Burroughs Corporation

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TITLE ENGINEERING SPECIFICATION TD820 SERIES TERMINALS

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1. SCOPE

1.1 GENERAL

This specification defines the requirements for a family of Burroughs Input and Display System terminals (the TD820 series). These terminals shall have the capability to accept and to display information entered locally, and to exchange information with a central processor or another terminal in a half-duplex mode via direct wire or communication lines. The terminals shall have the capability of operating with certain multipoint or point-to-point communications procedures described herein. The terminals shall also have the capability of matching certain interface requirements described in this specification. To the extent specified, this family of terminals shall have the capability of operating within the system environments of certain other Burroughs terminals which are named herein.

1.2 BASIC CAPABILITIES

The terminals shall contain the basic capabilities given in the following paragraphs.

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1.2.6.10 Right Justification in Forms (paragraph 3.3.3.4.1)

1.2.6.11 96 Character Set (paragraph 3.3.1.2)

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1.2.7.11.2 Negative Video, Forms (paragraph 3.3.3.1)

1.2.7.11.3 Disable/Enable Lower Case (paragraph 3.3.3.10)

1.2.7.11.4 Programmable Cursor (paragraph 3.3.3.6)

1.2.7.11.5 Disable/Enable Forms (paragraph 3.3.3.4)

1.3 ADDITIONAL CAPABILITIES

The terminal shall be capable of incorporating the capabilities given in the following paragraphs.

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b. Blink

c. Blank

1.3.1.2 Roll Up/Down (paragraph 3.3.3.11)

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1.3.3.4 Clear Variable Tab Stops (paragraph 3.3.3.3.3)

1.3.3.5 Line Erase, DC1 (paragraph 3.6.2.9)

1.3.3.6 Space Right, or Forms Enable, DC2 (paragraph 3.6.2.10)

1.3.3.7 End of Text, Non-Forms, GS (paragraph 3.7.3.3.3)

1.3.3.8 Escape Sequences, ESC (paragraph 3.6.1)

1.3.3.8.1 Character Insert/Delete, Line

1.3.3.8.2 Character Insert/Delete Page

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1.3.3.8.8 Clear Variable Tab Stops

1.3.3.8.9 Enable/Disable Search

1.3.3.8.10 Search Character Select

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1.3.3.8.17 Select Tape Drive 1

1.3.3.8.18 Select Tape Drive 2

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2. APPLICABLE DOCUMENTS

The following documents of the issue in effect on the date of this specification form a part of this specification to the extent specified herein.

STANDARD	TITLE
RS232C	EIA Standard, Interface Between Data Processing Terminal Equipment and Data Communication Equipment, August 1969.
CCITT Com Spa No. 100, Recommendation 24	Functions and Electrical Characteristics of Circuits of the Interface Between Data Terminal Equipment and Data Communication Equipment, October 1968.
GPO Data Services NP 3.4.3	Notes for Manufacturers of Data Terminal Equipment, No. 2, General Requirements for Data Terminal Equipment, November 1969.
CSA C22.2, No. 68	Standard, Canadian Standards Association Standard,
BSI 800	British Standards Institute Standard,
BSI 3861	British Standards Institute Standard,
CEE Publication No. 10	CEE
UL 478	Underwriters Laboratories Standard, Electronic Data Processing Units and Systems.
BPO Technical Guide No. 25	British BPO Memorandum, Design Requirements for the Connection of Non-Post Office Equipment to Post Office Private Circuits, April 2, 1970.
Post Office Datel Services	Note No. 2, General Requirements for Data Terminal Equipment, Issue 2, November 1969.
NFPA 70	National Fire Prevention Association, National Electrical Code, 1968.
NFPA 75	National Fire Prevention Association Standard for Protection of Electronic Computer Systems and System Installations, 1968.
VDE 0871/11.60	Limits of Radio Interference from Radio Frequency Apparatus and Installations, W. Germany, 1961.
VDE 0875/12.59	Rules for the Radio Interference Suppression for Appliances, Machines and Installations. W. Germany, 1961.

STANDARD	TITLE
RS 170	EIA Standard, Electrical Performance Standards - Monochrome Television Studio Facilities, Nov. 1957

Burroughs Corporation Documents:

1284 9006	Systems Standard for Communications Procedures, December 1971.
1700 3195	Specification, Two-Wire Direct Interface, August 1967.
60445	Product Specification, Reliability Standards, Rev C, May 1961, Pasadena.
66984	Product Specification, Environmental Standards, Rev K, October 1967, Pasadena.
B2-02	Technical Standard, Predominant Voltages and Frequencies in Foreign Countries, April 1969.
B2-05	Technical Standard, Normal Environments for Data Processing Equipment and Business Machines, June 1970.
B2-08	Technical Standard, Limits for Radio Interference Emission.
B2-09	Technical Standard, EMI Interference Control Guide For Machines and DP Equipment.
1257 4703	Specification, Acoustical Noise
1691 2602	General Specification, Keyboard, May 1972.
1691 0978	Specification, Power Supply, April 1971.
1498 5303	Specification, Balanced Differential Direct Connect Interface (BDI), April 1973.
1284 9022	Systems Standard for Bisynchronous Communications Procedures, January 1973.

3. REQUIREMENTS.

3.1 GENERAL.

The TD820 Series Terminal Input and Display Systems, hereinafter called the Terminal, shall be designed and constructed as a free-standing, self-contained data input and display device. The Terminal shall be suitable for the exchange of coded information, in domestic and international environments, with a computer system central unit (central processor) or with another terminal or device having a compatible interface.

The TD821 shall have the capability to display 960 characters. While retaining all other capability of the TD821, the TD822 shall have the capability to display 1920 characters. The TD823 and TD824 terminals shall have the capability to display 640 characters and 1280 characters respectively, and shall be applicable for use with the Katakana (Japanese) character set and display character format.

Thru installation set-up and adjustment, the TD820 family of terminals shall have the capability, at any one time, of compatible operation in the environment of any one of the following Burroughs terminal types: B 9352, B 9353, TD700 Design-Level-One, TD700 Design-Level-Two and upward, and TD800 Design-Level-Two and upward.

COMPARE 670s

3.1.1 UL Approval.

The Terminal in the basic and optional configurations defined by this specification shall be approved and listed by the Underwriters Laboratories, Inc. (UL), per UL Standard 478.

3.1.2 CSA Approval.

The Terminal in the basic and optional configurations defined by this specification shall be approved and listed by the Canadian Standards Association (CSA), per CSA Standard C22.2, No. 68.

3.1.3 BPO Approval.

The Terminal design shall have the capability to be configured to conform with BPO Technical Guide No. 25 requirements.

3.1.4 VDE Compliance.

The Terminal shall meet the RFI requirements of the VDE 0871/11.60 and VDE 0875/12.59 specifications as given in Burroughs Technical Standards B2-08 and B2-09.

3.1.5 Other Standards.

The Terminal in the basic and optional configurations defined by this specification shall be designed to conform to the requirements of other standards listed below. However, the conformance shall be by intent and design guidance and shall not be construed as necessarily requiring formal testing, approval, or listing to any or all of the other standards when those standards deviate from UL Standard 478 or CSA Standard C22.2, No. 68. The other standards are:

a. BSI 800

b. BSI 3861

c. CEE Publication No. 10

3.1.6 Communications Procedures.

Communications procedures and code shall conform to Burroughs Communications Procedure Standards 1284 9006 and 1284 9022, as applicable, within this specification. Also included are look-alike procedures for compatible operation with the IBM 2260 and IBM 3270 terminals.

3.1.7 Order of Precedence.

Where a conflict exists between the requirements of this specification and any of the referenced specifications, this specification shall take precedence.

3.2 TERMINAL CHARACTERISTICS.

3.2.1 General.

The Terminal shall consist of the following physical assemblies: the display monitor assembly; the logic and power supply assembly; and the keyboard assembly. The display monitor assembly and the logic and power supply assembly shall be housed together in a single unit. The display monitor assembly is designed to operate with several types of keyboard assemblies or without a keyboard assembly in the processing of messages between the operator and a central processor. The Terminal can be used with data sets and modem expanders, or can be direct connected to the central processor site.

Functionally, the Terminal shall be comprised of four interdependent subsystems: the display subsystem, the keyboard and keyboard interface, the communications interface, and the power supply. Each subsystem can be implemented in optional configurations. Control logic circuitry links the subsystem together to form the complete Terminal.

3.2.2 General Characteristics.

The general characteristics of the TD821 or TD822 Terminal are given in table 1 and characteristics of the TD823 or TD824 Terminal for Japan (Katakana) are given in Table 1A.

TABLE 1. TD821 OR TD822 TERMINAL CHARACTERISTICS

FEATURE	CHARACTERISTIC
Display device	Cathode-ray tube (CRT)
Memory storage capacity	960 characters (TD821) 1920 characters (TD822)
Character repertoire	Up to 96 characters (including space)
Input/output data transfer rate	75-1800 bps Asynchronous, EIA RS232C 600, 1200, 2000, 2400, 4800, and 9600 bps Synchronous, EIA RS232C 1200-9600 bps Two-Wire Direct, Asynchronous, 1000 ft. Up to 64,000 bps. Burroughs Direct Connect, 15,000 ft.
Character Codes	a. USASCII/ECMA, modified. (See figure 6-1 for character codes.) b. USASCII (option) (See figure 6-31 for character codes.) c. USA Modified CII (International modifications) (See figure 6-2 for character codes.)

TABLE 1A. TD823 OR TD824 TERMINAL CHARACTERISTICS

FEATURE	CHARACTERISTIC
Memory storage capacity	640 characters (TD823) 1280 characters (TD824)
Character repertoire	96 characters
Character code	See figure 6-26 for codes

Note: Other characteristics are identical to Table 1.

3.3 DISPLAY SUBSYSTEM

3.3.1 Description.

The display subsystem shall be defined by the referenced applicable documents of paragraph 2 to the extent specified herein. The subsystem shall be comprised of the following functional groups: an MOS character generator; an MOS random access memory (RAM); dot pattern storage buffers; timing and mode control; cursor generation and control; and the display monitor. The power supply subsystem (paragraph 3.8) shall provide all the functional groups, except the display monitor of the display subsystem, with the necessary dc voltages and power.

3.3.1.1 Display Monitor.

The display monitor shall contain a cathode-ray tube (CRT) and associated drive electronics. The display monitor shall be all solid state (not including the CRT) and shall include the high-voltage rectifier; regulated low-voltage power supply; and all necessary circuits for deflection; video amplification, and all other television-type functions which shall be derived from the composite sync and video input signals produced by other functional groups of the display subsystem. The composite sync and video input signals shall conform to the requirements of EIA Standard RS-170. The display monitor for the TD821 or TD822 shall have the characteristics given in table 2. The display monitor (TD823 or TD824) characteristics for the Japan (Katakana) terminal shall be as given in table 2A.

TABLE 2. DISPLAY CHARACTERISTICS

FEATURE	CHARACTERISTIC
CRT dimensions:	
Diagonal size	12 inches
Overall size	74 square inches
CRT viewing area:	
Width	9.5 inches
Height	7.5 inches
Display format	5 x 7 dot matrix
Line length	80 characters

TABLE 2. DISPLAY CHARACTERISTICS (Cont'd)

FEATURE	CHARACTERISTIC
Display character capacity	960 (TD821) 1920 (TD822)
Lines	12 (TD821) 24 (TD822)
Character size	0.09 inches wide 0.2 inches high
Character spacing	2 blank columns of dots between successive characters
Row spacing (standard memory)	13 blank rows of dots between successive rows
Row spacing (optional memory)	3 blank rows of dots between successive rows
Refresh rate	Input line frequency (50 Hz. or 60 Hz.)
Flicker	None observable
CRT brightness	50 ft.-lamberts (maximum)
Contrast ratio	20:1 (approximate)
Color of displayed image	White characters on a black background
Viewing angle	100° (minimum)
Deflection	Magnetic
Focus	Electrostatic

TABLE 2A. DISPLAY CHARACTERISTICS, JAPAN (KATAKANA)

FEATURE	CHARACTERISTIC
Display character capacity	640 (TD823) 1280 (TD824)
Display format	7 x 9 dot matrix
Line length	64 characters
Lines	10 (TD823) 20 (TD824)
Character size	0.12 inches wide 0.27 inches high

NOTE: Other characteristics are identical to Table 2.

3.3.1.2 Character Generator.

The character generator shall be contained within the display subsystem. The standard character generator shall produce a set of 96 display characters, including space. These characters consist of the 26 upper-case and 26 lower-case alphabetical letters, numbers 0 thru 9, and 33 special symbols (see figure 6-1 columns 2 thru 7). In addition to the 96 display characters, the character generator shall also produce the control character symbols for US (▷), RS (◁), GS (△), ETX (⧗), TAB (→), and CR (▽).

Where only the upper-case character set is used, such as many international sets, the ASCII character codes for the lower-case alphabetical letters shall be translated and displayed as the equivalent upper-case character codes during the text portion of the message. This shall be a Field Engineering adjustment.

3.3.1.3 Memory.

The display subsystem shall contain seven-bit per character memory circuits with a maximum capacity of 1920 characters. These memory circuits shall be random access (RAM) with solid-state MOS circuitry. The cursor control circuitry shall determine the memory access point which is based upon cursor positioning.

3.3.1.3.1 TD821 Memory. The TD821 shall utilize 960 characters of memory, presenting characters in a 5 x 7 display format with 12 rows of 80 characters per row.

3.3.1.3.2 TD822 Memory. The TD822 shall utilize 1920 characters of memory, presenting characters in a 5 x 7 display format with 24 rows of 80 characters per row.

