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Transaction III Terminal

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1. INTRODUCTION

The Transaction III terminal is a station device that provides access to Transaction Network Service--a switched common-user communication service for sending data messages between remote stations and Customer Service Center computers (see the Bell System Technical Reference, "Transaction Network System Description", Publication 41024). The Transaction III terminal, in conjunction with the polled access portion of the Transaction Network, gives users a highly reliable and available switched data message service with very low undetected error rates.

This terminal can be used in a variety of data communications applications such as credit authorization, check verification, teller operation, or inventory control. Information is entered into the terminal and temporarily buffered until the entry is complete; then the terminal transmits all the data when polled. Received messages of up to 128 characters are displayed on a series of response lamps and a seven-segment, eight character visual display.

The terminal operates in either a paired inquiry-response or a nonpaired inquiry-response mode. In the paired mode, the user sends an inquiry through the Transaction Network to the intended Customer Service Center (CSC) and waits for a response before proceeding with a new inquiry. Additionally, the terminal will accept an unsolicited response any time an inquiry message is not outstanding. In the nonpaired mode, the user sends the message to the CSC (through the Transaction Network) and the terminal automatically resets so that a new inquiry can be made. In both cases, the transaction typically begins when the user inserts two magnetic-stripe cards into the card reader--an identification (ID) card that specifies the desired CSC, and a customer card. Then, additional information, such as the dollar amount and type of transaction, is keyed into the terminal manually.

Two options supported by the Transaction III terminal are an auxiliary manual entry pad and a Transaction printer. The auxiliary pad is a remote keyboard for use by customers in applications that require inclusion of Personal Identification Numbers (PINs). The optional printer may be attached to the terminal for a hard copy printout of received messages.

1.1 Scope

This technical reference describes the Transaction III terminal and its operation with the Bell System's Transaction Network Service. It provides an overview of the terminal's operation from the user's standpoint and gives detailed operational specifications.

1.2 Use

This technical reference should be useful to system designers who program the CSC computer which interfaces with the Transaction III terminal via the Transaction Network. It should also be useful to potential Transaction III terminal users and magnetic-stripe card manufacturers.

1.3 Conventions

To clarify the operation of the Transaction III terminal, it is helpful to define the relationship among the character sets used by the Transaction Network and the Transaction III Terminal.

All terminal-to-network transmission is asynchronous (stop-start) at 1200 bits per second (bps) using Frequency Shift Keying (FSK). The characters are encoded using the seven-bit American Standard Code for Information Interchange (ASCII) convention. Characters are ten bits long and consist of a spacing "start" bit, the seven ASCII information bits, an even "parity" bit on the seven information bits, and a final marking "stop" bit.

On the other hand, the magnetic card information that is read into the terminal is defined in a hexadecimal format. The characters are the digits 0 through 9, A, B, C, D, E, and F. In this document, whenever reference is made to data transmitted to and from the Transaction III terminal, the ASCII-coded characters will be used. Likewise, whenever reference is made to magnetic card data, the hexadecimal characters will be used. See Table 1 for the relationships among ASCII and hexadecimal codings, card characters, and keyboard symbols.

1.4 References

Other Bell System documents are available that describe the Transaction Network Service and the components which make up the network. These references include:

1. Bell System Technical Reference, "Transaction Network System Description", Publication 41024.

2. Bell System Technical Reference, "Transaction Network Polled Access Interface Specification", Publication 41025.

3. Bell System Technical Reference, "Transaction Network Service - Dial-In Interface Specification", Publication 41026.

4. Bell System Technical Reference, "Transaction Network Services - Synchronous Interface Specification", Publication 41027.

5. Subscriber Instruction Booklet SIB-2459B, "How to Use the Transaction I Telephone".

6. Subscriber Instruction Booklet SIB-2482C, "How to Use the Transaction II Telephone".

7. "How to Operate the Transaction III Terminal", Publication 999-100-148.

8. Bell System Technical Reference, "Catalog - January 1977", Publication 40000.

2. SYSTEM CONFIGURATION

2.1 Transaction Network

Figure 1 is a representation of the Transaction Network with its three customer interfaces: dial-in, polled, and synchronous. The Transaction III terminal is designed for use with the Polled Access Network (PAN) of the Transaction Network (see Section 3.1). Essentially, the Transaction Network transfers messages between the polled terminal (Transaction III terminal) and the Customer Service Center.

2.2 Telephone Company Provided Equipment

Equipment provided by the telephone company consists of the Transaction III terminal and a communications service. The Transaction III terminal is used to make inquiries of and receive responses from a remotely located Customer Service Center or CSC. The terminal does not interface directly with the CSC.

The communications service for this system is Transaction Network Service.

3. SYSTEM ELEMENTS

A general description of each system element is given in this section, while operational characteristics are given in Section 4. This section contains a discussion of the Transaction III terminal, the auxiliary manual entry pad (also called the PIN pad, for Personal Identification Number), the optional printer, and the polled access portion of the Transaction Network.

3.1 Transaction III Terminal

The terminal operates in either of two short-formatted message modes: paired or nonpaired. It provides a means for reading information from plastic cards having an encoded magnetic stripe and contains a buffer for storing this information prior to transmission. Instruction lamps guide the user through the transaction.

Means are provided for entering data via a manual entry pad and for transmitting ASCII data to the Transaction Network. An integral 1200 bps modem (modulator-demodulator) unit assures that the terminal is compatible with the Transaction Network signaling.

As an option, an auxiliary manual entry pad and/or an alphanumeric printer may be added to the terminal.

3.1.1 Physical Description

A picture of the Transaction III terminal is shown in Figure 2. The terminal is 9-1/4 inches wide, 12 inches deep, and 5-3/4 inches high. It weighs 7-1/2 pounds. At the top rear of the terminal is the card reader. On the faceplate is the 12-button manual entry pad and control buttons. The card reader, manual entry pad, and an optional remote entry pad are means for entering data into the terminal.

Also on the faceplate are an eight-character visual display and a series of lamps. The visual display is located near the center of the faceplate and shows numerals 0 through 9 and a limited number of letters (see Section 4.4).

The lamps are functionally separated into four categories: instruction, call progress, system ready, and response. Three instruction lamps, located at the top left corner of the faceplate, are lit in sequence to guide the user through a transaction. Directly below the instruction lamps are three call progress lamps which indicate the progress of the transaction taking place. To the far right of these lamps are four response lamps which indicate to the user the Customer Service Center's response to the message. In the lower left corner of the faceplate is the SYSTEM READY lamp which when blinking tells the user the terminal is being polled by the Transaction Network.

On either side of the manual entry pad is a set of three control buttons which perform various functions during operation of the terminal. To the left of the pad are the CANCEL, PIN, and LAST ID buttons; to the right are the STATUS, ERASE, and END buttons. Two other control buttons are unmarked: a DISPLAY button located in the visual display window, which advances the received message being displayed, and a RESET button located on the left front edge of the terminal. See Section 4.3 for a functional description of the buttons.

3.1.2 Environmental Specifications

The design characteristics for the Transaction III terminal are as follows:

Operating Temperature Range:	40°F to 120°F
Storage Temperature Range:	-40°F to 150°F
Relative Humidity Range:	20% to 95% at 75°F
Maximum Power Dissipation:	24 watts at 117 VAC (± 10%), 60 Hz (± 5%)

The terminal is connected to the power source via a three-prong plug attached to a six foot power cord.

3.2 Auxiliary Manual Entry Pad (PIN Pad)

An Auxiliary Manual Entry Pad is available as an option for the Transaction III terminal. This pad is intended primarily for entering Personal Identification Numbers and is commonly called the PIN pad. It is equipped with 12 buttons in a TOUCH-TONE® dialing pad arrangement, except that the [*] button is labeled [.] and the [#] button is labeled END as shown in Figure 3. The standard alphabet arrangement is also shown on the buttons. In addition, the letters Q and Z (normally absent from a TOUCH-TONE pad) appear on the "1" button.

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The PIN pad is 4 inches wide, 4 inches deep, and 2-1/2 inches high. It is connected to the Transaction III terminal by means of a 3/8 inch diameter cable 4-1/2 feet long. Detailed operation of the PIN pad is described in Section 4.3.3.

3.3 Optional Printer

An optional printer is currently being developed for use with the Transaction III terminal. When the printer is available, it will be covered in a separate Technical Reference (Publication 41807).

3.4 Polled Access Network

The Polled Access Network is a dedicated distribution system that controls the polling of terminals for the Transaction Network. It consists of a network of Polled Access Circuits (PAC) and polled terminals. Each PAC has groups of terminals which share common portions of this network.

The Polled Access Network is described more fully in the Bell System Technical Reference, "Transaction Network Polled Access Interface Specification", Publication 41025.

4. SYSTEM OPERATION

4.1 Sequence of Operations--General

The Transaction III terminal operates in either a paired or nonpaired inquiry-response mode. In the paired mode, the user typically inserts an identification (ID) card and a customer card, keys in miscellaneous data (such as dollar amount of transaction) and then presses the END button. The terminal automatically sends the message when polled and waits for a response. A response to the inquiry message from the CSC must be received before the user can make another inquiry. After the transaction is completed, the terminal accepts unsolicited messages from any data base.

In the nonpaired mode, the user follows the data-loading procedure just described except that after the message is sent, the terminal automatically resets so that it may accept another inquiry as well as receive a response. The terminal displays messages as received, but does not pair inquiries and responses.

There are three phases of operation associated with the Transaction III terminal: data input, data transmission, and Customer Service Center (CSC) response.

4.1.1 Data Input

When using the terminal in a paired inquiry-response mode, the user would perform the following steps:

1. Observe that the first instruction lamp is on and the system-ready indicator is flickering (goes off momentarily approximately every two seconds or less).

2. Slide through the card reader the ID card appropriate for the CSC and transaction.

3. When the second instruction lamp goes on, slide the customer's card through the card reader.

4. When the third instruction lamp goes on, key in the amount of the transaction, or other variable data, and press END.

5. Observe that the TRANSACTION IN PROGRESS lamp goes on, indicating that the Transaction Network has accepted the message and the message is being forwarded to the CSC for a reply. The lamp stays on until a response is received.

While the terminal is in the paired mode and waiting for a response from the CSC, no new inquiries are allowed, except that if the user wishes to query the CSC about the current transaction, or cancel it, a "status" or "cancel" message can be sent. However, further attempts at status or cancel messages will be ignored by the terminal until a valid CSC response is received. Only one cancel message is allowed per transaction.

When the terminal is in the nonpaired mode (controlled by an option on the ID card) the user follows steps 1 through 4 as above; however, step 5 would be:

5a. Observe that the first instruction lamp comes on again, indicating that the Transaction Network has accepted the message and the message is being forwarded (the TRANSACTION IN PROGRESS lamp does not come on).

