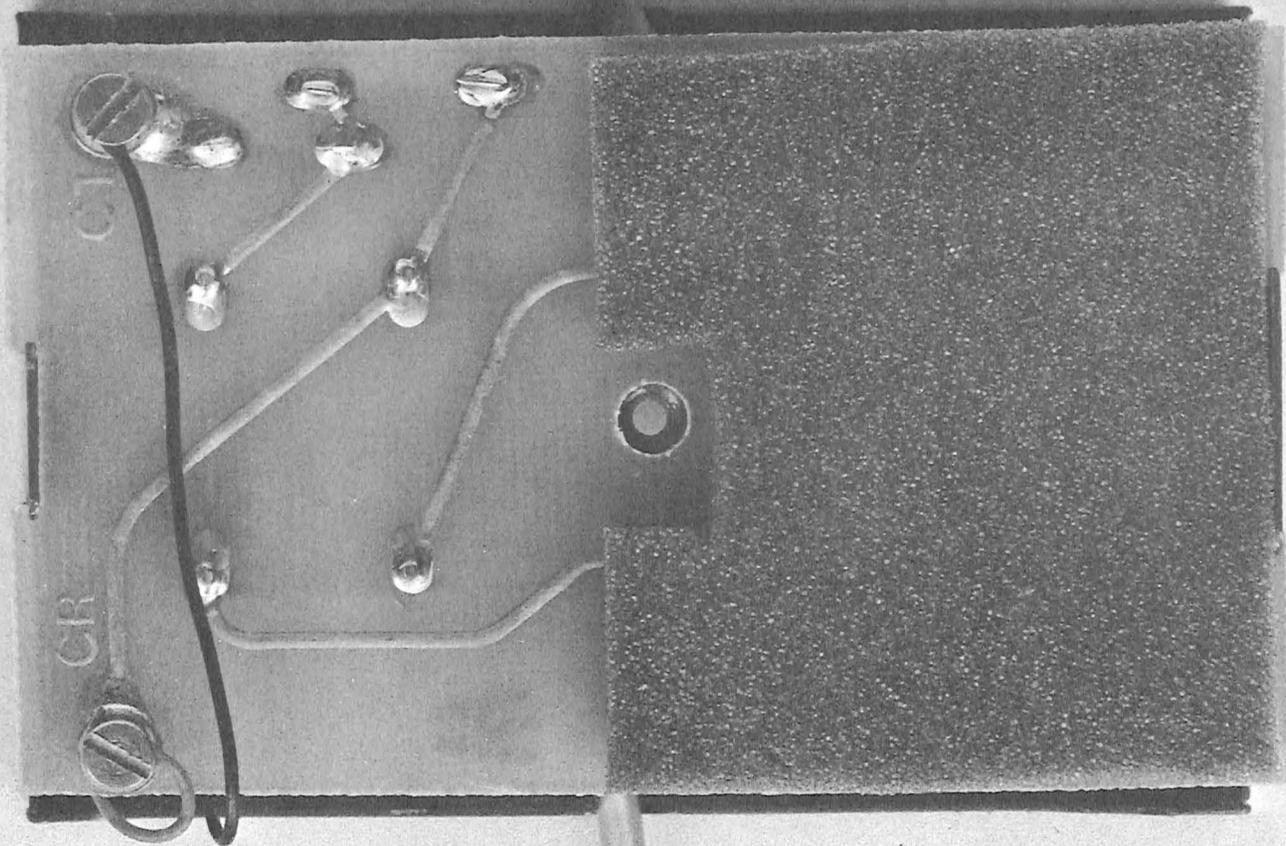
Transaction Network  
Dial-In Access

FIGURE 2



Channel Service Unit

Figure 3



Channel Service Unit Terminal Connection Screws

Figure 4