3.3.1.3.3 TD823 Memory. The TD823 shall utilize 640 characters of memory, presenting characters in a 7 x 9 display format with 10 rows of 64 characters per row.

3.3.1.3.4 TD824 Memory. The TD824 shall utilize 1280 characters of memory, presenting characters in a 7 x 9 display format with 20 rows of 64 characters per row.

3.3.1.4 Cursor.

The display subsystem shall generate a visual cursor for the display. The cursor shall indicate the location of data entry or recovery within the display memory and shall consist of the negative image of the character. The cursor character location shall be stored in the cursor location counter and shall not be stored in the display memory. After each character is entered into or read from the display memory, the cursor shall advance to the next character position to the right or to the beginning of the next line when the preceding line has been filled. The cursor shall also be moved in the appropriate direction on the display by a carriage return character from the communications interface or by the line feed, reverse line feed, backspace, forward space, carriage return, and home keys of the keyboard. The cursor shall blink at a 1.5 Hertz rate by alternately producing the reverse of the video at the cursor position. This blinking shall stop when the keyboard is locked out and if required, shall be capable of field disablement.

3.3.1.5 Auxiliary Video Output Connector

The display subsystem shall contain a coaxial connector (BNC-type plug, or equivalent) for providing the composite sync and video signal to a remote device, such as a slave display monitor. This auxiliary output connector shall be located on the lower rear section of the Terminal display unit and shall be capable of driving a 75 ohm coaxial conductor of up to 100 feet in length. The auxiliary output circuit shall be connected within the Terminal so as to have no effect on the line impedance of the primary video conductor of the Terminal.

3.3.2 Subsystem Operation.

The display subsystem accepts data on seven parallel input lines. The coding for the data is given in figure 6-1 (columns 2 through 7). Data is entered into the memory sequentially; i.e., the first character is loaded into column one of row one; the second character is loaded into column two of row one, and so on across row one until row one is filled. The remaining rows are loaded in the same manner. The data-load time to memory shall be 1.75 usec. (maximum), per character.

Data is entered into the display at the cursor location. When a character is entered into memory, the cursor shall automatically advance one character position to the right. When a row is filled, the cursor shifts to the leftmost character position of the next lower row. After all character positions are filled, the cursor shall automatically return to the home position (row one, column one) and continue to write data into memory, overwriting the previous data.

3.3.3 Display Subsystem Features.

The display subsystem shall have available the following features: negative video display, tabulation, protected and unprotected data (forms), right justification and automatic item correction, programmable cursor position, character insert and delete, line insert and delete, lower-case lockout, display roll up or down, and international character sets of 96 characters maximum.

3.3.3.1 Negative Video

The display subsystem shall have the capability of displaying white characters on a black background (normal video) or black characters on a white background (negative video). At power-on-time of the TD820, the mode shall be normal video. Upon receipt of an ESC followed by N from the data communications network during text or upon depression of the keyboard CTRL key followed by the shifted N key, the display subsystem shall enter the negative video mode. Upon receipt of an ESC followed by O from the data communications network during text or upon depression of the keyboard CTRL key followed by the shifted O key, the display subsystem shall return to the normal video mode.

3.3.3.1.1 Negative Video during Forms Mode

When both negative video and forms mode are active, the unprotected data areas shall be displayed as normal video as follows: The GS, US or left forms delimiter shall be considered as the start of a reverse video highlight field and the RS or right forms delimiter shall end the reverse video highlight field. (See 3.3.3.2) This reverse video highlight field upon a negative video background shall appear as normal video from left delimiter through right delimiter unless otherwise modified by other highlight modes.

Any unprotected data field so highlighted, that continues from column 80 to column 1 of the screen shall continue with the reverse video upon a negative video background until a right delimiter appears in memory.

3.3.3.1.2 Cursor

Depending upon negative video mode and reverse video highlight mode commands, the character at the cursor position shall appear as a reversed video character. An odd number of reverses shall display reverse video and an even number shall display a normal video character.

3.3.3.2 Data Highlight

The display subsystem shall have the capability of highlighting selected fields of data on the screen. Three modes of data highlighting shall be available to the central processor software for use on either the normal or negative video background modes with or without forms mode. The highlighting shall be accomplished by use of four characters SO, SI, EM, and CAN. SO, EM, and CAN shall be entered into memory by the central processor via data communications, during text, to start their respective fields of highlighting. Character SI shall be entered into memory likewise to end any or all of the three highlight modes. If the operator chooses, the four characters shall be overwritten in memory via keyboard action or by the central processor during selection. The operator shall not be able to overwrite data in the protected data field during forms mode. The four characters shall not be displayed and that location shall appear as the background would depending upon negative video mode, reverse highlight mode and cursor position.

The three highlight modes shall be independent, thus allowing nesting and giving a cumulative action upon the video data.

3.3.3.2.1 Reverse Video (SO)

Upon reading an SO character from memory during display refresh, the display subsystem shall commence a reverse video display and shall maintain this mode until a SI is read, thereby, ending all selective highlight fields. This mode will display negative video from SO to SI unless the negative video mode (3.3.3.1) has been entered via data communications or CTRL key operation, thereby causing the normal video display from SO to SI.

The detection of a GS, US, or left delimiter during forms mode and negative video mode (3.3.3.1) shall cause the reverse video to show normal video in the unprotected area. The RS or right delimiter during forms mode and negative video mode shall end the reverse video field and any other highlight fields that may be in process.

If the Reverse Video highlight field is not ended via SI or forms right delimiter by the 80th column of the screen, then the reverse video highlight shall be continued starting at column 1 of the next line up through the last line.

The cursor, if present within this reverse highlight field, shall reverse the video at that position one more time to indicate its position. The 1.5 Hz blink rate of the cursor shall aid in visually locating the cursor at negative/normal video boundaries.

3.3.3.2.2 Blink Video (CAN)

The display subsystem, upon reading a CAN character from memory during display refresh, shall commence a blinking video display at a 1.5 Hz rate, and shall maintain this mode until a SI is read, thereby ending all selective highlight fields. Blink video shall consist of alternating video data with a solid background (background dependent upon negative video mode (3.3.3.1), reverse video highlight (3.3.3.2.1) and a possible cursor display).

The blinking highlight field shall be able to highlight any area without regard to in-process highlighting of other types or to forms mode. This blinking highlight, if in process at the 80th column of the screen shall continue on to the next line up through the last line. The end of the blinking video field shall be at the next reading of SI following CAN.

3.3.3.2.3 Blank Video (EM)

Upon reading an EM character from memory during display refresh, the display subsystem shall commence a blank video display and shall maintain this mode until a SI is read, thereby ending all selective highlight modes. Blank video shall consist of solid video in contrast with the background (background dependent upon negative video mode (3.3.3.1), reverse video highlight (3.3.3.2.1), and a possible cursor display).

The blank highlight field shall be able to highlight any area without regard to in-process highlighting of other types or to forms mode. The blank highlight if in process at the 80th column of the screen, shall continue on to the first position of the next line up through the last line.

3.3.3.3 Tabulation

The display subsystem shall have the capability of either fixed or variable tabulation. However, both types may not be configured in the same terminal. Variable tabulation shall be the standard configuration, while the fixed tabulation feature shall be obtained by field engineering adjustment.

3.3.3.3.1 Fixed Tabulation. Fixed tab stop may be attained by field engineering adjustment and shall be the 1st, 9th, 17th, 25th, 33rd, 41st, 49th, 57th, 65th, and 73rd character position of each line of the display. The unshifted TAB key of the keyboard or the receipt of the HT character shall cause the cursor to move forward to the next tab stop location of that line. Beyond the 73rd character position, the cursor shall advance to the 1st character position of the following line.

3.3.3.3.2 Reverse Tabulation. The RTAB key of the keyboard shall cause the cursor to move from field to prior field or from tab stop to prior tab stop. Reverse tabulation shall have the capability of operating with either fixed or variable tab stops. In forms mode, reverse tabulation shall cause the cursor to be positioned at the first data entry position of the prior unprotected field.

3.3.3.3.3 Variable Column Tabulation. A variable tab position may be set thru keyboard or software in any of up to 80 column locations (non-forms only). The shifted TAB key shall set/reset, thru alternate key depressions, the cursor column position into tab-stop storage. Receipt of the proper ESC control character shall also cause the cursor column position to be stored in tab-stop storage. The tab-stop storage may also be cleared by software ESC control (table 6A). Either variable column tabulation or fixed tabulation shall be available by field engineering adjustment. However, these features shall be mutually exclusive.

3.3.3.3.4 Tab Field Identifier. The tab field identifier option shall be capable of operating with either fixed or variable tabulation in either forms or non-forms mode. In forms mode, the unshifted TAB key shall cause a field identifier (→) to be written into memory at the cursor location. The cursor shall then automatically advance to the next field. If the field is a right justify field, a field identifier (→) will be written into the first position following a left delimiter. During transmission, the character spaces between the field identifier and the next field will not be transmitted.

In non-forms mode, the unshifted TAB key shall cause a field identifier (→) to be written into memory at the cursor location. The cursor shall then automatically advance to the next tab stop. During transmission, the character spaces between the field identifier and the next tab stop will not be transmitted.

3.3.3.4 Forms.

A Forms mode of terminal operation shall be available and shall provide the capability for the handling of protected and unprotected data by the Terminal in both message reception and transmission modes. The central processor will cause the Terminal to operate in the Forms mode by the transmission of the proper ESC control character (shown in table 6A) in the message character stream. Upon receipt of the ESC control character, the FORMS indicator is lit to alert the operator to the active forms status and the cursor is placed to the right of the first left delimiter from the home position. The proper ESC control character (table 6A) in the same message shall deactivate the Forms mode.

In the Forms mode, display data is divided into two classes: protected and unprotected. Protected data cannot be altered by the operator; unprotected data is available for operator data entry and edit. Unprotected data fields which are limited to the display memory size shall be contained within delimiters.

The TD820 family of terminals, thru field engineering adjustment, shall have the capability to accept any two characters as forms delimiters. The terminal will convert the "delimiters" to display the US (▷) and RS (◁) symbols. The US character (column 1, row 15 of figure 6-1) shall be the delimiter preceding an unprotected data field. The RS character (column 1 row 14 of figure 6-1) shall be the delimiter following the unprotected data field.

The TD823 and TD824 Terminal configurations for Japan (Katakana) shall use the left parenthesis (column 3, row 12 of figure 6-26) as the preceding Forms delimiter and the right parenthesis (column 3, row 14 of figure 6-26) as the following delimiter.

When in forms mode, all cursor movements including CR, Line Feed, Reverse Line Feed, Backspace, and cursor advance are enabled. Full cursor movement is provided for the entire screen. However, data cannot be written into memory until the cursor is moved into an unprotected data field by either the use of the TAB or Reverse Tab key. In the forms mode, the Reverse Tab key shall move the cursor to the first data character location of the prior unprotected data field, the TAB key shall advance the cursor to the first data character location of the next unprotected data field, and the CLEAR key shall erase only unprotected data.

When transmitting a message to the central processor while in the Forms mode, the Terminal shall transmit only the unprotected data. The unprotected data that is transmitted shall begin at the cursor location and end at the stored ETX character. If no ETX character is stored, then the transmission of unprotected data shall be from home position to the cursor position. A message transmitted by the central processor and not containing the ESC control character for forms shall be treated as a standard message by the Terminal. As a result, the Terminal shall be taken out of the Forms mode. A typical Forms message from the central processor to the Terminal will have the following sequence:

...STX, P...▽,▷ , U...U,◁, P... etc., ESC, W, ETX

where P is protected data character and U is an unprotected data character. When the Terminal is not in the Forms mode, the FORMS indicator shall be extinguished and delimeter characters shall not be recognized as delimiters for unprotected data fields. In the event that the central processor transmits a message to the Terminal and the ESC W character sequence is included without at least one left delimiter, then the Terminal shall not remain in the Forms mode, the Forms indicator shall not remain illuminated, and the cursor shall halt at the first position on the display. The Terminal shall be returned to the Receive mode while in Forms by the actuation of the Receiver (RCV) key.

The operator shall be able to control the status of the Terminal relative to the Forms mode with keyboard CTRL control. If the Terminal is in the Forms mode, the operator can change its status by initiating the correct CTRL control, thereby, extinguishing the FORMS indicator. Conversely, the Terminal can be placed into the Forms mode by the operator initiating the correct CTRL control (provided at least one left delimiter

is displayed), thereby, lighting the indicator. The coordination of Forms status with the central processor shall be the operator's responsibili , when CTRL control is used. The forms enable (DC2) character shall be selectable in the TD820 by field engineering adjustment for compatibility with the TD700 and TD800 terminals.

3.3.3.4.1 Right Justification. This feature operates in forms mode only. It is identified thru the use of a special opening delimiter; the group separator GS (Δ) followed by an RS (◁) as the closing delimiter. When a right-justify field is entered, the cursor shall automatically move to the right most position of the field. As data are entered at the cursor position, the data are shifted to the left as follows:

Δ_ _ _ _ 1◁
Δ_ _ _ 1 2◁
Δ_ _ 1 2 3◁
Δ_ 1 2 3 4◁

If the field is filled with data, additional information that is entered will cause the data to be shifted out of the left side of the field and lost.

3.3.3.4.2 Field Overflow Inhibit. This feature operates in forms mode only. If this option is disabled by the field engineer, then a data character that is entered into the last position of an unprotected data field will automatically cause the cursor to be advanced to the first position of the next unprotected data field. If this feature is enabled, then the alphanumeric data will not permit the cursor to skip to the next unprotected data field, but will sit in the last data position and overwrite data characters as they are entered. The field overflow inhibit allows only the TAB, SKIP, or Reverse Tab keys to move the cursor between unprotected data fields.