The user is now able to make new inquiries, send status messages pertaining to the last transaction, or receive unsolicited messages. Cancel messages are not permitted in the nonpaired mode except to cancel a status message.

4.1.2 Data Transmission

Once the user depresses the END key, the terminal is armed to deliver the inquiry message on the next poll it receives from the Transaction Network. After receiving the poll, the terminal transmits the message in FSK at 1200 bps. Data and addressing information are exchanged between the Transaction Network and the terminal in the form of 10-bit asynchronous ASCII-coded characters. When a poll is received by a terminal that has no mssage to transmit, the terminal remains silent.

The Transaction Network acknowledges (accepts) the terminal inquiry message after it verifies the message format and performs transmission error checks. At this point the TRANSACTION IN PROGRESS lamp is lit and the message is forwarded to the specified CSC.

4.1.3 Customer Service Center Response

After the CSC has processed the inquiry, the Transaction Network delivers the response message to the terminal. The message can include information to light response lamps on the terminal, display other information on

the visual display, and print out still other information if the optional transaction printer is connected.

4.2 Magnetic Stripe Cards

The Transaction III terminal accepts input data either through a magnetic stripe reader or a manual entry pad. This section describes the card reader and presents the requirements for manufacturing and encoding the cards. Section 4.3 of this document will describe the manual entry pad.

In a typical application, the terminal's input source is two magnetic stripe cards. One card, known as the customer card, is encoded according to the American Banking Association (ABA) track two specification. The other is an ID card that is encoded in a manner similar to the ABA standard but which contains information defined by the Bell System for using the Transaction III terminal on the Transaction Network. Typically, the ID card is provided to the terminal user by the CSC; in no case is the card provided by the Bell System.

The ID card is used first. It is encoded with an identification number, assigned by the telephone company, that specifies the CSC to be reached. In addition, it contains other information assigned by the CSC such as identification information, access codes, or transaction codes associated with the user that will be transmitted to the CSC as part of the text. The ID card also contains an option field that controls featues of the Transaction III terminal. The card format and options are defined in Appendix B of this document.

ID cards may be associated with and kept with the Transaction III terminal in slots provided for them behind the card reader. There may be any number of ID cards: one for each of a number of CSCs or several cards for one CSC, but each containing differing access or transaction codes.

ID cards may also be associated with individuals (and used in more than one terminal). The customer thus can choose to associate the cards either with the terminal or with an individual (or both if desired).

The second card (customer card) contains information pertaining to the particular transaction being consummated. It is not normally associated with a particular Transaction III terminal. As a bank or credit card, it is carried by the customer and has encoded on it an account number, an expiration date, and additional discretionary data. Alternatively, the card could be used for an application such as inventory control, where it might contain part numbers and inventory control information.

4.2.1 Card Reader

The card reader accepts cards that meet the ABA track two specification, which is also described as the American National Standards Institute (ANSI) track two. The card reader is hand powered, contains no moving parts, and is engineered for long service life and ease of operation.

The magnetic stripe cards are inserted by placing the edge of the card into the right-hand end of the long slot of the reader. The stripe

should be facing the user as the user faces the keyboard. The edge of the card should be resting against the bottom of the slot to align the encoded portion of the stripe with the reading equipment. The card is then moved steadily from right to left through the slot.

The card reader will accommodate reasonable changes in velocity as the card is moved through the reading slot. However, jerky motion of the card, or extremely fast or slow motion, is not recommended. The card reader accepts velocities between 2.5 and 50 inches per second.

As the card is read, the terminal will detect the error by checking both the parity of each individual character and the card Longitudinal Redundancy Check (LRC) character (see Section 4.5). Any error condition is noted by a flashing instruction lamp on the faceplate. When an error is detected, the terminal expects the data to be reentered. The card may be inserted again, or the information may be keyed in manually. If errors occur, the card information should be entered manually.

4.2.2 Card Format and Standards

As previously mentioned, the Transaction III terminal is fully compatible with cards manufactured and encoded according to ANSI standards for credit cards. The specific standards and applicable paragraphs are:

X4.13-1971 - Paragraphs 2.1 and 3.1

X4.16-1973 - All of sections 2, 3, and 4
- Paragraphs 5.1 through 5.6

The assignment of five-bit card characters and the corresponding ASCII, hexadecimal, and keyboard characters are given in Table 1.

A description of card format and standards is given in Appendix A. When the magnetic stripe cards are made according to correct procedure and the requirements described in Appendix A, the card's useful life expectancy will exceed 50,000 insertions in the magnetic stripe card reader.

4.3 Keyboard

This section describes the operation of the manual entry pad, control buttons, and the auxiliary PIN pad.

4.3.1 Manual Entry Pad

The manual entry pad is similar to the TOUCH-TONE dialing pad except that all entries through the pad go into the logic circuits of the Transaction III terminal. Also, the [*] and [#] symbols on the TOUCH-TONE dialing pad are replaced by [.] and [/], respectively.

Information can be entered into the terminal manually by the Transaction III pad in place of either card operation described in the previous section. To replace the first-card operation, the user does the following while the first instruction lamp is on:

1. Keys in the CSC number.

2. Presses the [/] button.

3. Keys in the user ID number.

4. Presses the END button.

5. To replace the second-card operation, the user keys in the customer's number/date after the second instruction lamp comes on and presses the END button to continue.

More typically, however, data is entered manually after the two cards have been inserted and the third instruction lamp is on. This is done to provide information that cannot be stored on the cards. In the banking and credit industry, for example, this information could include the dollar amount of the transaction. It might also include a transaction code or inventory number. Also, a Personal Identification Number (PIN) could be entered by the customer using the optional PIN pad described in Section 4.3.3.

4.3.2 Control Buttons

The control buttons on the face of the Transaction III terminal perform various functions depending on when they are used during the operating sequence of the terminal. The functions performed by each of the buttons are as follows:

ERASE. In data entry, this button acts as a field erase which deletes all data entered while the current instruction lamp is on. The ERASE button cannot be used to "back up" a transaction to a previous lamp (see CANCEL below).

The ERASE button performs an additional function during the visual display of response messages. Whenever the DISPLAY arrow is blinking, pressing the ERASE button causes the displayed message to cycle back to the beginning of the message. When ERASE is pressed and the DISPLAY arrow is not blinking (there are no additional characters to display), the display is cleared.

END. When the first or second instruction light is lit, this button is used to end segments of entered data. Where appropriate, it then inserts field separators, sequences the instruction lamps, and clears the display for the next field of data entry. When the third instruction lamp is lit, it causes the terminal to transmit the message when the next poll is received.

When the optional printer is used the END button causes paper in the printer to be clamped and the current terminal operation to proceed. Also, pressing END with the paper removed causes the terminal to continue operating as if the printer were not connected.

PIN. When the second or third instruction lamps are on, this button is used to disable the visual display (only the letter P is

displayed), the main keyboard (CANCEL and PIN are the only buttons left active), and the magnetic card reader. AT the same time, it enables the PIN entry pad. In this mode the lamp adjacent to the PIN button and the PIN pad "enable" lamp are on, indicating the PIN pad is enabled. A text format option (see Appendix B) on the ID card may be used to set off the PIN pad entries in the transmitted text with the ASCII character "/".

When identification data is being entered manually (the first instruction lamp is on), pressing PIN causes the letter P to be displayed for all data entries until END is pushed. A second depression of the PIN button, or pushing END, returns the terminal to its normal state. The PIN pad is not enabled during this operation.

LAST ID. This button operates the last-number repertory feature. When used as the first operation with the first instruction lamp on, the terminal proceeds as if an ID card has been inserted. The terminal uses the identification data from the previous ID card or manual entry until a new ID card is entered, a new manual entry is made, or a loss of power occurs. For confidential card operations, an ID card option can be used to disable this feature (see Appendix B).

STATUS. By pushing this button, the user can send additional messages to the CSC regarding the current transaction. Its operation is inhibited until a message has been sent to the CSC. To send a status message, the user presses STATUS, waits for the lamp adjacent to the button to light, then follows it with a one digit numeric entry and END. ERASE will reset the status operation before END is pushed. The numeric entry replaces the status character in the original text, as described in Section 4.6, and is transmitted on the next poll. The terminal inhibits all further entries except CANCEL until a status response is received from the CSC. When a status response is received from the CSC, or CANCEL is pushed, the lamp adjacent to the STATUS button goes off.

CANCEL. When this button is pushed, the current terminal operation is cleared. If the TRANSACTION IN PROGRESS lamp is off, the CANCEL button resets the terminal when pressed. If the TRANSACTION IN PROGRESS lamp is on (paired mode), depressing the CANCEL button causes the CANCEL button lamp to turn on; this indicates that the terminal has accepted the cancel request and a cancel message will be sent to the CSC (see Section 4.6). The CANCEL button lamp will remain on and all further entries will be inhibited until the terminal receives a cancel acknowledgment from the CSC or a status message from the Transaction Network. The lamp adjacent to the CANCEL button automatically goes off when the cancel operation is completed. If the terminal is in the process of receiving a message when CANCEL is pushed, the cancel operation is ignored and the received message is displayed. Hitting the CANCEL button would then clear the display.

If the SPECIAL CONDITION lamp is on, indicating an error condition, the user must push CANCEL to clear the terminal before proceeding further. If a message is received before CANCEL is pushed, the receive message has the effect of clearing the error condition without the user's intervention.

DISPLAY. This is an unmarked button located in the visual display viewing window. A blinking arrow (the DISPLAY arrow lamp) next to the button indicates that the user should push the DISPLAY button to see more of the received message. Each depression of the DISPLAY button causes the next field of characters to appear on the display. Its operation ceases when the entire message has been displayed.

RESET. Located on the bottom left front edge of the terminal, this button is used whenever the user cannot resolve a problem using normal procedures. An example would be when a message is sent to a CSC but a response is not returned to the terminal after a reasonable period of time, and the paired inquiry/response made prevents further entry. In this case, if the terminal is needed for another transaction, the user should first attempt to clear the terminal by sending a cancel message.

When a transaction is not in progress, the RESET button also allows the user to test if the integral modem unit is operating properly. If it is, the SYSTEM READY lamp will go off and stay off while the RESET button is depressed. Any other lamp condition indicates a modem error.

If the Transaction III terminal is to be used in a nonpaired mode but the ID card calls for pairing, the user should push RESET after the TRANSACTION IN PROGRESS lamp comes on.

4.3.3 Auxiliary Manual Entry Pad (PIN Pad)

The Transaction III terminal is equipped with a PIN button which is used to enable and disable the optional PIN pad. When the PIN pad is enabled, the PIN button's Light Emitting Diode (LED) and a LED on the PIN pad itself are lighted. The main keyboard (except for CANCEL and PIN), visual display, and card reader are all disabled when the PIN pad is being used. The letter P appears on the visual display for each PIN pad entry except END, which generates a space and disables the PIN pad.