3.3.3.5 Search Mode.

The search mode shall be enabled/disabled thru keyboard CTRL control or software ESC control (table 6A). If enabled, placing the Terminal in forms mode shall cause an immediate search for either the error character (¦), (column 7, row 12 of figure 6-1) or an opening delimiter. If the cursor stops on error character (¦) in a protected field, data can be written into that one location. Either entering data or depressing the SKIP key will cause a skip to the next field or error character. Thru use of keyboard CTRL control or software ESC control, any alphanumeric character can be selected in place of the normal search character ¦. Disabling the search mode shall cancel the selected alphanumeric search character. After correction of data, with the Terminal still in forms mode and search mode, activation of the transmit key shall cause the total form (protected and unprotected data) to be transmitted.

In non-forms, the search mode will operate the same as in forms except that it will not recognize delimiters.

3.3.3.6 Programmable Cursor Position.

The display subsystem shall have the capability of accepting a cursor position preset from the central processor. This function shall be performed using a four character ESC control message (ESC " POS LINE). This message shall be interpreted as follows:

1st char. ESC control function

2nd char. " control function is cursor preset

3rd char. POS any character, of which the first seven binary bits shall preset the cursor column counter POS = $(32)_2 + (n)_2$ where $0 \leq n \leq 79$

4th char. LINE any character, of which the first five binary bits shall preset the cursor row counter LINE = $(32)_2 + (n)_2$ where $0 \leq n \leq 23$

3.3.3.7 Character Insert/Delete by Line or Page.

The Terminal shall have available the capability for character insert and delete functions. The CHAR INS key inserts a space at the cursor location without advancing the cursor. The succeeding characters within the line are moved one space to the right. Surplus characters, if any, shall be shifted off the end of the line and lost. If the CTRL key is activated prior to depressing the CHAR INS key, the function is performed on a page basis. The succeeding characters are moved one space to the right and down line to line. The surplus characters, if any, shall only be shifted off the last line of the display. A character insert function together with an alphanumeric key shall cause the alphanumeric character to be inserted at the cursor location.

The CHAR DEL key shall cause the erasure of the displayed character at the cursor location. The succeeding characters within the line are moved one space to the left. If the CTRL key is activated prior to depressing the CHAR DEL key, the function is performed on a page basis. The succeeding characters down the entire page are moved one space to the left and up line to line.

The Terminal shall also have the capability of performing the character insert and delete functions on command thru ESC control (table 6A).

3.3.3.8 Line Insert/Delete.

The Terminal shall have available the capability for line insert and delete. The line insert function shall cause all data in the lines below and including the line in which the cursor is positioned, to be pushed down one line. The line delete function shall cause the erasure of the line in which the cursor is positioned and all data in the lines below shall be moved up one line. The line insert/delete functions shall be initiated by the LINE DEL/INS key (shifted and unshifted respectively) or by ESC control (table 6A). This function is inhibited in Forms mode.

3.3.3.9 Clear to End of Line/Page.

The Terminal shall have available the capability to clear data from the cursor position to the end of line or page. In non-forms, the CLR EOP/EOL key (unshifted) shall clear all data from the cursor position to the end of line. In forms, the CLR EOP/EOL key (unshifted) shall clear all data from the cursor position to the trailing delimiter(◁).

In non-forms the CLR EOP/EOL key (shifted) shall clear all data from the cursor position to the end of page. In forms, the CLR EOP/EOL key (shifted) shall clear all unprotected data from the cursor position to the end of page.

The Terminal shall alsc be capable of initiating the clear to end of line/page functions thru ESC control (table 6A).

3.3.3.10 Lower-Case Lockout.

The Terminal shall have the capability thru keyboard CTRL control of software ESC control (table 6A) of inhibiting display of lower-case letters. When the lower case lockout is enabled, all upper and lower case letters shall be displayed in upper case. The Terminal shall be adjustable by field engineering to display only upper-case letters without the lower-case lockout feature being required.

3.3.3.11 Display Roll Up/Down

The Terminal shall have the capability thru keyboard CTRL control or software ESC control (table 6A) of causing the data on the screen to roll up or down while the cursor remains in a fixed position in relation to the screen. During a roll-up function, all of the data on the screen is simultaneously transferred line-for-line up the screen. The data transferred from the top line shall appear on the bottom line causing a "wrap-around" effect. The roll-down function shall be converse to a roll-up function.

3.3.3.12 International Character Set. (Option)

The display subsystem shall have available character generators which produce the special characters required by international markets. These character generators include both 64 and 96-character sets. Special characters shall be provided for those nations as described in paragraph 6.1.

3.4 KEYBOARDS.

3.4.1 General.

The Terminal shall contain a keyboard assembly which shall provide for manual data entry to the display. The keyboard data shall be simultaneously stored in the refresh memory of the display subsystem and displayed on the CRT. The key characteristics (including spacing pressure) and throw shall be similar to that of an electric office typewriter. Three basic configurations of keyboards shall be available; the alphanumeric typewriter keyboard (paragraph 3.4.5), the data preparation (source data) keyboard (paragraph 3.4.4), and the auxiliary numeric keypad (paragraph 3.4.6). An alphanumeric typewriter keyboard with fully compatible USACII coded outputs shall be available as an option (paragraph 3.4.9). With the exception of the auxiliary numeric keypad, each keyboard set shall contain function keys (paragraph 3.4.3) for editing, message formatting cursor control, etc. All alphanumeric and function keys shall be operable in Local mode only. These keys shall be locked out in all other modes. In addition to a keyboard set, the keyboard unit shall contain control keys and indicators (paragraph 3.5) for mode selection and control.

3.4.2 Keyboard Characteristics.

The Terminal keyboards shall have the following characteristics to the extent specified (see Burroughs specification 1691 2602 for detailed characteristics):

TABLE 3. KEYBOARD CHARACTERISTICS

FEATURE	CHARACTERISTICS
Keystroke	0.2 inches (approximate)
Keypressure:	
Alphanumeric and function keys	3 ounces (approximate)
Mode control keys	9 ounces (approximate)
Output level compatibility	TTL
Signal outputs	9 data and coded function key lines (6 data and 3 tagging), strobe, and 2 noncoded function key outputs

TABLE 3. KEYBOARD CHARACTERISTICS (Cont'd)

FEATURE	CHARACTERISTICS
Data line output voltages:	
Key non-operated	+2.6 volts dc minimum (logic 0)
Key operated	0 to +0.45 volts dc maximum (logic 1)
Strobe line output voltages	Same as data lines except that it is delayed
Function keys	11 coded, 2 non-coded
Control keys	5 coded
Two key rollover	Two key rollover maintains the data code produced when the first key is pressed and a second key is pressed before the first key is released. When the first key is released, the data code produced by the second key is applied as the output. During any multi-key action the strobe shall be logic 0.
Shift key control	Electronic, non-locking
Shift lock	Alternate action: locks shift key in shift position.

3.4.3 Function Keys.

In addition to the standard alphanumeric keys, the keyboard shall have function keys. These keys are described in table 4.

TABLE 4. FUNCTION KEYS

KEY	FUNCTION
↓ (Line Feed)	Line feed moves the cursor one line down. When the cursor is in the bottom line, line feed causes it to reappear in the top line.
↑ (Reverse Line Feed)	Reverse line feed causes the cursor to be moved one line up. When the cursor is in the top line, reverse line feed causes it to reappear in the bottom line.

TABLE 4. FUNCTION KEYS (cont'd)

KEY	FUNCTION
← (Backspace)	Backspace the cursor one character. When the cursor is at the left edge of viewing area, backspace causes it to reappear at right edge of viewing area, one line higher. If the cursor is located at the home position, backspace causes it to reappear in the last position of the bottom line.
→ (Forward Space)	Forward space moves the cursor one space to the right. If cursor is at the right edge of the viewing area forward space causes it to reappear at the left edge, down shifted one line. If the cursor is located in the last position of the bottom line, forward space causes it to reappear in the home position.
HOME	HOME causes the cursor to be moved to the home (upper left) position. Operates in unshifted mode only.
CLEAR	CLEAR erases all data on the display; however, when in the Forms mode, only unprotected data is erased. Operates in shifted mode only.
RET ▽	Return. Moves the cursor from its position in a line to the first position of the following line and writes the carriage return character (▽) into memory prior to performing the carriage return. The feature of writing the ▽ character can be disabled by field engineering adjustment.
TAB	TAB causes the cursor to move forward to the next fixed or variable tab stop location. If enabled by the field engineer, fixed tab stops are located at positions 1, 9, 17, 25, 33, 41, 49, 57, 65, and 73 of each line. In Forms mode, TAB causes the cursor to move forward to the first unprotected character location following the leading delimiter of the next unprotected character field. With the variable tab feature installed, alternate depressions of the shifted TAB key shall set or clear the tab stop at the cursor location. If the tab field identifier feature is enabled by the field engineer, the TAB key shall cause a field identifier (→) character to be written into memory (paragraph 3.3.3.3.4).

TABLE 4. FUNCTION KEYS (Cont'd)

KEY	FUNCTION
SKIP	With search mode enabled, the SKIP key causes the cursor to skip to the next field or error character (paragraph 3.3.3.5).
RTAB	Reverse Tab. When forms is disabled, the RTAB key shall cause the cursor to move to the prior tab stop. In forms, the RTAB key shall cause a tab from unprotected data field to prior unprotected data field.
EOP CLEAR	Clear to End of Page. The shifted EOP key shall clear all data (or unprotected data in forms) from the cursor position to the end-of the page.
EOL CLEAR	Clear to End of Line. When forms is disabled, the EOL key shall clear all data from the cursor position to the end of that line. In forms, the EOL key shall clear all data from cursor to ◁ or Δ.
DEL LINE	Delete Line. The shifted DEL LINE key shall cause the erasure of the line in which the cursor is positioned and all data in the lines below shall be moved up one line. This function shall be inhibited in forms.
INS LINE	Insert Line. The unshifted INS LINE key shall cause all data in the lines below and including the line in which the cursor is positioned, to be pushed down one line. Any data that was on the bottom line shall be lost. This function shall be inhibited in forms.
GS(Δ)	Group Separator. With forms mode enabled, this symbol is interpreted as the leading delimiter of a right justified field (paragraph 3.3.3.4.1).

TABLE 4. FUNCTION KEYS (Cont'd)

KEY	FUNCTION
ETX (X)	End-of-text. The ETX key causes the symbol X to be written into memory. This symbol is interpreted as the end-of-text character.
US (▷)	Leading Delimiter. The US key causes the symbol ▷ to be written into memory. In forms, this symbol is interpreted as the leading delimiter of an unprotected data field.
RS (◁)	Trailing Delimiter. The RS key causes the symbol ◁ to be written into memory. In forms, this symbol is interpreted as the trailing delimiter of an unprotected data field.
CHAR INS	Character Insert. Inserts a space at the cursor location and, together with the key of the character to be inserted, causes the added character to appear at the cursor location. The succeeding characters within the lines are moved one space to the right. Surplus character, if any, shall be shifted off the end of that line or unprotected data field (Forms option). Depressing the CTRL key prior to depressing the CHAR INS key causes the succeeding characters on the page to be shifted one space to the right and down line to line (paragraph 3.3.3.7).
CHAR DEL	Character Delete. Causes the removal of the displayed character at the cursor location. The succeeding characters are moved one space to the left within the line or unprotected data field (Forms option). Depressing the CTRL key prior to depressing the CHAR DEL key causes the succeeding characters on the page to be shifted one space to the left and up line to line (paragraph 3.3.3.7).

3.4.4 Data Preparation (Source Data) Keyboard.

The data preparation keyboard with inboard numeric keys shall be configured according to the keyboard layout shown in figure 6-3. This keyboard shall contain 69 keys.

3.4.5 Alphanumeric Typewriter Keyboard

The alphanumeric typewriter keyboard shall be configured according to the keyboard layout shown in figure 6-4. This keyboard shall contain 69 keys.

3.4.6 Auxiliary Numeric Keypad

An auxiliary numeric keypad (figure 6-5) shall be available for connection to any of the domestic or international alphanumeric or data preparation keyboards to provide a format for convenient numeric inputs. This keypad shall contain 13 keys.

3.4.7 Automatic Key Repeat

Any alphanumeric key, line feed, reverse line feed, backspace, forward space, carriage return, character insert, or character delete key, when depressed for a period exceeding 0.5 seconds, shall initiate an automatic 12 Hertz repeat of that key. Automatic repeat of a key shall cause the repetition of that character or function in successive display and memory locations. Releasing the key shall terminate the repeat. All keys shall have the repeat function except the top row; CTRL, SPCFY, LOCAL, RCV, and XMT.

3.4.8 Keyboards for International Use

The Terminal shall be available with data preparation and alphanumeric keyboards for international use. These keyboards shall provide the special characters and symbols required by various countries. Data preparation and alphanumeric keyboards will be available for the country groupings defined in paragraph 6.1.

3.4.9 Alphanumeric Typewriter Keyboard, USASCII (Option)

The alphanumeric typewriter keyboard configured for the full 96 character USASCII character set shall be available for the Terminal and an option. This keyboard shall contain 69 keys and shall be configured according to the layout shown in figure 6-32.

3.4.10 Optional Terminal with No Keyboard

The Terminal shall be available in an optional configuration which contains no keyboard. This Terminal shall be a receive-only terminal which shall accept data from the central processor into the display memory and display the data on the display screen.

3.4.11 Security Lock (Option, Factory Installed).

A security lock shall be available as a factory installed option for the keyboard. The security lock shall electrically inhibit unauthorized use of the keyboard by disabling the MOS encoder outputs. The security lock shall consist of a tumbler lock with a removable key and shall be located on the right side of the keyboard assembly. **Locking the keyboard disables the keyboard and results in the Terminal being placed in the Local or Receive modes.**

3.5 CONTROLS AND INDICATORS.

The Terminal shall contain certain controls and indicators which relate to the mode of operation and operational status of the Terminal. These controls and indicators are for use by the operator. For the most part, these controls and indicators shall be located on the keyboard unit. However, certain of these Controls and indicators are located on various other assemblies of the Terminal. The controls and indicators are listed in table 5.

TABLE 5. CONTROLS AND INDICATORS

CONTROL/INDICATOR	FUNCTION
Keyboard Controls:	
XMT key	Transmit key. Places the Terminal in the Transmit mode of operation, lights the XMT indicator, initiates a transmit operation (3.7.2.2), and disables all keyboard keys except LOCAL.
RCV key	Receive key. Places the Terminal in the Receive mode of operation and lights RCV indicator.
LOCAL key	The LOCAL key places the Terminal in the Local mode of operation and lights the LOCAL indicator.
SPCFY key	Specify key. The SPCFY key shall cause the location of the cursor to be transmitted to the central processor during the next interrogation sequence.

TABLE 5. CONTROLS AND INDICATORS (Cont'd)

CONTROL/INDICATOR	FUNCTION
CTRL	Control key. In unshifted mode, activation of the CTRL key prior to striking a single or multiple alpha or numeric key(s) shall cause the alpha or numeric key(s) to be interpreted as a control code. In shifted mode, activation of the CTRL key shall lock the system in the control mode until the CTRL key is activated in the unshifted mode.
Keyboard Indicators:	
XMT	Transmit mode indicator. Illuminated by the activation of the XMT key. Indicates that the Terminal is transmit ready. The indicator is extinguished when a transmission from the Terminal has been positively acknowledged by the receiving station or when the Terminal is switched to Local mode.
RCV	Receive mode indicator. Illuminated by the activation of the RCV key or by the successful completion of data transmission from the Terminal. The indicator signifies that the Terminal is prepared to receive data. The indicator is extinguished when the Terminal is switched to the Local or Transmit modes.
LOCAL	Local mode indicator. Illuminated by the activation of the LOCAL key or by use of the keyboard when the Terminal is in the Receive mode with no data being transmitted to the Terminal. It is also illuminated following the successful completion of data transmission to the Terminal unless the programmatic mode control character (DC1) was present in the received text. The indicator is extinguished when the Terminal is switched to the Receive or Transmit modes.
FORMS	The FORMS indicator is illuminated when the Terminal is operating in Forms mode. The Terminal shall be placed in the Forms mode either by the receipt of the DC2 character from the central processor or by the activation of the FORMS key by the Terminal operator, (at least one leading delimiter must be in the display data). The FORMS indicator is extinguished either by the receipt of a central processor message with no ESC control character, with ESC control character cancelling Forms, or by generating the proper CTRL control code from the keyboard. See paragraph 3.3.3.4 for description of Forms mode.

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TABLE 5. CONTROLS AND INDICATORS (Cont'd)

CONTROL/INDICATOR	FUNCTION
CTRL	The control indicator shall be illuminated upon activation of the CTRL key. The control indicator shall remain illuminated until such time as the control sequence is completed. The control shall also be illuminated momentarily as ESC control sequences are received by the Terminal.
ENQ	Central-processor inquiry indicator. Illuminated when the Terminal detects the central processor attempting to transmit a message to the Terminal while the Terminal is not in the Receive mode. The indicator is extinguished by entering the Receive mode or by operator activation of the LOCAL key. The audible alarm shall sound in conjunction with the ENQ indicator at the central-processor transmission attempt.
ERROR	The ERROR indicator is illuminated when a parity or block check error in data being received is detected by the Terminal or when buffer overflow is caused by the receipt of more characters than the display capacity. The ERROR indicator is turned off by the successful receipt of a new message, or the activation of the LOCAL key.
LTAI	Line-terminal activity indicator. Indicator shall be illuminated whenever data is transmitted from the central processor to any terminal on the line. Whenever the addressed terminal responds to the central processor, that terminal shall extinguish its LTAI indicator. In normal operation, the LTAI indicator will blink due to the data line activity. An LTAI indicator which remains unilluminated indicates the central processor is not transmitting on that line, while an LTAI indicator which remains illuminated indicates the Terminal is not responding.

TABLE 5. CONTROLS AND INDICATORS (Cont'd)

CONTROL/INDICATOR	FUNCTION
Other controls:	
Power switch	The power switch provides the on/off control for activating the Terminal with AC line voltage and automatically clears all registers. The power switch is located on the front of the display unit.
Audible alarm volume control	The audible alarm volume control shall provide a continuous range of sound level from maximum to nearly "off" for the audible alarm. This control is located on the front of the display unit.
Brightness control	The brightness control shall provide a continuous range of display brightness from maximum to nearly "off". This control is located on the front of the display unit.
Rate Select Switch (Speed dial) (option, factory installed)	The rate select switch selects the baud rate for data communication in domestic and international data sets. The switch is located on the rear of the display unit.
Vertical-hold control	The vertical-hold control provides stability adjustment for the vertical scan frequency of the display. This control is located on the front of the display unit.
Horizontal-hold control	The horizontal-hold control provides stability adjustment for the horizontal scan frequency of the display. This control is located on the front of the display unit.
Other indicators:	
Audible alarm	The audible alarm shall sound momentarily whenever the central processor attempts to transmit to the Terminal while the Terminal is not in the Receive mode. The audible alarm shall sound momentarily whenever the cursor is advanced to the eighth character position from the right end of the last (12 or 24) line of the display. The audible alarm shall sound momentarily upon the receipt of a Broadcast or Group Select message and also upon receipt of the proper ESC or CTRL sequence (Table 6A).

3.6 TERMINAL FORMAT/FUNCTION CONTROL

3.6.1 General

The Terminal shall use certain characters and character sequences to control display data format, editing, functions and I/O interfaces. The control characters are given in table 6.

The character sequences are given in table 6A and consist of a two, three or four character sequence which produces a specific function code. The first character shall be ESC or the CTRL key on the keyboard. Thus, any software controlled ESC function that can be initiated by the central processor can also be initiated through the keyboard.

3.6.2 Character Definitions

3.6.2.1 Carriage Return (CR) Character

The control character CR (column 0, row 13 of figure 6-1) shall cause the Terminal to execute a combined CR-LF (carriage return - line feed) function by moving the cursor to the left to the first position of the following line. The Terminal shall write the CR character (▽) into memory, and also have the optional capability of not writing the CR character into memory, through field engineering adjustment.

3.6.2.2 Backspace (BS) Character

The BS character (column 0, row 8 of figure 6-1) shall cause the Terminal to execute a backspace function by moving the cursor one character position to the left. When the cursor is at the first position of a line, the backspace character shall cause the cursor to move to the last character position of the preceding line. When the cursor is located at the home position, the backspace character shall cause the cursor to appear in the last character position of the bottom line.

Table 6. Terminal Format Control Characters

Character	Identification
DC1	Programmatic mode control (paragraph 3.7.2.3.1) or line erase option (paragraph 3.6.2.9)
DC2	Forms control option (paragraph 3.3.3.4) or space right option (paragraph 3.6.2.10)
CR	Carriage return (paragraph 3.6.2.1)
BS	Backspace (paragraph 3.6.2.2)
LF	Line feed or new line (CR) (paragraph 3.6.2.3)
DC3	Reverse line feed (paragraph 3.6.2.4)
HT	Tabulation (paragraph 3.6.2.5)
DC4	Home (paragraph 3.6.2.6)
FF	Home and clear (paragraph 3.6.2.7)
VT	Variable TAB set option (paragraph 3.6.2.11)
ESC	Escape Code - Initiates software controllable function (paragraph 3.6.1)
SO	Data highlight (reverse video) (paragraph 3.3.3.2)
SI	Terminate data highlight field (paragraph 3.3.3.2)
CAN	Data highlight (blink video) (paragraph 3.3.3.2)
EM	Data highlight (blank video) (paragraph 3.3.3.2)
US/RS	Forms delimiters (paragraph 3.6.2.8)
GS	Right justify delimiter (paragraph 3.3.3.4.1) or end of text option (paragraph 3.6.2.12)

3.6.2.3 Line Feed (LF) Character.

The LF character (column 0, row 10 of figure 6-1) shall cause the Terminal to execute a line feed function by moving the cursor one line down. When the cursor is in the bottom line, the line feed character shall cause the cursor to appear in the top line. The Terminal shall have the capability of ignoring a LF character if it is received immediately after a CR character. Thru field engineering adjustment, the terminal shall also have the optional capability of interpreting a LF character as New Line (CR-LF).

3.6.2.4 Reverse Line Feed (DC3) Character.

The DC3 character (column 1, row 3 of figure 6-1) shall cause the Terminal to execute a reverse line feed function by moving the cursor one line up. When the cursor is in the top line, the reverse line feed character shall cause the cursor to appear in the bottom line.

3.6.2.5 Tabulation (HT) Character.

In either variable or fixed tabulation (paragraphs 3.3.3.3.3 and 3.3.3.3.1), the HT character (column 0, row 9 of figure 6-1) shall cause the Terminal to execute a tab function by moving the cursor forward to the next tab stop. In the Forms mode the tab character causes the cursor to move forward to the character position following the leading delimiter of the next unprotected character field.

3.6.2.6 Home (DC4) Character.

The DC4 character (column 1, row 4 of figure 6-1) shall cause the Terminal to execute a cursor home function by moving the cursor to the first character position of the first line (home position).

3.6.2.7 Home and Clear (FF) Character.

The FF character (column 0, row 12 of figure 6-1) shall cause the Terminal to execute a combined home and clear function by moving the cursor to the home position and erasing all data (except protected data when in Forms mode) from the screen. The terminal shall also have the optional capability of interpreting an FF character as Clear and Home and Clear Variable Tab Stops.

3.6.2.8 Forms Delimiter (US/RS) Characters.

The US and RS characters (column 1, rows 14 and 15 of figure 6-1) shall cause the ▷ and ◁ characters to be displayed on the screen. Other pairs of forms delimiter characters which may be set up by field engineering adjustment shall be displayed as ▷ and ◁ characters respectively.

3.6.2.9 Line Erase (DC1) Character Option.

In a B 9352 environment, the DC1 character (column 1, row 1 of figure 6-1) shall, as an option, cause the Terminal to execute a line erase function by erasing all data from and including the cursor position to the end of the line.

3.6.2.10 Space Right or Forms Enable (DC2) Character Option.

In a B 9352 environment, the DC2 character (column 1, row 2 of figure 6-1) shall, as an option, cause the Terminal to execute a cursor advance function. In a TD700 or TD800 environment, the DC2 character shall as an option, cause the Terminal to interpret the character as Forms enable.

3.6.2.11 Variable Tab (VT) Character Option.

In a B 9352 environment, the VT character (column 0, row 11 of figure 6-1) shall be used to set the variable tab positions.

3.6.2.12 Group Select (Δ) Character Option.

In a B 9353 environment, the GS character shall, as an option, cause the Terminal to interpret the character as End-of-Text (ETX).

TABLE 6A. SOFTWARE CONTROLLABLE ESC FUNCTIONS

Notes: 1. ESC - Used as a prefix in a control sequence from communication control.

2. CTRL Key - Used as a prefix in a control sequence from the keyboard.

3. * - Column = $(32)_2 + (n)_2$ where $0 \leq n \leq 79$

Row = $(32)_2 + (n)_2$ where $0 \leq n \leq 23$

4. ** - M identifies tape drive: 0=Drive 1, 1-Drive 2

5. N_1, N_2, and N_3 are block numbers on tape and range between 000 and 999.

Key or Code	Key			Function
CTRL or ESC	!			Character insert/line
CTRL or ESC	@			Character insert/page
CTRL or ESC	%			Character delete/line
CTRL or ESC	P			Character delete/page
CTRL or ESC	S			Roll up
CTRL or ESC	T			Roll down
CTRL or ESC	M			Line delete
CTRL or ESC	L			Line insert
CTRL or ESC	K			Clear to end of line
CTRL or ESC	J			Clear to end of page
CTRL or ESC	#			Clear all variable tab stops
CTRL or ESC	"	Column	Row	Programmable cursor*
CTRL or ESC	;			Print complete screen
CTRL or ESC	:			Print unprotected data
CTRL or ESC	G	M**		Write received data to tape
CTRL or ESC	H	M**		Read record from tape

TABLE 6A. SOFTWARE CONTROLLABLE ESC FUNCTIONS (Con't'd)

Key or Code	Key		Function
CTRL or ESC	I	M**	Rewind tape
CTRL or ESC	A	M**	Write tape mark
CTRL or ESC	B	M**	Backspace one tape record
CTRL or ESC	+	M**	Read tape record and transmit
CTRL or ESC	*	M**	Read screen from tape
CTRL or ESC	)	M	Read screen and transmit
CTRL or ESC	V	N_1 N_2 N_3	Search tape drive 1 to selected block
CTRL or ESC	U	N_1 N_2 N_3	Search tape drive 2 to selected block
CTRL or ESC	Y		Lock out lower case
CTRL or ESC	Z		Enable lower case
CTRL or ESC	E		Search enable
CTRL or ESC	F		Search disable
CTRL or ESC	N		Negative video "on"
CTRL or ESC	O		Negative video "off"
CTRL or ESC	W		Forms enable
CTRL or ESC	X		Forms disable
CTRL or ESC	C		Space right
CTRL or ESC	-	(char)	Search character change
CTRL or ESC	?		Activate audible alarm
CTRL or ESC	.		Set/Reset tab stop

3.7 COMMUNICATIONS PROCEDURES AND INTERFACES

3.7.1 General

The communications procedures (line disciplines) and electrical interfaces utilized in the basic and optional configurations of the Terminal are given in the contents of this section. The communications procedures include, to the extent specified, the Burroughs Standard Communications Procedures (1284 9006), the IBM 2260 look-alike procedures and the Bisynchronous Communications Procedures (1284 9022) as adapted for IBM 3270 look-alike operation. The electrical interfaces include, to the extent specified, the RS232C/CCITT interface, the Two-Wire Direct Interface (1700 3195), and the Burroughs Direct Interface (1498 5303).