The PIN pad (see Figure 3) may be used for keying all or part of manually entered data. It has 12 buttons: digits [0] through [9], a decimal point [.], and END. Because some Personal Identification Numbers may be alphabetically based, all 26 letters of the alphabet appear on the buttons of the pad (Q and Z appear on the [1] button).

Consider a typical transaction between a merchant and a customer. After the terminal user (the merchant) enters the customer card in the card reader the third instruction lamp goes on. The merchant then presses the PIN button to enable the PIN pad. The customer keys in his or her PIN (or other information) on the PIN pad as soon as the pad's lamp comes on. When the customer data entry is complete, the customer presses

END. Then the merchant enters the dollar amount of the sale on the manual entry pad and presses END. As mentioned previously, data is not displayed when the PIN button is on; this feature protects the confidentiality of the PIN or other information entered by the customer, but the P permits the attendant to monitor that the correct number of digits have been entered.

4.4 Display Elements

A series of lamps and a visual display are incorporated into the Transaction III terminal to guide the user through a transaction, indicate the progress of a call, signal a response from the CSC, or display a message.

4.4.1 Instruction Lamps

Three lamps on the faceplate of the terminal are used to guide the user through a transaction. The operation of these lamps is described in Section 4.5 as part of the process of entering data. Briefly, however, the first lamp signals when the terminal is ready to accept ID information; the second lamp indicates when the terminal is ready to accept customer cards and/or manually entered data; and the third lamp indicates when the terminal will accept miscellaneous data, including magnetic cards. If a magnetic stripe card is not properly read by the terminal, the appropriate instruction lamp blinks; the user must then reenter the data.

4.4.2 Call Progress Lamps

A set of five lamps provides the user with status information while waiting for a response from a Customer Service Center.

TRANSACTION IN PROGRESS. This lamp comes on in the paired mode when an inquiry message has been successfully sent to the Transaction Network. It remains on until the Transaction Network returns an error message or a response other than WAIT from the CSC. If the user requests a status or cancel operation before a valid response is received, the lamp will go off until the new message is again received by the Transaction Network.

WAIT. When the CSC anticipates a delay in providing a complete response to an inquiry, it may send a message to the terminal that will turn the WAIT lamp on. The user can still enter status or cancel messages; however, new inquiries are not permitted until a completed response is received which automatically resets the WAIT lamp. If the optional printer is used, the paper is not available to the user (it remains clamped) until the WAIT lamp is reset. In other applications this lamp could be used as a far-end acknowledgment from the CSC that the message is being processed.

SPECIAL CONDITION. This lamp comes on when the terminal is used improperly or the Transaction Network experiences difficulty with a message. A numeric code, preceded by a prompt word, will always accompany the SPECIAL CONDITION lamp. When the word "Error" is

displayed on the visual display, it identifies a terminal error (see Section 5). If the Transaction Network detects a problem, the word "CodE" appears on the display.

CANCEL. This lamp, located adjacent to the CANCEL button, comes on when a cancel message request is made by the user. It is turned off when a far-end acknowledgment is received from the CSC or when RESET is pushed.

STATUS. This lamp, located adjacent to the STATUS button, comes on when a status message request is made by the user. It is turned off when a far-end acknowledgment is received from the CSC, when a cancel message is sent, or when RESET is pushed.

4.4.3 Response Lamps

Four lamps indicate the CSC's response to a message: APPROVED, DECLINED, REFERRED, and STATUS. Their operation is controlled by the action field in the CSC's response message (see Section 4.7.2).

4.4.4 Visual Display

The Transaction III terminal can receive a 128 character message. However, the visual display only shows up to eight characters at a time. When a message with more than eight characters is received, the first eight characters are immediately displayed and the DISPLAY arrow lamp blinks. When the DISPLAY button is pressed, the next eight characters are displayed. This procedure is continued until all characters have been viewed (the DISPLAY lamp then turns off).

Once the entire message has been viewed, it cannot be viewed again. However, if the ERASE button is pressed before all the characters have been viewed, the display message is restored to its beginning and can be repeated as before. The display will automatically clear one minute after the complete message has been paged onto the display (the DISPLAY arrow lamp is not blinking).

4.4.4.1 Display Input Source

The display shows entries from either the manual entry pad or the received message. Magnetic card entries are not displayed. Data from the optional PIN pad is replaced with the letter P on the display for each entry. Additionally, as a security feature, the user can display the letter P while entries are made with the first instruction lamp on; this is accomplished by pressing the PIN button. The display returns to normal when either the END button or PIN button is pushed. In this mode (i.e., when instruction lamp one is on), the PIN pad is not enabled.

4.4.4.2 Character Set

The display shows the characters 0-9 and ".", corresponding to button pad entries for the digits and decimal point. A "-" is displayed for the "/" key.

Furthermore, the terminal can display the characters A, b, C, d, E, F, G, H, i, J, L, n, o, P, Q, r, S, t, U, v, Y, Z and "-" in received messages (see Figure 4). The displayed characters correspond to the ASCII characters in the receive text. Only upper case letters are decoded, but either upper or lower case letters are displayed as shown above. Characters that cannot be displayed will be shown as spaces, except for the first 16 ASCII control characters which are ignored. In addition "=" (HEX 3D) is displayed as "-" and "<" (HEX 3C) is displayed as ".".

4.4.4.3 Format

The display shows up to eight received characters, right justified. If more than eight characters are recieved, additional characters may be cycled into the display (eight at a time) by operating the DISPLAY button. To allow formatting of data when fewer than eight characters are to be displayed, spaces may be used.

Alternatively, if less than eight characters are to be displayed for a given data segment, the ASCII character "/" (HEX 2F) may be used to delineate the end of the segment. In this case, data is displayed up to the ensuing "/" character when the DISPLAY button is pressed. The "/" character is not displayed.

If the entire display message is less than eight characters, a "/" character may be desirable at the end of the display field. This will ensure that the operator has an opportunity to view the response without being concerned about the automatic clearing of the display after one minute.

4.5 Data Entry

As mentioned previously, data can be entered into the Transaction III terminal either by means of a magnetic stripe card or by using the manual entry pad. During data entry operations, the user is guided through the transaction by a set of instruction lamps.

If a card is not properly read or if an improper entry sequence is attempted, the appropriate instruction lamp will blink. If a message is received during the entry mode, the instruction lamps will go off and the user must reenter the data after the incoming message is displayed. The instruction lamps are also off when a message is being delivered to the CSC. If a response is not expected (nonpaired mode), the first instruction lamp comes on when the message has been delivered to the Transaction Network; otherwise (paired mode) it remains off until a valid response is received and displayed.

4.5.1 When Instruction Lamp One is On

This condition indicates that the terminal is ready to accept an ID card, manual entry of ID data, or operate in the one-card (previously stored ID data) mode. The lamp remains on until the ID data is read successfully or the END button is depressed.

4.5.1.1 Card Entry--Identification Card

Insertion of the ID card into the card reader identifies the CSC to be addressed (called number), the optional functions the card can perform on the terminal, and the user number. This information is contained within three subfields on the ID card. (See Appendix B for a description of the ID card format and optional features.)

4.5.1.2 Manual Data Entry

When data is entered manually, it has the following format:

> Called number (zero to seven digits), "/" user ID (digit, slash, and decimal point entries limited only by buffer size), END.

If the called number is not required (implied addressing under restricted access option of Transaction Network), a "/" is entered as the first character.

4.5.1.3 One-Card Operation

A last-number repertory feature is available for repeated calls to the same CSC. To use it, the user can either insert the customer card or press the LAST ID button and then enter the customer number on the manual entry pad. The terminal, in either case, automatically proceeds as if an ID card had been inserted, using information from the previous ID card or manual ID entries.

An option is available (see Appendix B) that always returns the terminal to instruction lamp two (instead of instruction lamp one) after a transaction. The user need only insert the customer data, followed by any miscellaneous data, to make an inquiry. This option is particularly suited to unattended self-service terminals, such as found in the lobbies of banks or stores, where it is desirable to protect the terminal from data entries that may inadvertently destroy the stored information. The RESET button is pushed to insert new ID information.

4.5.2 When Instruction Lamp Two is On

When this lamp is on, the terminal is ready to accept either customer magnetic stripe cards or manually entered data. An option available on the ID card (see Appendix B) enables data to be entered in any "mix" of cards or manual keying. In this case, the field is terminated by pressing the END button. If this option is not specified, the terminal will accept data and sequence to the third lamp when the card is read successfully (data may be entered manually before inserting the magnetic card) or when the user presses the END button after manually entering the data.

4.5.3 When Instruction Lamp Three in On

At this stage the terminal is ready to accept any additional data (dollar amount, transaction code, inventory information, etc.). Magnetic card and keyed data entries may be mixed in any sequence. When the user

presses the END button, all instruction lamps are turned off and the terminal is ready to transmit the information on the next poll.

4.6 Utility Message Operation

Two function buttons--STATUS and CANCEL--allow terminal users to send additional messages to the CSC about the current transaction. The text of such a message is identical to the text of the first except that the status character is changed according to the keyboard entry made by the user. These messages can be requested by the user only after an inquiry message has been sent to the CSC and before any new transactions are entered.

After a cancel or status message is transmitted to the Transaction Network (the TRANSACTION IN PROGRESS lamp comes on), the terminal rejects any message from the CSC unless it contains a status or cancel acknowledgment, whichever is appropriate (see Section 4.7). Messages that do not contain an acknowledgment are returned to the CSC by the Transaction Network. The terminal automatically rejects the received messages so that users will not confuse any of them with the expected cancel or status response. If the terminal receives a CSC response message before the cancel or status message is sent, or the Transaction Network returns the cancel or status message because of message status irregularities (see Section 5.1), the cancel or status operation is ignored by the terminal and the response message is displayed.

Once the user sends a cancel or status message, the terminal prohibits certain user operations including the ability to send a new transaction until the terminal receives a status or cancel acknowledgment from the CSC. If a status message is sent, the user can still use the terminal to send a cancel message; however, after the cancel message is sent, all further entries are prohibited until the CSC acknowledgment is received or RESET is pushed to clear the terminal. An LED next to the cancel or status button remains on until the acknowledgment is received. The CSC response can include additional information as well as the cancel or status message acknowledgment.

A cancel message can be requested by the user only while the TRANSACTION IN PROGRESS lamp is on. This means that the terminal will not send cancel messages in the paired mode after a CSC response (other than WAIT) is received. Similarly, in the nonpaired mode, cancel messages are not sent after the inquiry is transmitted to the Transaction Network.

Status messages can be requested by the user any time after the original inquiry is sent to the Transaction Network and before a new transaction is entered or a cancel message is requested.

4.7 Messages

The messages sent and received by the Transaction III terminal have identical formats in that they contain two main fields--the message heading and the message text--followed by an LRC character. The formats of the messages are described in more detail in the discussion that follows. Message headings are modified by the Transaction Network

before forwarding messages to and from the CSC (see Publication 41027, "Transaction Network Services - Synchronous Interface Specification").

4.7.1 Inquiry Messages

The inquiry message heading field consists of up to three subfields, including the station identifier, the called number, and the Terminal Identification Number (TID). See Figure 5.

The optional station identifier subfield when sent by the terminal consists of one character (HEX 41) and indicates that an external output device (Transaction Printer) is connected to the Transaction III terminal. If no external output devices are connected to the Transaction III terminal, the station identifier sent to the CSC will be two space (HEX 20) characters which are inserted by the Transaction Network. If an external device is connected, the station identifier sent by the terminal replaces the second space character inserted by the Transaction Network and the modified two-character field is sent to the CSC. The "@" (HEX 40) character is reserved for future devices while the character "A" (HEX 41) identifies that a Transaction Printer is connected to the terminal. The terminal inserts the station identifier only if an external output device is connected and the user has not disabled the use of the external device for this transaction.

The called number subfield, which identifes the CSC the message is to be delivered to, can be entered by the user from the magnetic card reader using the ID card or the data entry pad. The subfield contains one to seven numeric characters, except when implied addressing is to be used, in which case the subfield and the preceding FS character is deleted. Implied addressing is indicated during manual entry by pushing [/] as the first entry.

The TID subfield, consisting of four numeric characters, is automatically inserted by the terminal in all inquiry messages. The TID is assigned by the Bell System and set by a craftsperson at the time of installation.

The Transaction Network has a maximum message text limit of 128 characters, counting from STX (start of text) to ETX (end of text) but not including these characters. Included in the count must be four characters generated by the terminal: two field separators and the session number and status characters. Also, if the PIN format option (see Appendix B) is used (which encloses PIN entries in slash characters in the message text), the available text size is reduced by the two slash characters for each PIN operation. For example, if the user made one PIN field entry using the PIN format option, up to 122 characters could be entered from magnetic cards or by manual entries before violating the Transaction Network text size limit. The message text size available to the user may be expressed as: all key plus card entries must be less than or equal to 124 characters, minus two times the number of PIN operations if the PIN format option is used.

The message text field, beginning with STX, consists of five subfields: session number, status, user ID, customer identification, and miscellaneous.

The ASCII characters "?" (HEX 3F) or "!" (HEX 21) are used to separate the last three fields. The character "!" indicates that the preceding field contained some data that was entered manually and "?" indicates that all information in the preceding field was entered via magnetic card. The field separators are included whether or not any data is in the field.

The first and second characters after STX are the session number and status character, respectively. The session number is an internally generated code (HEX 30-3E) which is increased automatically for each new transaction (status and cancel messages retain the same session number). This code is used by the terminal in the paired mode and should be returned by the CSC in the appropriate place in the response message.

The status character identifes the type of message being received by the CSC. A normal inquiry is identified by a ";" (HEX 3B) character, which corresponds to the user's original inquiry message. If the user sends a status or cancel message, the text of the message remains unchanged except for the status character (see Section 4.6). Cancel is identified by either "=" (HEX 3D), or ">" (HEX 3E). The "=" character is used to cancel a status message that was forwarded after a completed response was received from the CSC and after the transaction was complete. The ">" character is used to cancel a transaction in the paired mode before the CSC response is received. A status message is identified by the user's insertion of a number from 0 through 9. The CSC is responsible for assigning the definition of numerics the user enters in a status message.

The next three subfields correspond to data entered during the time that instruction lamps one, two and three are on. These subfields are of variable length, with the only restriction being that the user ID field is limited to approximately 24 characters when entered from a magnetic card. The customer number and miscellaneous fields may be a mix of manual data, magnetic card data, or PIN pad entries in any sequence defined by the CSC message format requirements. An option on the ID card will cause "/" (HEX 2F) characters to bracket the PIN data if specified.

4.7.2 Response Messages

The response message heading field consists of up to three subfields: the Terminal Identification number (TID), the calling number, and the Transaction Network status (see Figure 6). The information contained in the heading field is used by the terminal but the user is normally not aware of its existence.

The TID consists of four digits and must be present in all received messages. If this field does not match the internal TID set by switches at installation time, the terminal will respond to messages with a negative acknowledgment.

The calling number subfield identifies the CSC. In a paired mode transaction, the terminal compares this field, when present, against the CSC being called (the called number subfield of the inquiry message). If a match

does not occur, the terminal does not respond to the response message and the Transaction Network returns the message to the CSC as an undeliverable message.

The Transaction Network status subfield is preceded by GS when present. This subfield consists of two numeric characters and is present only if an irregularity is encountered by the Transaction Network. The text of the returned message will be dropped by the terminal and a numeric code will be displayed as described in Section 5.1.

The message text field starts with STX and consists of up to four subfields: session number, action, display, and printer. The "?" is used as a delimiter between the action, display, and printer subfields. The delimiter is required to terminate a "null" subfield when it occurs between subfields. The final subfield is terminated by an ETX.

The session number subfield consists of a single character following the STX. It is compared by the terminal to the current terminal session number, which is internally generated, and sent as part of the inquiry message. If the terminal is in a paired mode and the session number does not match or is not a null session number ("?" HEX 3F), the terminal will not respond to the message. A null session number should only be used to deliver important unsolicited messages or if the CSC does not support a session number feature for each terminal response.

The action field uses the following numeric characters for control of the designated terminal function.

0 - status acknowledgment
1 - cancel acknowledgment
2 - light the APPROVED response lamp
3 - light the DECLINED response lamp
4 - light the REFERRED response lamp
5 - light the STATUS response lamp
6 - light the WAIT call progress indication
7 - allow repeats of the printer message

Any of the above action characters--except 0 and 1--can be combined in the same message. (See Section 4.6 for use of 0 or 1 acknowledgment codes.) Any character (between HEX 30-3E) not defined will be ignored. This field is terminated with an ETX if no further subfields are needed, otherwise a "?" character is used to designate the end of the action field.

The display subfield, following the first field separator "?", can include ASCII text as described in Section 4.4. This field is terminated with a "?", or by ETX if the optional printer field is deleted.

The printer subfield consists of text that is directed to the printer. When the printer is not connected, the printer text is automatically directed to the visual display after the display field contents have been viewed by the operator.

5. ERROR CONDITIONS

Two basic types of errors are detected by the Transaction III terminal and displayed: message status irregularities and terminal errors. Anytime the terminal detects an error, the SPECIAL CONDITION lamp comes on.

5.1 Message Status Irregularities

These error conditions relate to any inquiry that encounters telephone company or customer equipment anomalies (not covered by the data link protocols) when being transmitted through the Transaction Network. The inquiry messages will be returned to the terminal and the irregularity identified by a two-character code in the message status subfield. The terminal indicates these errors on the visual display by the word "CodE" preceding the error condition. This type of error condition is described in Section 5.4 of the Bell System Technical Reference "Transaction Network Polled Access Interface Specification" (Publication 41025).

5.2 Terminal Errors

These are errors detected by the Transaction III terminal during its use. When a magnetic card is "misread" by the terminal, an instruction lamp blinks to indicate that the user should reinsert the card or enter the data manually. (If the card continues to be misread, the card format should be verified.)

Other terminal errors are shown on the visual display by the word "Error" accompanied by a numeric code. Normally, the terminal must be cleared by pushing CANCEL after an error is detected.

An explanation of each of the terminal error codes follows:

Error 00 - This code is displayed when the user enters more data that the terminal can accommodate. The terminal has a transmit buffer size of 148 characters entered from magnetic cards or manual entries, including the called number field. If the PIN format option is used, the buffer size reduces by 8 characters for each PIN operation (not counting the PIN entries). For example, if the user made one PIN field entry and entered a seven digit CSC number, up to 133 characters could be entered from magnetic cards or manual entries before the terminal would display this error. This example corresponds to a message text of 139 characters; 133 characters entered by the user, plus six characters entered by the terminal (four from terminal-inserted characters and two from each PIN operation), which exceeds the Transaction Network limit of 128 characters. The buffer size available before the terminal will detect an error may be expressed as follows: all key and card entries must be less than or equal to 148 characters, minus the number of digits in the CSC number plus eight times the number of PIN operations.

Error 01 - This is generated when the terminal, in trying to deliver a message to the Transaction Network, receives a negative acknowledgment more than three times. The terminal stops trying to deliver the message and the message is lost. The user should clear the terminal by pressing the CANCEL button and then test the terminal.

Error 02 - This code occurs when the user tries to enter data both manually and via a magnetic card when instruction lamp one is on. (The terminal allows only one mode of entry when instruction lamp one is on.) The data must be reentered after the CANCEL button is pushed.

Error 03 - This is displayed when the user tries to enter a card while the PIN pad is enabled. (Magnetic cards cannot be read when the PIN lamp is on.) All data must be reentered after CANCEL is pushed.

Error 04 - This code is generated when the user attempts to use the last ID card repertory feature but it has been disabled by the ID card option. The ID card must be reentered after CANCEL is pushed.

Error 05 - If AC power is lost to the terminal, all information is lost. The terminal detects the loss of data and this code is displayed when the user attempts to use the last ID card repertory feature. The ID card information must be reloaded before proceeding.

Error 06 - If the user tries to send a status message before a message is successfully delivered to the Transaction Network, the terminal will generate this error code.

Error 07 - This code is generated when a protocol error is encountered in receiving a message. If the terminal receives a message with a correct TID but detects an error in the message, it will send a negative acknowledgment in response. If the next Transaction Network operation seen by the terminal is a specific poll, the terminal will display this error. The Transaction Network will return the message to the CSC. The user should test the terminal to verify its operation.

Error 08 - The terminal is equipped to receive a 128-character text, counting from STX to ETX but not including the control characters. A message larger than this buffer size will generate this error code unless the Transaction Network message status subfield is present. If it is, the received text is dropped by the terminal and the numeric code is displayed as an error.

Error 09 - This is displayed when a printer malfunction occurs during a print operation. Malfunctions would include loss of paper, paper jam, etc. The user should clear the printer problem, press CANCEL to clear the terminal, and possibly request a duplicate response message from the CSC via the status message operation.

Error 10 - This code appears when the terminal detects an error during an operational test (see Section 7). The error can result from either a hardware fault or a data entry error by the user. The user should repeat the operational test before reporting a trouble.

6. SIGNAL SPECIFICATIONS

6.1 Transmission Levels

Transmission is half duplex. Simultaneous data transmission by the Transaction Network and the terminal is never permitted; this is controlled by a protocol specified in Section 7 of Bell System Technical Reference "Transaction Network Polled Access Interface Specification" (Publication 41025).