There shall be one communications procedure and one electrical interface in each of the various configurations of the Terminal.

3.7.2 Modes of Operation

The Terminal shall operate in three modes: Local; Transmit; and Receive. The operator shall control the mode from the keyboard with the LOCAL, XMT, and RCV keys. Pressing the LOCAL key during either transmit or receive immediately transfers the Terminal to Local mode and no further data is transmitted or received.

3.7.2.1 Local.

In the Local mode, the Terminal shall be off-line and data shall be entered manually through the keyboard. If an ENQ character is received through selection or from the point-to-point calling station, as applicable, the Terminal shall automatically transmit an NAK character indicating that the Terminal is busy or not ready to receive. If an ENQ character is received through polling, the Terminal shall automatically transmit an EOT character indicating "no traffic".

The Terminal shall activate an audible alarm and a visual indicator to alert the operator that the central processor or calling station is transmitting. Power turn-on shall place the Terminal in Local mode regardless of the setting of the mode keys.

3.7.2.2 Transmit

Pressing the XMT key on the Terminal keyboard by the operator shall cause the Terminal to enter the Transmit mode. The Transmit mode shall be cancelled prior to transmission only by actuation of the LOCAL key.

3.7.2.3 Receive

The completion of message transmission or actuation of the RCV key on the Terminal keyboard by the operator shall place the Terminal in the Receive mode. When in the Receive mode, the Terminal shall accept data from the communication lines in accordance with the communication discipline utilized.

A transmission number (XM#) character may be included in the message from the central processor following the character sequence SOH-AD1-AD2. The Terminal shall ignore the character except for BCC calculation. Data received with the DC4 or FF characters shall cause the cursor to move to the home position, or to move to the home position and erase the previous data, respectively. Data received without a DC4 or FF character will be stored in the memory beginning at the previous ETX location. With the receipt of an SOH character, the Terminal, depending upon field engineer installation adjustments, may automatically clear the display of the existing message and cause the cursor to be moved to the home position.

Receipt of messages by the Terminal shall employ two error checks. The first shall be a character parity check utilizing the eighth bit of each received character as the parity bit. (See paragraphs 3.7.3.2.1 and 3.7.3.2.2 for parity definition.) The second error check shall be a longitudinal binary sum (without carry) of each of the seven data bits of the received character following SOH or STX, and up to and including the ETX. The longitudinal sum will be contained in the block check character (BCC) which also contains the character parity bit. All received characters shall be included in the BCC check. If the tests for character parity within the text of the message and longitudinal redundancy are correct, the Terminal shall respond with an ACK character. If either error check fails, the Terminal shall light the ERROR indicator and respond with an NAK character. The ERROR indicator shall be turned off on receipt of a valid message in response to the NAK character or by the operator pressing the LOCAL key on the keyboard. The Terminal shall respond to a correctly received message with an ACK character and shall switch to the Local mode or shall remain in the Receive mode if the programmatic mode control option (paragraph 3.7.2.3.1) has been implemented and activated. Any keyboard action or the activation of the LOCAL key by the operator shall place the Terminal in the Local mode; however, the keyboard shall be disabled during the actual receipt of data. The LOCAL key shall switch the mode from Receive to Local at anytime.

3.7.2.3.1 Programmatic Mode Control. The Terminal shall have the capability for programmatic mode control to permit the central processor to select the operating mode of the Terminal following a successful transmission from the central processor. Normally, when in the Receive mode the Terminal shall switch to the Local mode at the successful completion of the transmission. Programmatic mode control consists of the insertion by the central processor of the DC1 character (column 1, row 1 of figure 6-1) into the message between STX and ETX. The DC1 character requires no memory space. The receipt of the DC1 character shall cause the Terminal to remain in the Receive mode for the receipt of successive messages from the central processor.

3.7.3 Communications Control Characters

The communications control characters given in table 6B are those characters which directly effect the transmission or reception of data by the Terminal using the Burroughs Standard Communications Procedures and the IBM 2260 look-alike procedures. Communications control characters used by the Bisynchronous Communications Procedures in the IBM 3270 look-alike configuration are given in Section 3.7.6.2.

TABLE 6B. COMMUNICATIONS CHARACTERS

CHARACTER	IDENTIFICATION
Communications Control Characters:	
ACK	Acknowledgement
BCC	Block check character
DLE/EOT (DEOT)	Mandatory disconnect
DLE	Data Link escape
ENQ	Enquiry
EOT	End of transmission
ETX	End of text
NAK	Negative acknowledgement
SOH	Start of heading
STX	Start of text
SYN	Synchronous idle (paragraph 3.7.7.1.3)
NUL	Time fill character (paragraph 3.7.3.1)

TABLE 6B COMMUNICATIONS CHARACTERS (Cont'd)

CHARACTER	IDENTIFICATION
Other Communications Characters:	
AD1	Address 1
AD2	Address 2
BSL	Broadcast select
CON	Contention
FSL	Fast select
GSL	Group select
POL	Poll
SEL	Select
XM#	Transmission number option (paragraph 3.7.5.1)

3.7.3.1 Time Fill (NUL) Character Definition. 0C 3C

The NUL character (column 0, row 0 of figure 6-1) shall be used as time fill when required in the Forms mode following characters HT, VT, FF, ESC W, and DC4. Also any cursor movement requiring a forms delimiter search through protected data may require nulls following the unprotected data. In either case, the number of nulls required is determined by the following formula:

NOTE: Use an additional NUL character when a fractional solution is obtained.

$$\text{Minimum No. of Nulls} \geq \frac{\text{Character positions moved} \times \text{transmission speed} \times 6 \times 10^{-6}}{8 \text{ (synchronous) or } 10 \text{ (asynchronous)}} - 1$$

1920 9600 = 10 MAX

3.7.3.2 Illegal Characters.

An illegal character shall be defined as a character having incorrect parity or a legal character appearing incorrectly in a predefined control sequence. The Terminal shall test each character received for having the correct parity (see paragraph 3.7.7.1 for character format) and shall accept control characters only in the sequence defined for the communication procedure being employed.

3.7.3.2.1 Data Error Checking. Upon receipt of a data character which is illegal because of a parity error, an invalid block check, the Terminal shall detect the error, illuminate the ERROR indicator, and prepare to transmit the NAK character automatically to the central processor at the appropriate point in the communication procedure sequence. For a parity error in a data character, the Terminal shall, in addition to the above, insert the "question mark" character (column 3, row 15 of figure 6-1) into the displayed message at the location of the incorrect character.

3.7.3.2.2 Control Character Error. A control character may be received incorrectly during any of the control sequences of the communication procedure because of parity error in the character or an incorrect character in the sequence. In either case, the error shall constitute an illegal character of unknown identification. The Terminal shall be unable to provide a response to the central processor because of the incomplete control sequence and shall cause a time-out condition.

3.7.3.3 Data Transmission Features.

@02@ @27@ @7F@

3.7.3.3.1 Transmission of Cursor Position. The Terminal shall have the capability of transmitting its current cursor location. The cursor position message shall be initiated by depressing the SPCFY key. Then, when the Terminal is polled, the Terminal shall respond with its normal heading, followed by STX, ESC, ", CHAR, CHAR, ETX, BCC. The first CHAR shall represent the cursor column position and the second CHAR shall represent the cursor line position.

@32@

The column position shall be given in binary form as $(32)_2 + (n)_2$ where $0 \leq n \leq 79$. The line position shall be given in binary form as $(32)_2 + (n)_2$ where $0 \leq n \leq 23$.

3.7.3.3.2 Numeric Control Message. The Terminal shall have the capability of transmitting a numeric control message whose significance shall be defined by the central processor. The control message shall be initiated by depressing the CTRL key, followed by a numeric code 00-99, followed by XMT. Then, when the Terminal is polled, the Terminal shall respond with its normal heading, followed by by STX, ESC, CHAR, CHAR, ETX, BCC. The two CHAR's shall be the numeric code. The numeric control message will not be displayed on the screen.

3.7.3.3.3 Variable Data Transmission. The Terminal shall have the capability of a selectable (field strapped) start and stop position for the transmission of data in both forms and non-forms as follows:

FORMS:

1. Cursor to ETX or beginning of form to cursor if no ETX (unprotected data only) - Standard TD820 Series

2. Beginning of form to end of form (unprotected data only) - B 9353, B 9352 and TD700 D/L 1

3. Beginning of form to cursor position (unprotected data only) - TD700 D/L 2 and above, and TD800 D/L 2 and above.

NON-FORMS:

1. Cursor to ETX or Home to cursor position if there is no ETX - Standard TD820 series.

2. Cursor to ETX or end-of-screen if there is no ETX - B9352.

3. Home to cursor - All TD700 and TD800 D/L's

4. Home to cursor or cursor to GS (Δ) or end of screen when GS (Δ) is not used (selectable by field engineering adjustment) - B9353.

3.7.4 Communications Procedures

The Terminal shall have the capability for utilizing any one of the following communications procedures for transmitting and receiving data: multipoint, point-to-point, IBM 2260 look-alike, and IBM 3270 look-alike bisynchronous multipoint.

3.7.4.1 Multipoint Communications Procedures (1284 9006)

The multipoint communications procedures are Poll, Select, Fast Select, Modified Contention, Broadcast, Group Select and Group Poll.

3.7.4.1.1 Poll (POL).

The polling procedure shall be used to transmit data to the central processor. The polling procedure shall conform to that given in table 7 and its associated notes.

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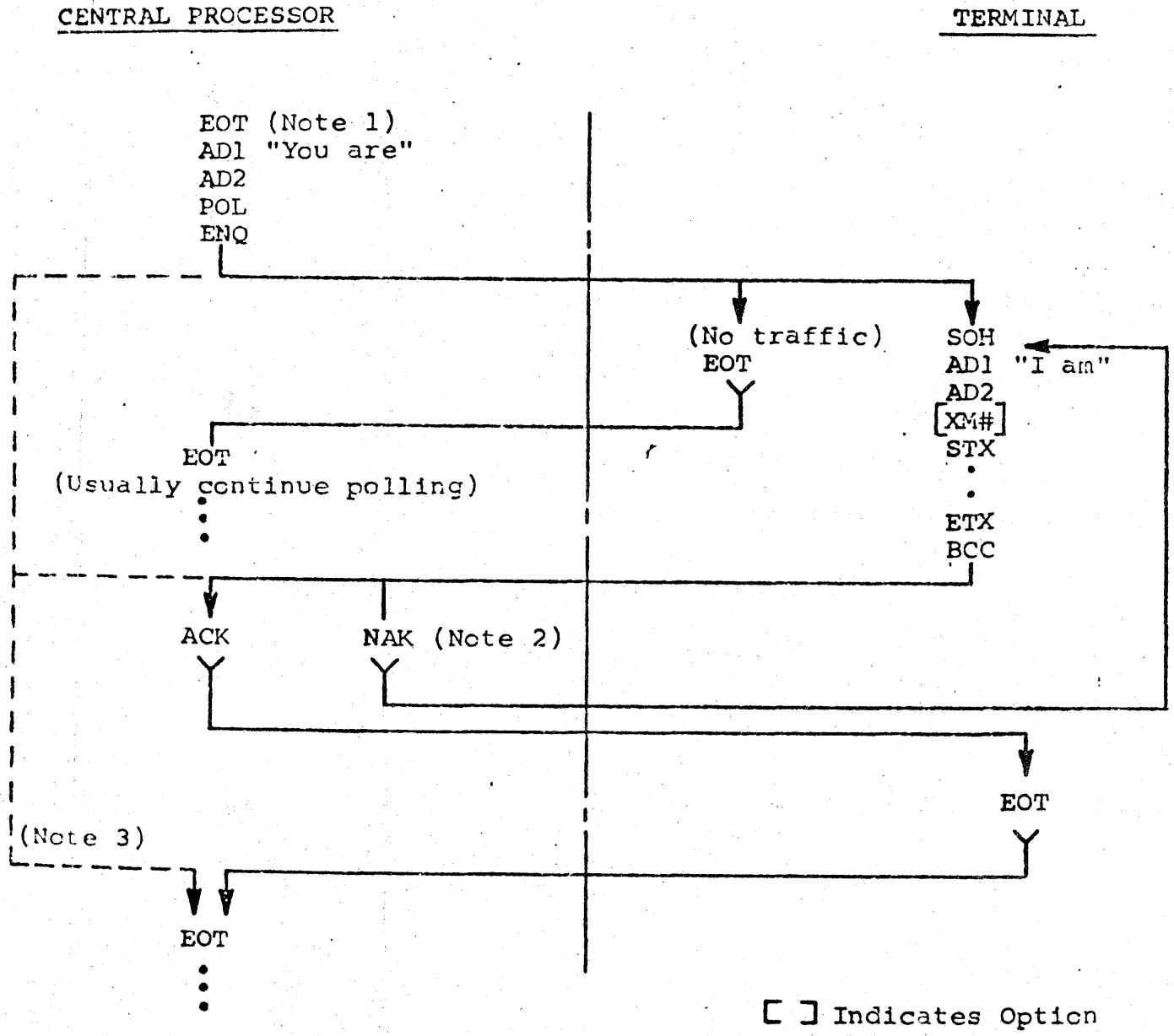
TABLE 7. POLLING PROCEDURE



NOTES TO TABLE 7:

1. This EOT may have been the termination of a previous transmission sequence. To minimize the effect of noise, the polling sequence may follow immediately.