The transmission level at the terminal end of the Polled Access Circuit is as follows:

Nominal -20 dBm for transmissions to the terminal (receiving).

Transmissions from the terminal do not exceed 0dBm when working into a 600 ohm load (transmitting). The transmitted signal from the terminal conforms to the requirements specified below regarding out-of-band power:

The power in the band from 3995 to 4005 Hertz does not exceed 18dB below the specified maximum in-band signal power.

The power in the band from 4 to 10 kHz does not exceed -16dBm.

The power in the band from 10 to 25 kHz does not exceed -24dBm.

The power in the band from 25 to 40 kHz does not exceed -36dBm.

The power in the band above 40 kHz does not exceed -50dBm.

6.2 Transmission Mode

All data transmission between the Transaction Network and the terminal employs Frequency Shift Keying (FSK) compatible with data set 202T (see the Bell System Technical Reference "Analog Parameters Affecting Voiceband Data Transmission - Description of Parameters - July, 1974" (Publication 41008). Data is defined as the 10-bit characters which comprise an inquiry or response message, a control sequence, or signaling sequences.

The transmission rate from the Transaction Network System is 1200 bps ± 0.1%. A space (Logic 0) is represented by 2200 Hz ± 0.1% and a mark (Logic 1) by 1200 Hz ± 0.1%. The transition from a space to mark frequency, or vice versa, is phase continuous. The space and mark frequencies are also referred to as the start and stop frequencies respectively.

The transmission rate from the terminal is 1200 bps ± 0.5%. A space (Logic 0) is represented by 2200 Hz ± 0.5% and a mark (Logic 1) by 1200 Hz ± 0.5%. The transition from a space to mark frequency, or vice versa, is phase continuous.

6.3 Leading and Trailing Carrier

Unless otherwise specified, all data transmission is preceded and followed (without any drop in carrier) by "padding" intervals of carrier. The trailing intervals include a soft "turn-off" carrier that is outside the data band; this prevents generating spurious spacing signals which can occur when the marking carrier is turned off. The soft turn-off carrier frequency is 900 Hz ± 1%.

The carrier transmitted before each data transmission from the Transaction Network is 10.5 ± 0.5 milliseconds at the mark frequency.

The carrier transmitted before each data transmission from the terminal is at least 12 milliseconds in duration, but no more than 17 milliseconds in duration at the mark frequency.

The trailing carrier from the terminal consists of no more than 2 milliseconds of carrier at the mark frequency following the stop bit of the last transmitted meaningful character. It is followed immediately by 8.5 ± 0.5 milliseconds of "soft turn-off" carrier.

7. TESTING

The Transaction III terminal can be tested by the user either by sending a test message (a quick test) or by following a longer test sequence to determine if the terminal external options are fully opperational. A test card provided with the terminal is used in both cases.

7.1 Quick Test

This test checks the keyboard, integral modem, and the card reader. To test the terminal, the user should follow the procedure printed on the test card. But in general, the user inserts the test card into the card reader twice, keys in the 12 data characters on the manual entry pad, and presses the END button. The test message is sent to the Transaction Network and reflected back to the terminal where the user, using the visual display, verifies the information with that printed on the test card.

7.2 External Options Test Sequence

After testing the terminal using the quick-test procedures, the user can use the external options test to check the PIN pad and optional Transaction printer. A failure to pass any step of the test sequence means that the external options have not passed the test. However, the user should repeat the test once more before reporting a trouble.

The test sequence is as follows:

1. The first instruction lamp should be on. The SYSTEM READY lamp should be on and flickering.

2. Slide a test card through the card reader twice. Observe sequencing of instruction lamps.

3. The third instruction lamp should be on. Press the PIN button. Observe that the PIN lamp comes on. Press buttons [1] through [9], [.], [0], and END on the PIN pad.

4. Press the END button; observe that the TRANSACTION IN PROGRESS lamp lights briefly. If the printer is connected, insert paper. Observe that "PUSH End" appears on the visual display, then push END and observe that the TRANSACTION IN PROGRESS lamp goes on.

5. Observe that all response lamps, including WAIT, are on and the DISPLAY lamp is blinking. The display will read (.2-999-0).

6. Press the DISPLAY button; the display will show (123456).

7. Press the DISPLAY button. Display will show (12345678).

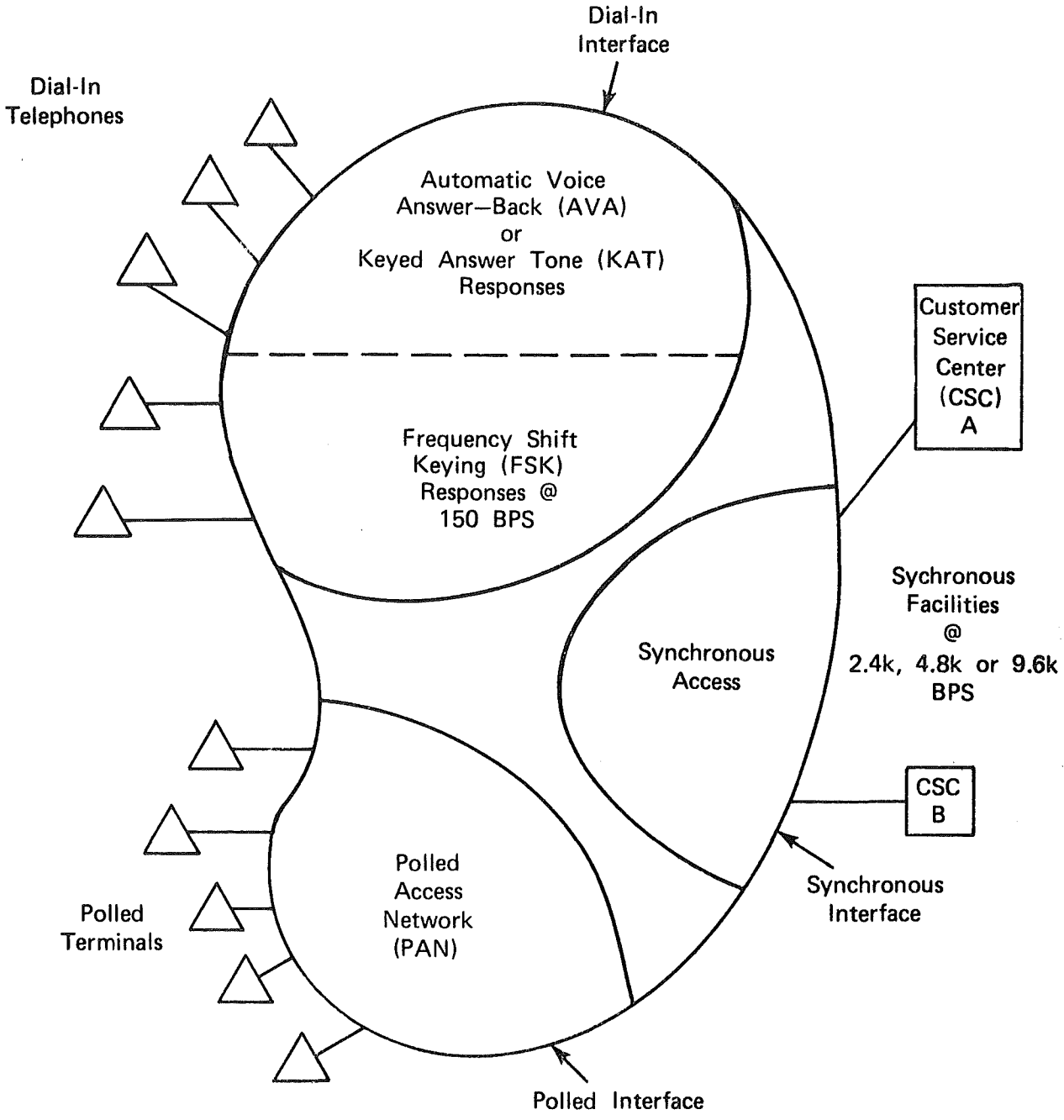
8. Press the DISPLAY button. The display will show (9.0).

9. Press the RESET button.

10. Test is complete.

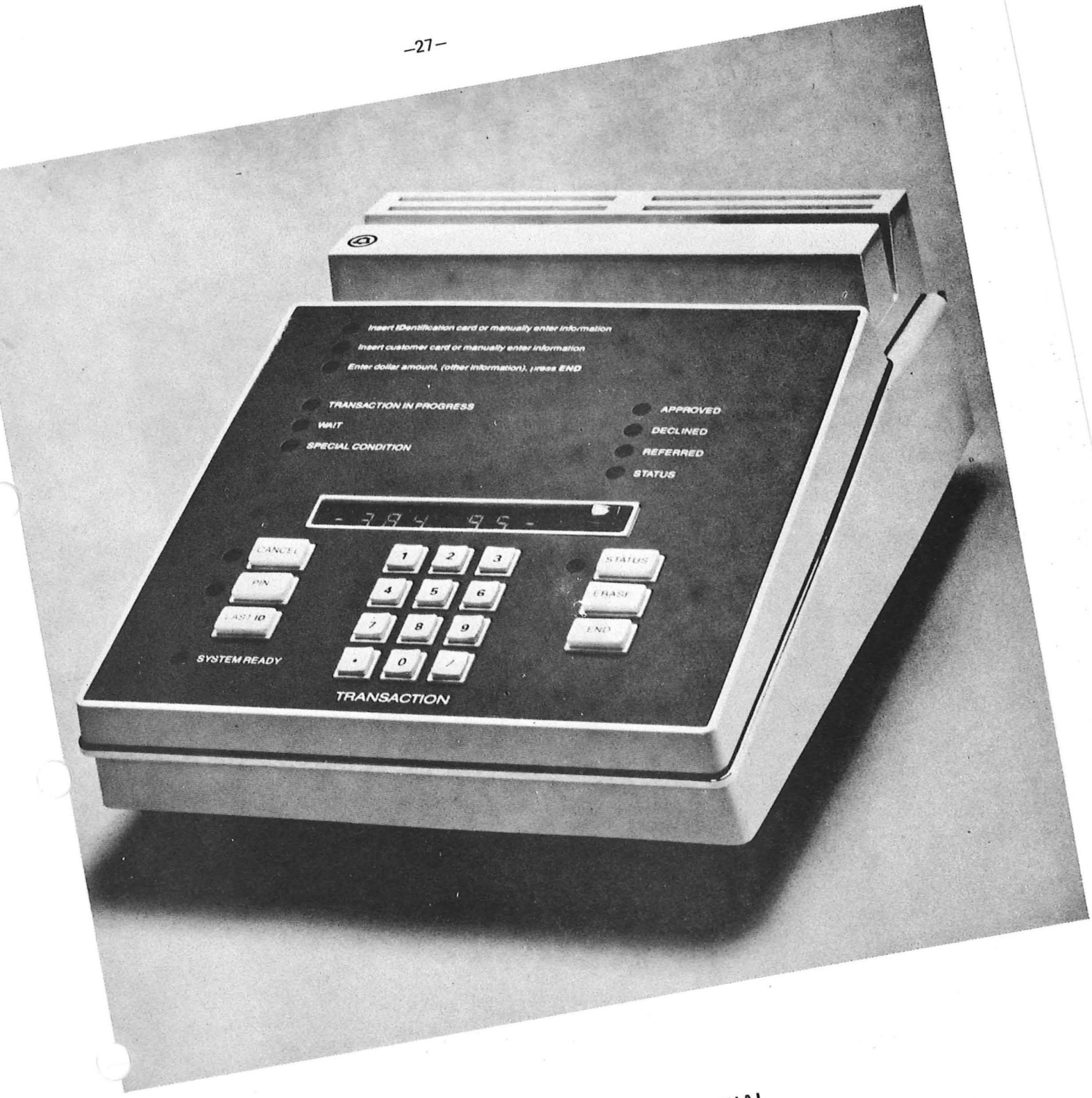
CARD CHARACTERS						KEYBOARD	ASCII
BINARY WITH PARITY					HEX		
P	B3	B2	B1	BO			
1	0	0	0	0	0	0	0
0	0	0	0	1	1	1	1
0	0	0	1	0	2	2	2
1	0	0	1	1	3	3	3
0	0	1	0	0	4	4	4
1	0	1	0	1	5	5	5
1	0	1	1	0	6	6	6
0	0	1	1	1	7	7	7
0	1	0	0	0	8	8	8
1	1	0	0	1	9	9	9
1	1	0	1	0	A		:
0	1	0	1	1	B		;
1	1	1	0	0	C	•	<
0	1	1	0	1	D	/	=
0	1	1	1	0	E		>
1	1	1	1	1	F		?

CODE TRANSLATIONS
TABLE 1

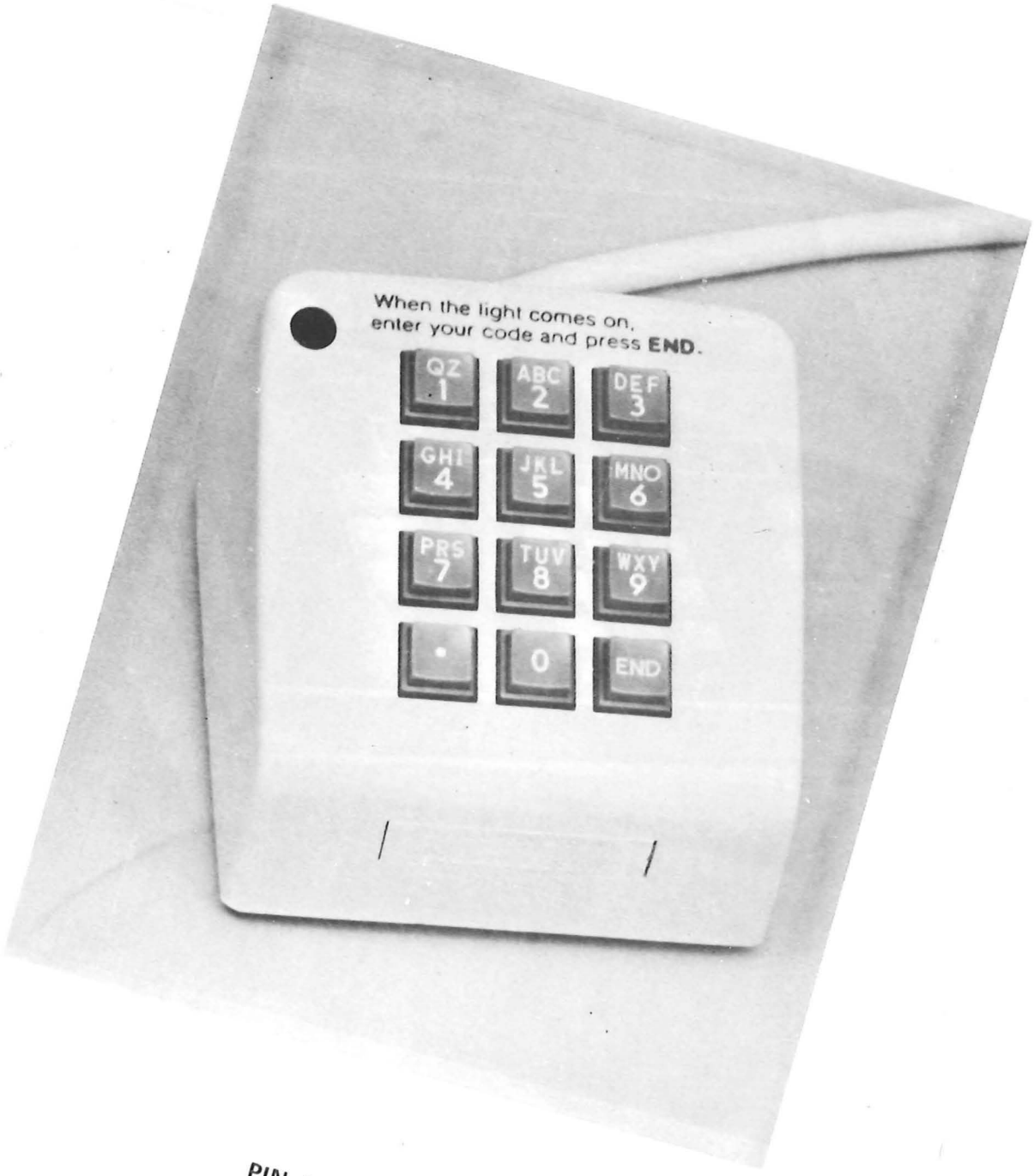


TRANSACTION NETWORK

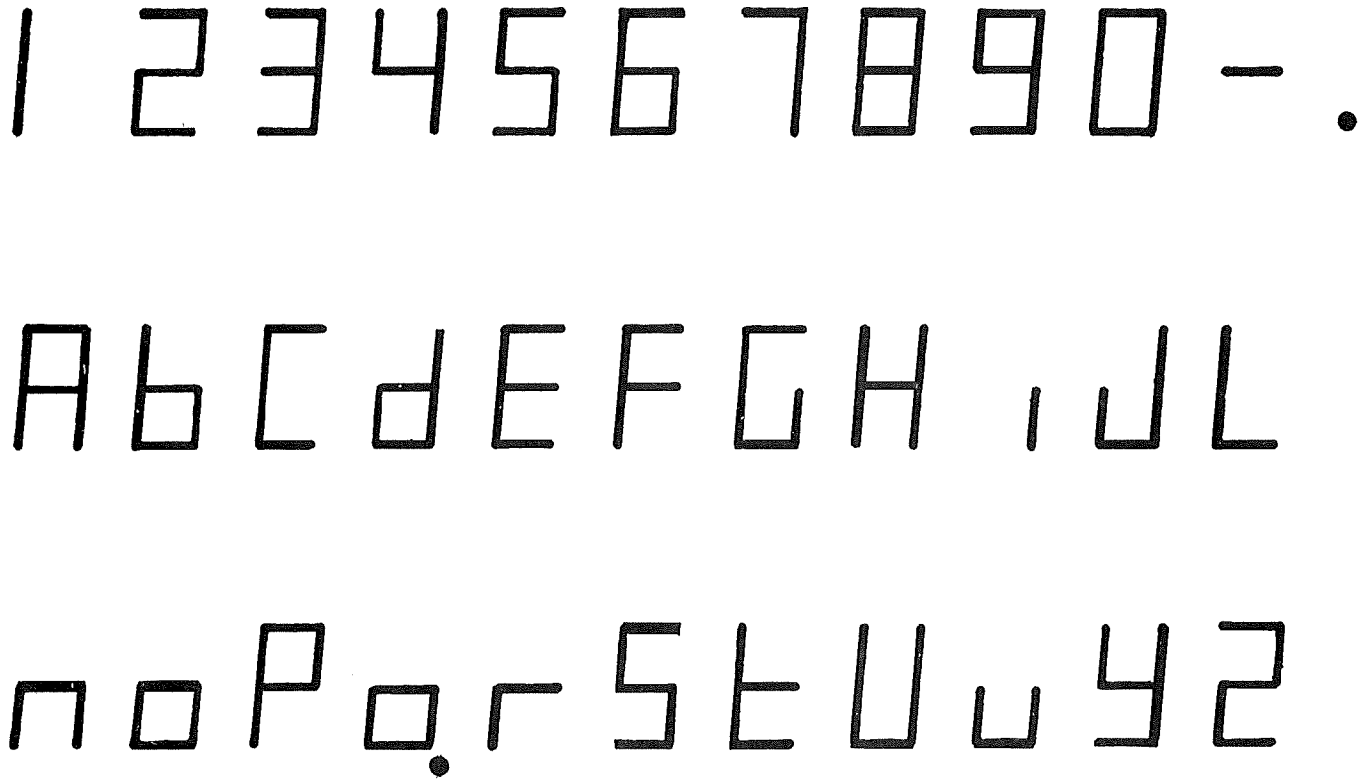
FIGURE 1



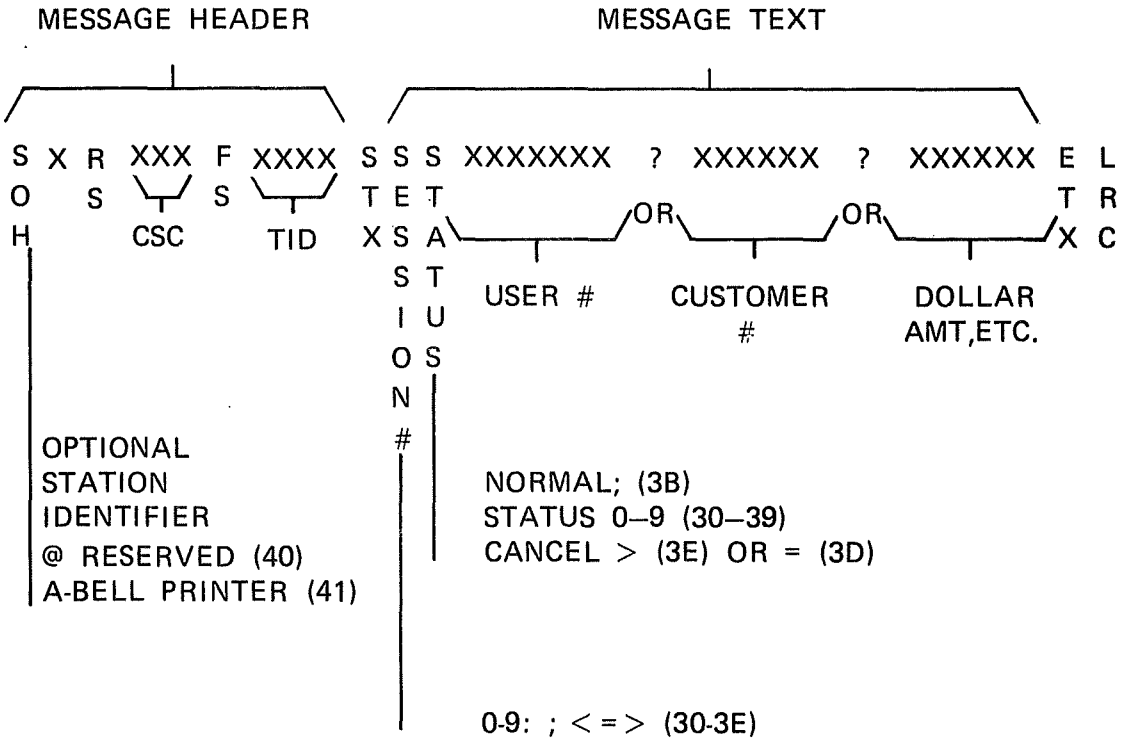
TRANSATION III TERMINAL
FIGURE 2



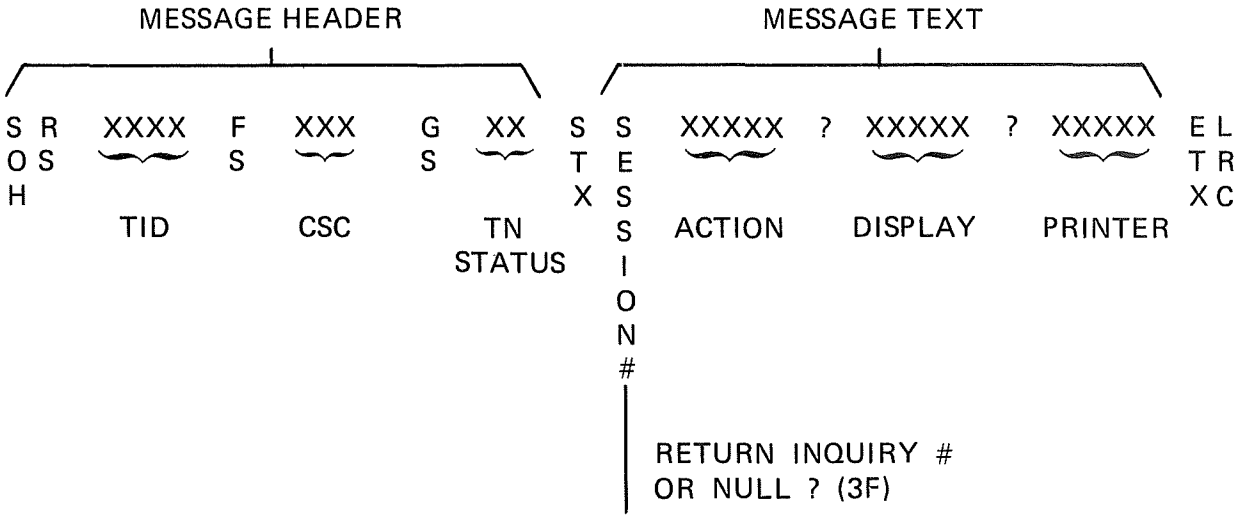
PIN PAD
FIGURE 3



DISPLAY CHARACTERS
FIGURE 4



INQUIRY MESSAGE FORMAT
FIGURE 5



RESPONSE MESSAGE FORMAT
FIGURE 6

APPENDIX A

CARD FORMAT AND STANDARDS

1. Summary of Card Standards--Mechanical

Pertinent physical dimensions of the card and the location of the magnetic stripe are shown in Figure A1. The length of the card is not critical. Signature panels and the like should not be placed opposite the magnetic stripe due to possible damage from a tension spring in the card reader. Edge burrs normal to the card face shall not exceed 0.003 inch (0.08 mm) above the card surface. No point on any edge of the card shall lie more than 0.004 inch (0.10 mm) from a straight edge against which that edge is resting. The card material shall not contain elements which migrate into and modify the magnetic material. A warped card will be read by the card reader if a force of 0.5 pounds placed over any point along the magnetic stripe will render that card in contact with a flat surface on which the card rests.

Any surface distortions, irregularities, or raised areas which might interfere with a recording or playback head must be at least 0.250 inch from either the top or bottom edge of the magnetic stripe. Raised areas in excess of 0.005 inch from the card surface must reside in the area allowed for embossing as per Figure A1.

2. Magnetic Material--Physical Characteristics

Magnetic material shall be located on the card so that it permits the encoding of the data track specified in Section 4 of this Appendix. The card shall contain no elements which migrate into and modify the magnetic material. The reading surface must not be lower than the surface of the surrounding card area. Thickness of the card plus the read surface shall not exceed 0.035 inch.

The average peak-to-peak surface irregularity of the reading surface shall not exceed 50 microinches (1.3 μm) Centerline Average in either the longitudinal or the transverse direction, using a cutoff wavelength of 0.01 inch (0.25 mm) or 0.03 inch (0.76 mm) when using a probe having a minimum radius of 100 microinches (2.54 μm).

The profile of the reading surface of the magnetic stripe, as measured parallel to the height of the card with a probe having a radius of 0.015 inch (0.38 mm) to 0.100 inch (2.54 mm), shall show a deviation from high point to low point of not more than 0.00015 inch (150 microinches, 3.8 μm) for each 0.100 inch (2.54 mm) of the stripe width.

3. Performance Characteristics of Magnetic Material

The magnetic material shall be capable of producing peak read-back signals of not less than 80 percent of the read-head voltage calibration, when written with any current between 350 percent and 500 percent of a defined write-head current calibration.

The 100 percent read-head voltage calibration is defined as the maximum peak read-back signal obtained from a saturation plot of a "secondary signal amplitude reference tape" (Standard Reference Material [SRM] 3200 as given in American National Standard Unrecorded Magnetic Tape for Information Interchange (9-Track 200 and 800 CPI, NRXI, and 1600 CPI, PE), X3.40-1973), corrected to the primary standard, written at 200 flux reversals per inch [FRPI] (8 flux reversals per millimeter [FR/mm]), nonreturn-to-zero, and transported at a velocity equal to that of the card encoder/reader.