2. If the central processor receives a message for which the character parity or block check, tests fail, the NAK character will be transmitted, calling for a repeat of the transmission. This action can be repeated "n" times ("n" may be equal to zero), at which time, if the test fails, an error will be recorded at the central processor and an EOT character will be transmitted, terminating the transmission sequence. The Terminal shall transmit the same message when next polled.

3. If the Terminal does not receive an ACK, NAK, or EOT character, it may retain its message and remain quiet. The central processor will timeout and transmit an EOT character, thereby, terminating the transmission sequence. The message will be retransmitted when next polled.

3.7.4.1.2 Select (SEL). The selection procedure shall be used for receiving data from the central processor. The selection procedure shall conform to that given table 8 and its associated notes.

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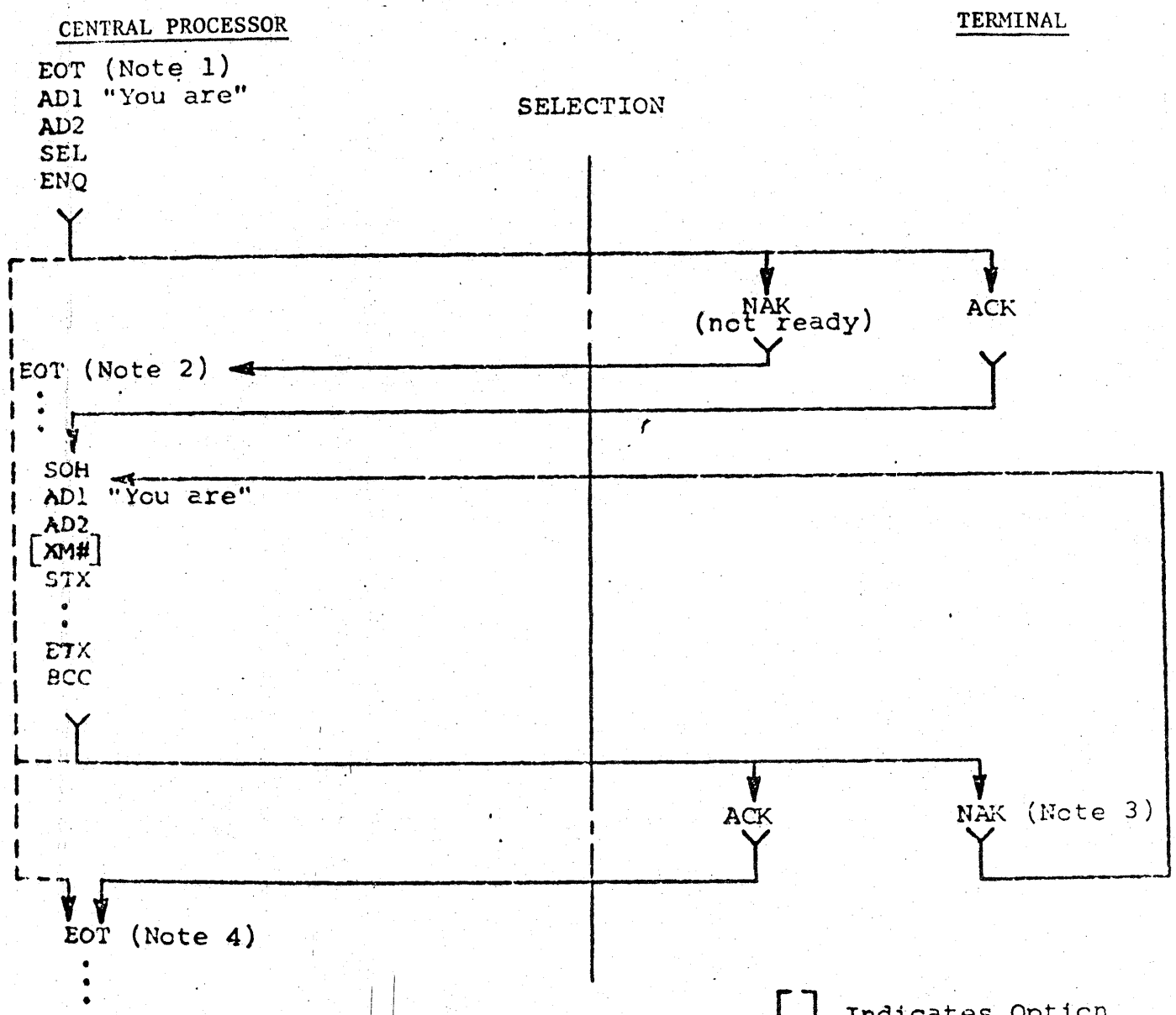
TABLE 8. SELECTION PROCEDURE



NOTES TO TABLE 8:

1. This EOT may have been the termination of a previous transmission sequence. To minimize the effect of noise, the selection sequences may follow immediately.

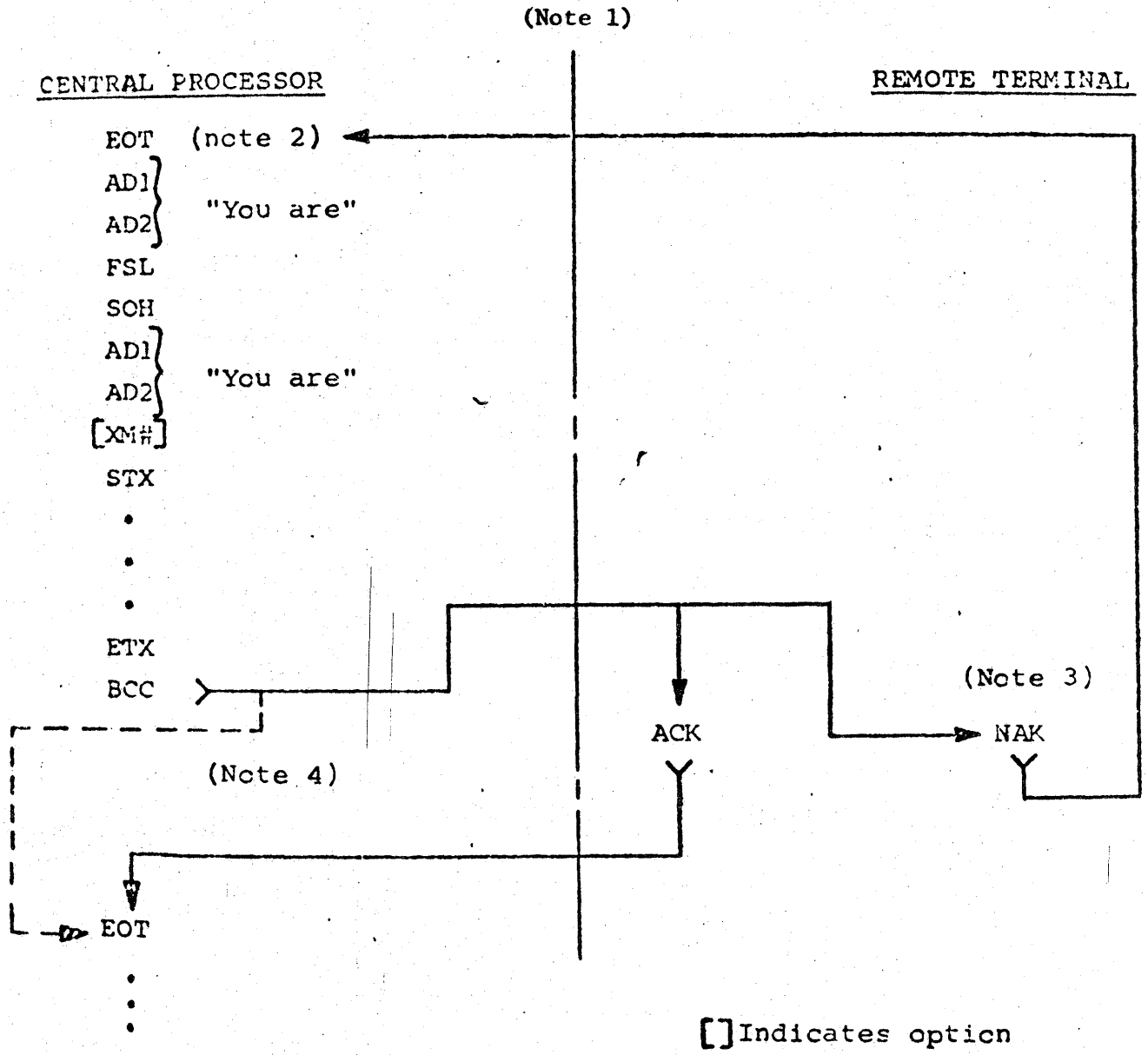
2. If the terminal is not ready to receive, as indicated by transmission of the NAK character, the central processor will normally retry the selection sequence at the terminal's proper sequence; however, for some installations it may be desired to repeat a selection sequence immediately.

3. If character parity or block check are not validated by the terminal, it will send an NAK character. In this case the central processor will retransmit the message "n" times ("n" may be equal to zero). If the Terminal still does not acknowledge the message, the central processor will terminate the sequence with an EOT character after recording the error. The central processor will retain the message for transmission of the next selection sequence to this terminal.

4. If the central processor does not receive a response (ACK or NAK) to its message, it may time out and retransmit the block "n" times ("n" may be equal to zero). If still no response is received, the central processor will time out and terminate the selection sequence with an EOT character after recording the error. The central processor will retain the message for transmission on the next selection sequence to this terminal.

3.7.4.1.3 Fast Select (FSL). The FSL procedure enables the central processor to transmit a message to a particular terminal without testing, as in the selection procedure, that the terminal is ready to receive. The FSL procedure and associated notes are given in table 9. With the FSL procedure, the terminal shall accept the central processor message sequence of AD1, AD2, FSL, SOH, AD1, AD2, followed by STX and the message. If the fast-select transmission is not successfully received by the terminal, it shall respond with the NAK character and the central processor will retransmit the message starting with the EOT character of the FSL sequence.

TABLE 9. FAST SELECT PROCEDURE



NOTES TO TABLE 9:

1. Fast selection is used when the central processor wishes to transmit a message without testing that the terminal is ready to receive. In this case the message immediately follows the selection.

2. This EOT may have been the termination of a previous transmission sequence. To minimize the effect of noise, the fast selection sequence may follow immediately.

3. If character parity and block check are not validated by the terminal, it will send the NAK character. In this case the central processor will retransmit the message "n" times ("n" may be equal to zero). If the terminal still does not acknowledge the message, the central processor will terminate the sequence with an EOT character after recording the error. The central processor will retain the message for transmission on the next selection sequence to the terminal. If both pairs of addresses do not verify against the station address, the TD820 will remain quiet.

4. If the central processor does not receive a response (ACK or NAK) to its message, it will time out and terminate the sequence with an EOT character after recording the error. The central processor will retain the message for transmission on the next selection sequence to this terminal.

3.7.4.1.4 Modified Contention Mode (CON). The CON procedure enables the central processor to terminate polling of the multipoint network after placing the system in the Contention mode. In this mode any terminal desiring to transmit a message to the central processor shall initiate the polling activity by transmitting the character sequence AD1, AD2, POL, ENQ. The central processor will respond by polling that terminal in the normal polling procedure. The Contention mode procedure is given in table 10.