The 100 percent write-head current calibration is defined as that square-wave current required to achieve 80 percent of maximum voltage from the National Bureau of Standards tape, corrected to the primary standard.

NOTE: Saturation plots for both the SRM 3200 tape and the plastic card specimen must be conducted using the same set of write heads and read heads, and associated electronics, and the same transport velocity.

Write heads and read heads must be aligned for maximum signal transfer on both the tape transport and the card encoder/reader.

Transport velocity differences should be kept to an absolute minimum since the read-back signal varies with transport velocity. Saturation plots should be performed at velocities such that frequency response of the head remains constant.

Head pressure should be applied to produce uniform results in read-back signal throughout the length of the card specimen. It is desirable to provide minimum head-to-material spacing. Head pressure should not, however, be so heavy as to cause damage to the magnetic material or to the head. This procedure characterizes the material and does not compensate for signal loss due to stripe curvature allowed in Section 1 of this Appendix.

CAUTION: This test does not guarantee any minimum or maximum value of intrinsic coercivity, H_{ci}. The specification of this parameter (if required) is left to the individual card purchasers. In general, higher coercivities provide greater encoded permanence at increased cost.

The standard environment for signal amplitude measurements is 73°F ±5°F (23°C ±3°C) and 40-percent to 60-percent relative humidity. When tested under otherwise identical conditions, the read-back signal amplitude from the magnetic stripe shall not deviate from its value in the standard environment by more than 15 percent over the range, as follows:

Temperature:	-30°F to +122°F (-35°C to +50°C)
Relative humidity:	5 percent to 95 percent with a maximum wet bulb temperature of 77°F (25°C).

4. Encoding Specifications

Data read by the Transaction III terminal is encoded on Track 2 of the magnetic stripe only. Other tracks may be encoded for other purposes.

The encoded data shall extend between two lines 0.353 inch (8.97 mm) and 0.463 inch (11.76 mm) from the top edge of the card.

Data shall be arranged as given below and shall begin in sequence from the right-hand side of the card, as viewed from the side containing the stripe, with the encoded tracks at the top.

The centerline of the first data bit (low order bit of the start sentinel) is 0.293 ±0.020 inch (7.44 ±0.51 mm) from the right edge of the card. The centerline of the last data bit (Longitudinal Redundancy Check [LRC] character) recorded shall not extend closer than 0.273 inch (6.93 mm) from the left edge of the card.

The lead-in up to the first data bit (start sentinel) shall be clocking bits (zeros), and the distance from the last data bit (LRC character) to the end shall also be clocking bits. The first clocking bit shall not begin further than 0.115 inch from the right-hand edge of the card.

The encoding technique was developed by Aiken in 1954 and is known as Two-Frequency, Coherent Phase Recording. This method allows for serial recording of self-clocking data (on one channel).

The data comprises data bits and clocking bits together. An intermediate flux transition occurring between clocking transitions signifies a "one"; the absence of an intermediate flux transition signifies a "zero".

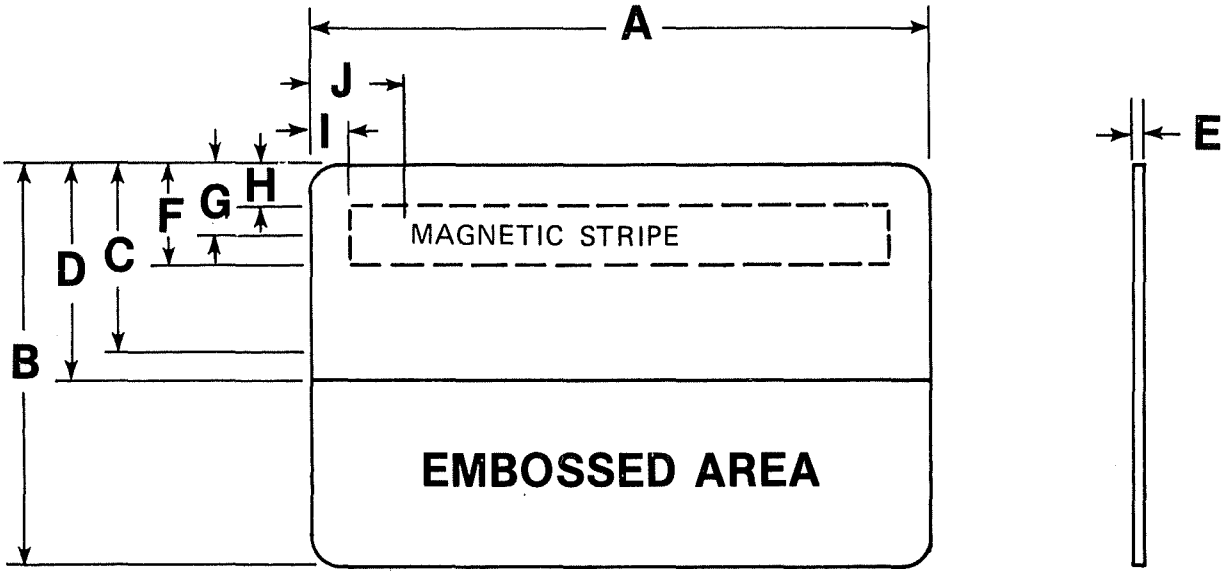
The data shall be recorded as a synchronous sequence of characters without intervening gaps. Table 1 lists the hexadecimal characters which may be encoded on this stripe.

Recording shall be in a saturation mode with magnetization parallel to a line in the plane of the track. The direction is determined by the recording angle.

The signal on Track 2 shall be recorded in such a way that the maximum playback amplitude will occur when the magnetic centerline along the head gap is at an angle of 0° ±20' for Track 2 to a line normal to the top edge of the card.

5. Additional Characteristics of Track 2--Bit Density

The average bit density of the recorded signal shall be 75 bits per inch (2.95 bits per millimeter), ±3 percent, when measured along a line parallel to the longitudinal centerline of the signal. The spacing between adjacent flux changes shall be 13,333 ±400 microninches (0.3387 ±0.0102 millimeter), ±3 percent for a "zero" and 6667 ±267 microinches (0.1693 ±0.0068 mm), ±4 percent, for a "one". For a sequence of recorded "ones" the density corresponds to a nominal 150 FRPI (5.91.FR/mm).



A	NOT CRITICAL	LENGTH OF CARD
B	NOT CRITICAL	HEIGHT OF CARD
C	1.06	MINIMUM DISTANCE FROM TOP OF CARD FOR EMBOSSING PROTRUDING ON BACK FACE
D	1.22	MINIMUM DISTANCE FROM TOP OF CARD FOR EMBOSSING PROTURDING ON FRONT OF CARD
E	0.030 ±.003	THICKNESS OF CARD
F	0.463	BOTTOM OF ENCODED ANSI STRIPE 2 FROM TOP OF CARD
G	0.353	TOP OF ENCODED ANSI STRIPE 2 FROM TOP OF CARD
H	0.218 MAX.	TOP OF MAGNETIC MATERIAL FROM TOP OF CARD
I	0.115	MAXIMUM DISTANCE TO START OF MAGNETIC MATERIAL FROM CARD EDGE
J	0.273 ± 0.020	MINIMUM DISTANCE TO FIRST BIT OF START SENTINEL

NOTE: ALL DIMENSIONS IN INCHES

CARD DIMENSIONS CRITICAL TO TRANSACTION TERMINAL
FIGURE A1

APPENDIX B

ID CARD FORMAT AND OPTIONS

The complete data format for the ID card is shown in Figure B1. The characters, in order of appearance, are:

1. The start sentinel and ID card identification--two characters.
2. Three optional control characters, followed by a field separator--one or four characters.
3. A called number subfield, followed by a field separator--zero to eight characters.
4. A user identification subfield--zero to 24 characters.
5. The END sentinel and LRC--two characters.

ID Card Identification

The terminal identifies the ID card by the appearance of a HEX "C" as the first character after the start sentinel* (HEX B). The presence of this character informs the terminal to accept the card as an ID card when the first instruction lamp is on.

Option Field

The optional control-character field, if present, follows the ID card identification character. If no options are required, the field separator (HEX D) is encoded as the next character. Manual entry of ID information causes the terminal options to be the same as that resulting from an ID card with no options.

The field is three characters long, with each character in the range of 0 through 7, and is terminated by the field separator character. Each bit uniquely defines a different and independent option, with bit 1 being the least significant bit (2^0) and bit 4 (2^3) and most significant. Bit 4 is always zero. The options and their bit postions are as follows:

Character 1

Bit 1--Inhibit testing of the customer card's LRC character.

Bit 2--Inhibit storage of data entered by the ID card. This disables the last number repertory feature.

Bit 3--Enable the nonpaired mode. This causes the terminal not to wait for a response message before returning to instruction lamp one.

*Care should be used to determine whether the start sentinel is automatically encoded by the user's card encoding facilities.

Character 2

Bit 1--Disable the automatic sequencing of instruction lamp two to instruction lamp three when a magnetic card is entered. This allows manual data to be entered after a magnetic card.

Bit 2--Enable the text format option by inserting the ASCII character "/" at the beginning and end of PIN entries.

Bit 3--Disable the printer during this transaction.

Character 3

Bit 1--Disable the one minute timeout on the reprint capability.

Bit 2--Enable the automatic LAST ID mode. The terminal will always return to instruction lamp two.

Bit 3--Not assigned.

Called Number

The called number field contains the number of the CSC to be accessed. The field is up to seven characters long, not including a HEX D which delineates the end of the field. For implied addressing the field is blank; otherwise, the normal number of characters used will be one, two, three, or seven as defined by the Transaction Network.

User Identification

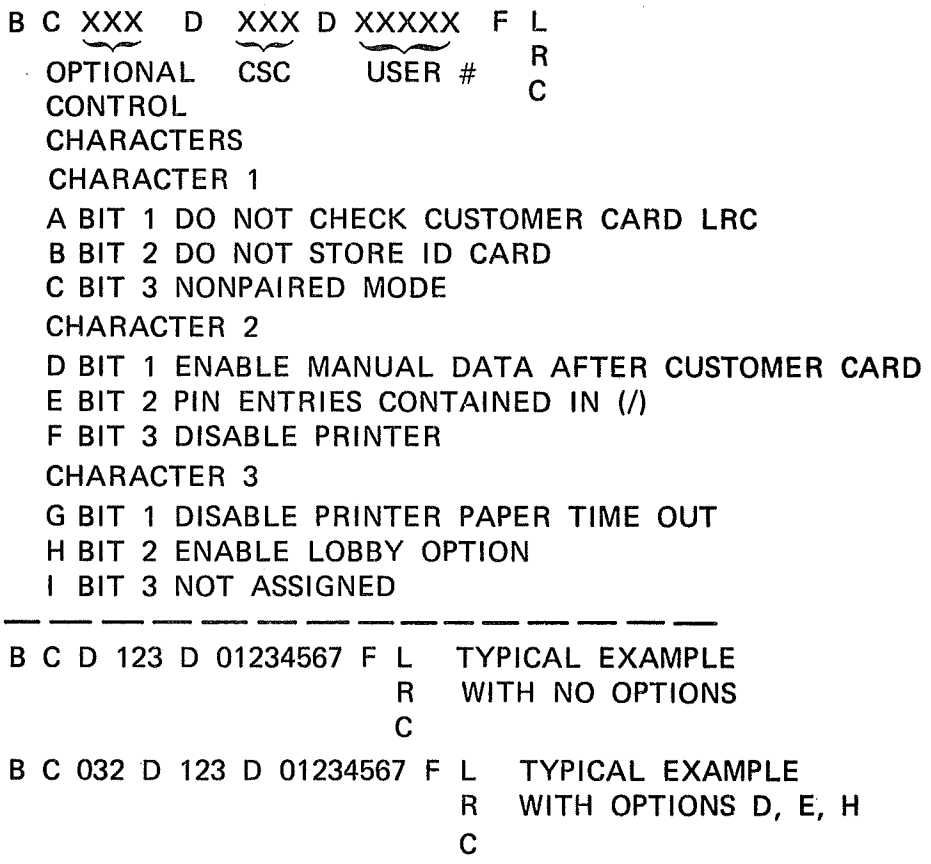
There may be between zero and 24 characters in this field (up to 34 characters if all other fields are deleted) in the HEX range of 0-9, A-E. The entire field, consisting of the characters following the called number field separator and up to but not including the end sentinel, are included in the message text transmitted to the Customer Service Center.

End Sentinel and LRC

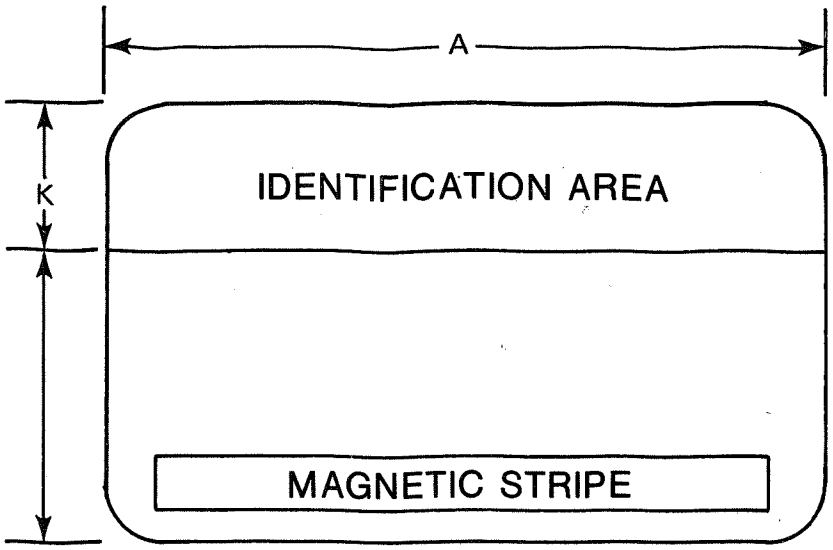
The final two characters on the ID card are the end sentinel (HEX F) and the Longitudinal Redundancy Check character. The LRC is a binary sum that adds "without carrying" the characters preceding it on the magnetic card.

Card Design

The recommended dialing card design is shown in Figure B2. Note that the magnetic stripe should be in the lower portion of the face of the card, on the same side as the printed information. This facilitates placing the cards in the card-holding slots so that they can easily be removed and used in the card reader.



ID CARD FORMATS
FIGURE B1



A	3.4	MAXIMUM CARD LENGTH FOR STORAGE IN CARD HOLDING SLOTS
K	0.65	LIMIT OF CARD VISIBLE AREA
	NOTE:	DIMENSIONS IN INCHES AREA BOUNDED BY DIMENSIONS A AND K SHOULD BE USED TO IDENTIFY DIALING CARD FOR USER. READABLE PORTION SHOULD BE ON SAME SIDE OF CARD AS THE MAGNETIC STRIPE. ANY OTHER PERTINENT INFORMATION SUCH AS SPECIAL INSTRUCTIONS, ETC., CAN BE PRINTED ELSEWHERE ON THE CARD. HOWEVER, EMBOSSING CONSTRAINT (FIG. A1) MUST BE MET WITH RESPECT TO THE STRIPE LOCATIONS.

RECOMMENDED CARD DESIGN
FIGURE B2