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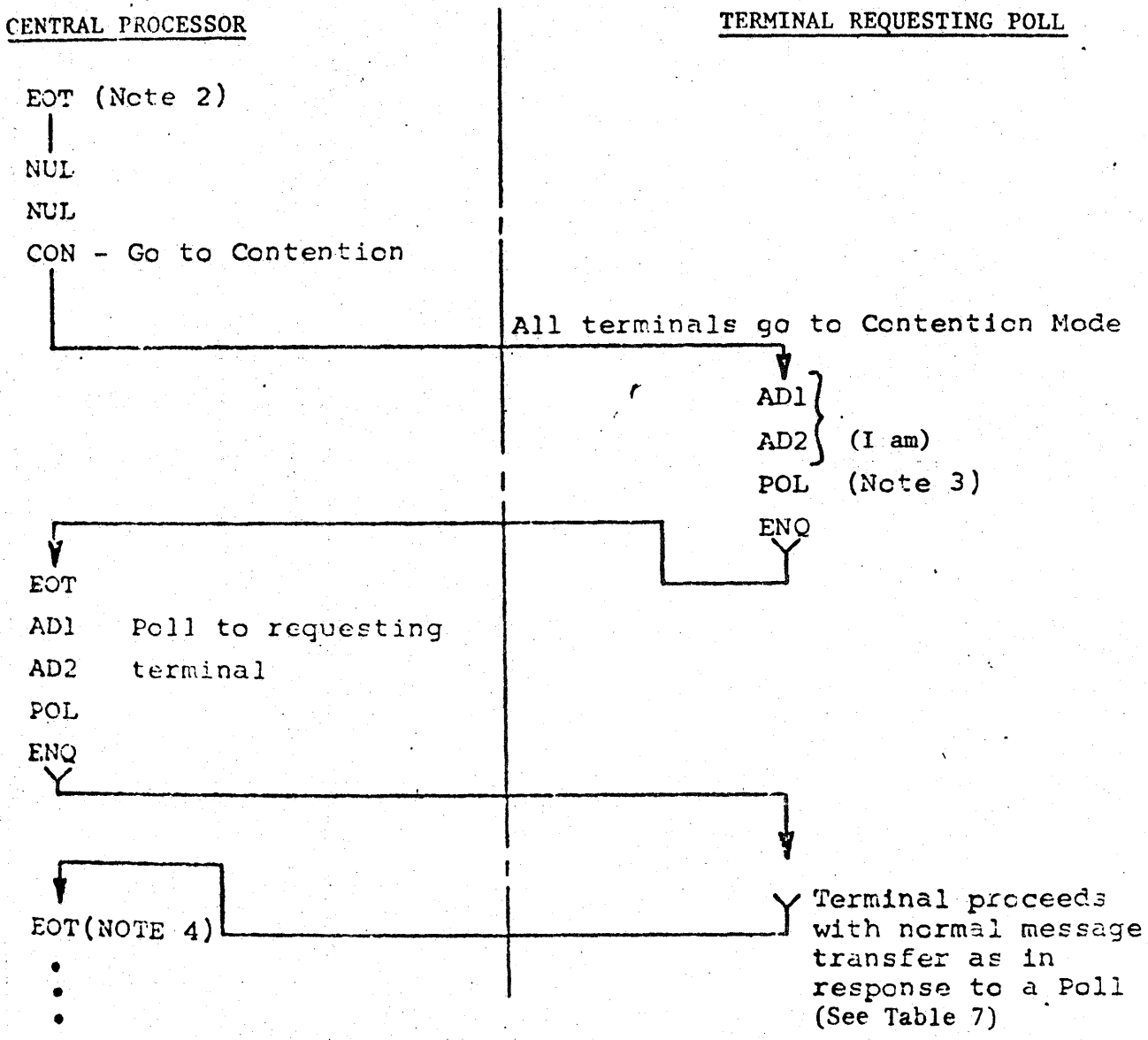
TABLE 10. MODIFIED CONTENTION MODE

(Note 1)



NOTES TO TABLE 10:

1. In times of low activity, it may be desirable to terminate polling and to place all or part of the system in Contention mode. This is accomplished by transmission of an EOT-NUL-NUL-CON character sequence which will cause the terminals to remain quiet until they have something to transmit.

2. This EOT may have been the termination of a previous transmission sequence. To minimize the effect of noise, the "go to contention" sequence may follow immediately.

3. A terminal can activate the polling activity by transmitting a character sequence of AD1, AD2, POL, ENQ. This action will cause the central processor to poll that terminal. If two terminals attempt to transmit at the same time, the garbled message will initiate general polling by the central processor.

4. Following the normal verification procedures for the receipt of a message as in table 7, the central processor may continue polling or instruct all terminals to go to Contention.

3.7.4.1.5 Broadcast (BSL). The BSL procedure enables the central processor to perform a fast selection of all multipoint network terminals which contain the BSL option. The BSL procedure with associated notes is given in table 11. The address characters (AD1 and AD2) are selected to represent the address of the terminal that shall acknowledge the central processor transmission with an ACK or NAK character. The receipt of the BSL character shall cause the Terminal to activate the audible alarm momentarily and shall cause the Terminal, if in Local mode, to switch to Receive mode and accept the BSL message.

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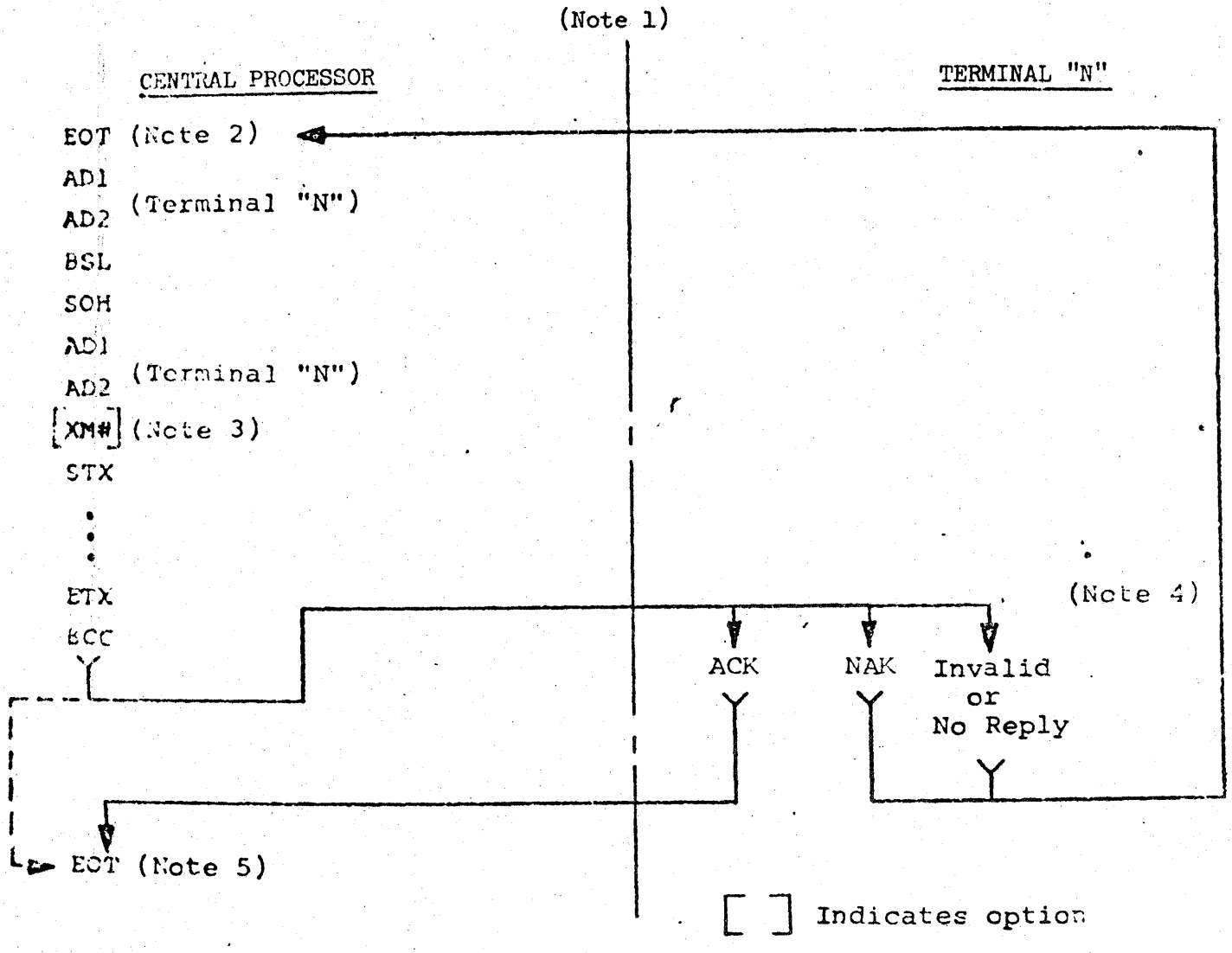
TABLE 11. BROADCAST



NOTES TO TABLE 11:

1. Broadcast select is a fast selection of all terminals. AD1 and AD2 are selected to represent the terminal which acknowledges receipt of the message.

2. This EOT may have been the termination of a previous transmission sequence. To minimize the effect of noise, the broadcast sequence may follow immediately.

3. Transmission numbers shall be ignored by the terminal when used by the central processor except during the calculation of BCC.

4. If the acknowledging terminal does not receive a valid message (e.g., there is a parity error), the central processor shall repeat the broadcast.

5. If the central processor does not receive a response (ACK or NAK) to its broadcast, it may time out and rebroadcast the message "n" times ("n" may equal zero). If no response is received, the central processor will terminate the broadcast mode with an EOT character after recording the error.

3.7.4.1.6 Group Select (GSL). The GSL procedure permits the fast selection of a particular group of terminals in the multipoint network. Each terminal may have a group address for which it will accept the GSL message. The GSL procedure with associated notes is given in table 12. The address characters (AD1 and AD2) are selected to represent the address of the Terminal which acknowledges the central processor transmission with an ACK or NAK character. The Terminal shall have the capability through internal adjustment to recognize the character codes shown in columns 2 through 6 of figure 6-1. The receipt of the GSL character shall cause the Terminal to activate the audible alarm momentarily and shall cause the Terminal, if in Local mode, to switch to Receive mode and accept the GSL message.

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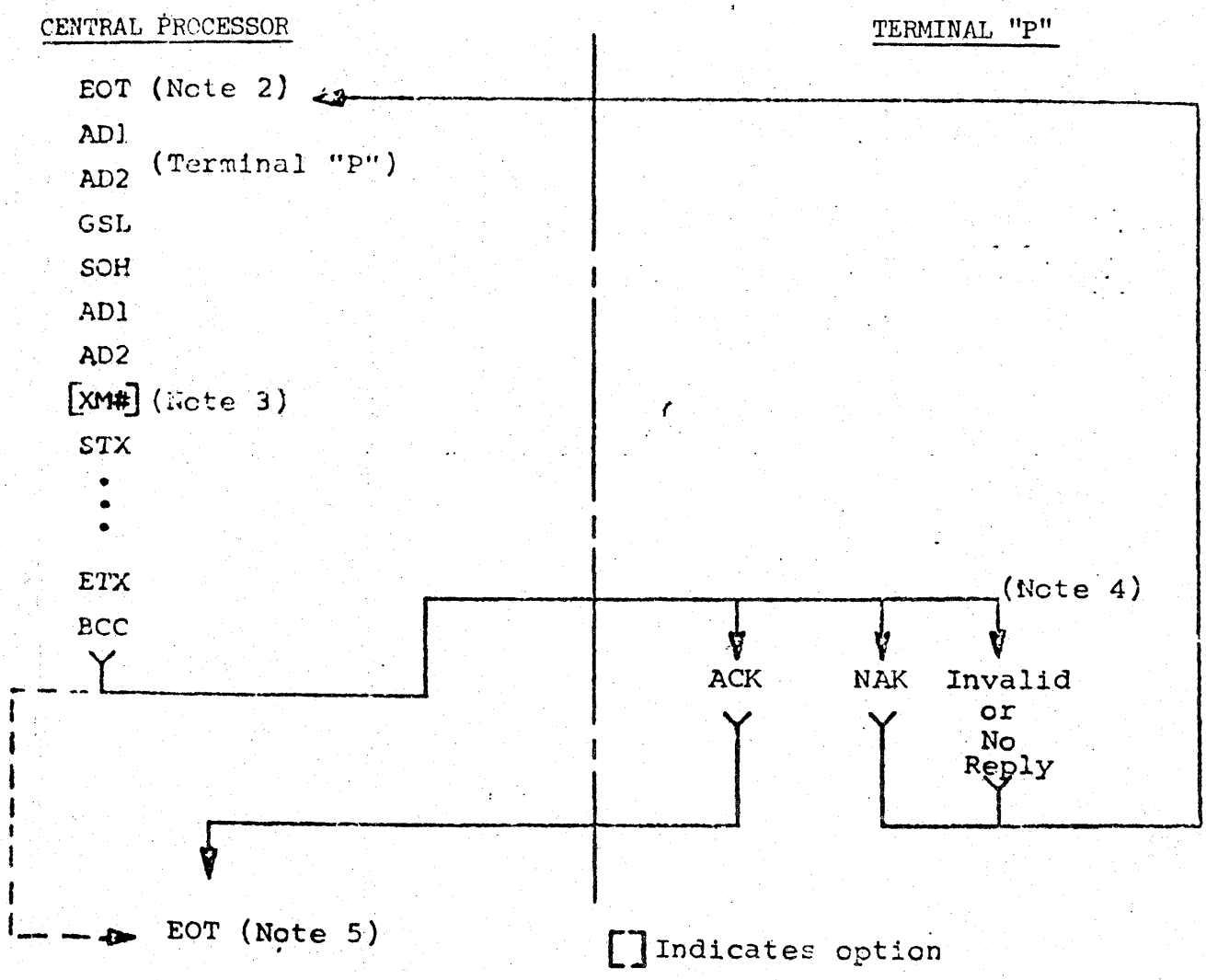
TABLE 12. GROUP SELECT

(Note 1)



NOTES TO TABLE 12:

1. Group selection is a fast selection of a group of terminals. Each terminal may have a group address for which it will accept messages. AD1 and AD2 are selected to represent the address of the terminal which will acknowledge receipt of message.

2. This EOT may have been the termination of a previous transmission sequence. To minimize the effect of noise, the group selection may follow immediately.

3. Transmission numbers shall be ignored by the terminal when used by the central processor except during the calculation of BCC.

4. If the acknowledging terminal does not receive a valid message (e.g., there is parity error), the central processor repeats the total group selection or any portion thereof.

5. If the central processor does not receive a response (ACK or NAK) to the group selection, it may time out and reselect the group "n" times ("n" may equal zero). If no response is received, the central processor will terminate the group select mode with EOT after recording the error.

3.7.4.1.7 Group Poll (GPL). The GPL procedure with associated notes is given in table 13. The GPL procedure is an option of the standard multipoint procedure. The terminal shall have the optional capability of accepting an additional AD1, AD2 other than its terminal address AD1, AD2. These address characters shall be field selectable from columns 2 thru 6 of figure 6-1. If these group addresses are decoded during the standard poll procedure (paragraph 3.7.4.1.1), the terminal shall respond by attempting to transmit an EOT character (indicating no traffic), or by transmitting a message if in the Transmit mode. Orderly transmission of data to the central processor by all terminals having the same group address is accomplished by the following:

a. All terminals with the same group addresses must be on the same concatenation (paragraph 3.7.7.3).

b. A terminal with data to transmit shall block propagation of the Request-to-Send and Clear-to-Send signals over the data set interface lines until released by a successful transmission to the central processor followed by the receipt of the ACK or EOT characters from the central processor.

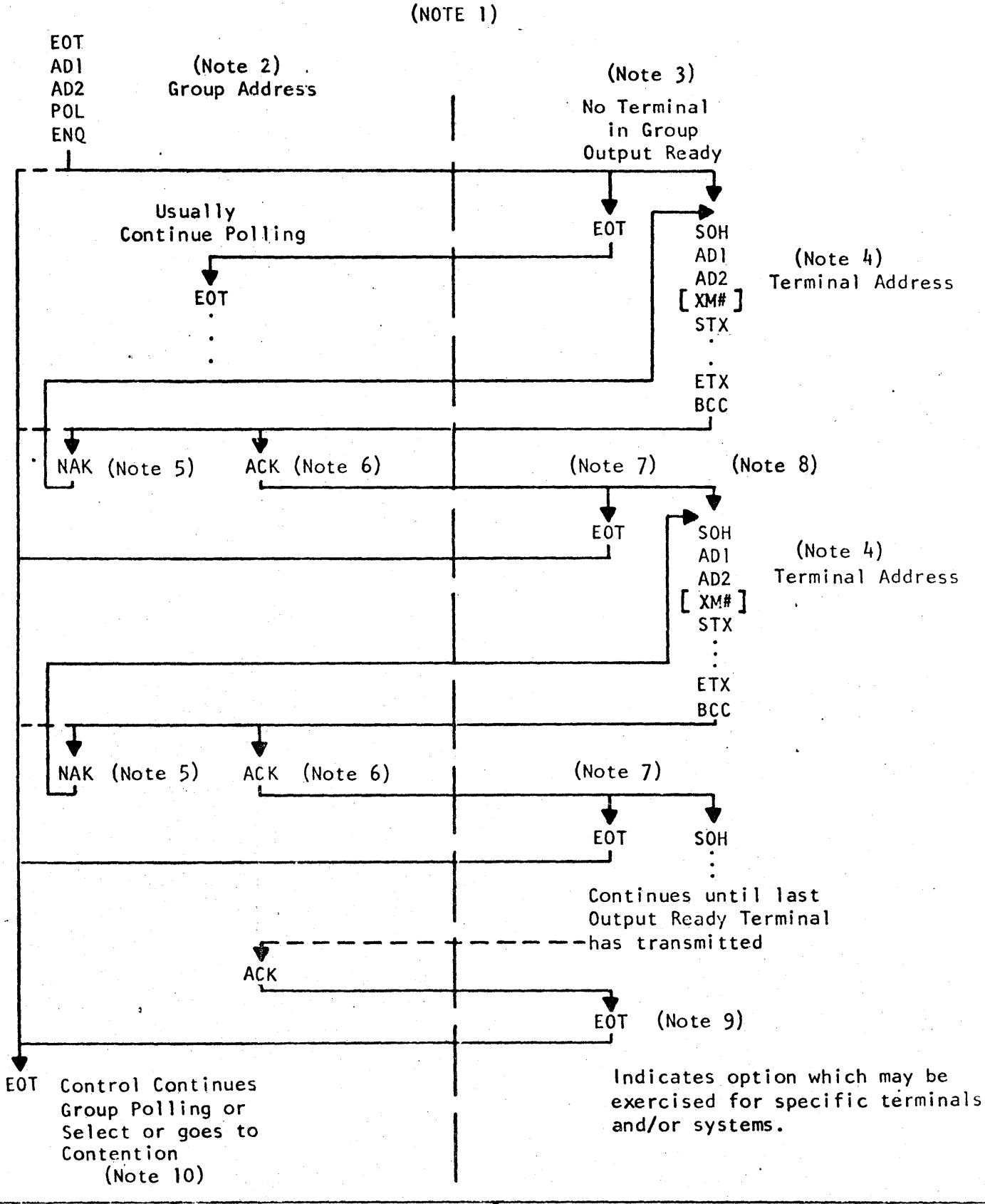
c. An EOT character will not be transmitted by any terminal detecting a Request-to-Send signal sent by any terminal more remote from the data set in the concatenation.

d. No terminal will transmit anything until it receives, in response to its Request-to-Send signal, a Clear-to-Send signal from a terminal closer to the data set in the concatenation.

Data received by the central processor will be in order from the group member closest to the central processor in the concatenation and ending with an EOT from the group member furthest from the central processor in the concatenation. Each message will contain the individual terminal's address characters (AD1, AD2). Upon receipt of an NAK character, retransmission will be via the standard poll procedure. Concatenated terminals with the same group address for group polling will be similar in their characteristics of the Request-to-Send/Clear-to-Send response time.

The central processor may terminate a group poll sequence at any time by transmitting EOT in place of ACK. The terminals remaining in the Group shall not attempt to transmit and shall retain their message until the next poll. The terminal awaiting the ACK character shall retain its message for retransmission with the same transmission number during the next poll.

TABLE 13. GROUP POLLING



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NOTES TO TABLE 13:

1. This procedure is used to reduce the overhead in a network of terminals where several are located at one location on a common communication line. The receipt of one group poll will, if no terminals are output ready, result in one response for the group. Thus, the control can pass to the next group. In periods of low activity, the control will be able to go through the polling list determining the output status of all terminals with but one poll to each location, not each terminal. Also, if multiple terminals are output ready at a location, they are allowed to transmit, in sequence, in response to one poll. Selecting, Broadcast, Fast Select, etc., are not affected by this group polling procedure. In a concatenation of terminals, if one of the terminals is removed because of down time, etc., the loss of the missing terminal will have no affect on these procedures.

2. In this procedure, the polling sequence follows the same format as a normal poll and uses the normal poll character. Group polling is controlled by addresses only. The group address is assigned to a group of concatenated terminals. Each member of the group shall respond to the group address as if the group address were its' individual address.

3. When the poll is received by the addressed group, each terminal connected to the data set via concatenation will prepare to answer the poll by raising the Request-to-Send signal line. The terminals which have a message ready for Transmission will prepare their message; the terminals with no message will prepare to transmit EOT. In sequence, each terminal without the message traffic will sample the Request-to-Send signal line and, if a Request-to-Send signal from another terminal is detected, the terminal without message traffic will cancel its' EOT response and will wait for the next EOT from the central processor.

4. Each message sent in response to a group poll contains the address of the individual responding terminal. The responding terminal shall block the concatenated Request-to-Send and Clear-to-Send signals related to terminals more remote from the data set. These signals shall remain blocked from the more remote terminals until the responding terminal has completed its transmission and has received an ACK or EOT character from the central processor.

5. If the central processor detects an error in the message received in response to a group poll, the NAK character will be transmitted, thereby, calling for a repeat of the transmission. This action can be repeated "n" times ("n" may be equal to zero), at which time, if the test fails, an error will be recorded at the central processor and an EOT character will be transmitted, terminating the transmission sequence. The terminal shall transmit the same message when next polled.

6. If the Terminal does not receive an ACK, NAK, or EOT character, it may retain its message and remain quiet. The central processor will timeout and transmit an EOT character, thereby, terminating the transmission sequence. The message will be retransmitted when next polled.

7. If no other terminals are output ready, EOT is sent. In some systems, the number of messages allowed to be sent from a group as a result of a single poll may be limited by system agreement. In this case, EOT may be sent by the CP in place of ACK even though other output-ready terminals may be in the group awaiting service. The terminal awaiting ACK will retain its message until the next group poll is received as will the remaining output-ready terminals.

8. As soon as an ACK character is received from the central processor, the next output-ready terminal will transmit.

9. When an ACK character is received from the central processor and no terminals are output ready, the last terminal in the concatenated group shall be responsible for transmission of the final EOT.

10. The same error recovery procedure outlined in table 7 is used with this procedure.

3.7.4.2 Point-To-Point Communications Procedures (1284 9006).

The point-to-point communications procedures are switched and dedicated (contention).

3.7.4.2.1 Switched Procedures. The point-to-point communications procedure utilizing switched lines shall conform to that given in table 14 and related notes.

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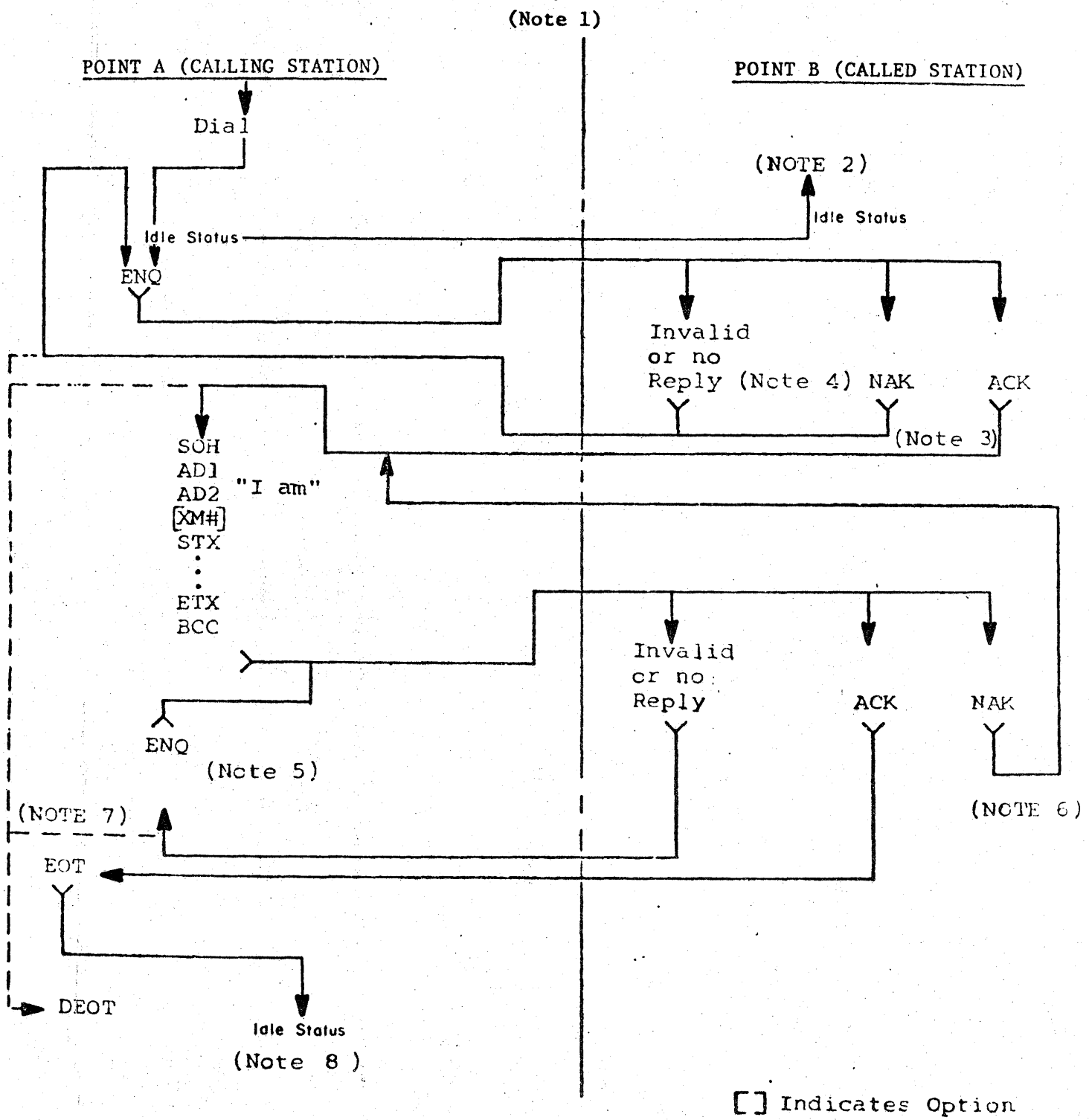
TABLE 14. POINT-TO-POINT - SWITCHED



NOTES TO TABLE 14:

1. This procedure applies when a point-to-point link is established on the switched network.

2. When a physical connection has been made or after a terminate function, the stations are in the idle condition. In this condition, neither station has master status, but either or both stations may bid for master status by sending ENQ. Simultaneous bids will be unsuccessful and must be reinitiated.

3. If the station is ready to receive, it sends an ACK character. The master station, detecting the affirmative reply, proceeds with message transmission. If the station is not ready to receive, it sends an NAK character. A TD820 master station will detect the NAK character as "no response" and the operator, at his option, may retransmit an ENQ character with the XMT key any number of times before proceeding to mandatory disconnect by pressing the LOCAL key.

4. If the station receives an invalid reply or no reply, it may send an ENQ character again. Any number of attempts may be made to verify the status. After these attempts, the station may proceed to the mandatory disconnect.

5. If the master station receives an invalid or no reply to a transmission, it may send a reply request character (ENQ). Carefully note that this use of the ENQ character may result in the loss or duplication of transmissions. If, after repeating the ENQ character "n" times (depending on system discipline) and a valid acknowledgement is still not received, the master station may exit to DEOT.

6. If a slave station receives a message for which the character parity or block check tests fail, an NAK character may be transmitted, thereby, requiring a repeat of the transmission. This action can be repeated "n" times, depending on the master station operator; after which, the master station may exit to mandatory disconnect.

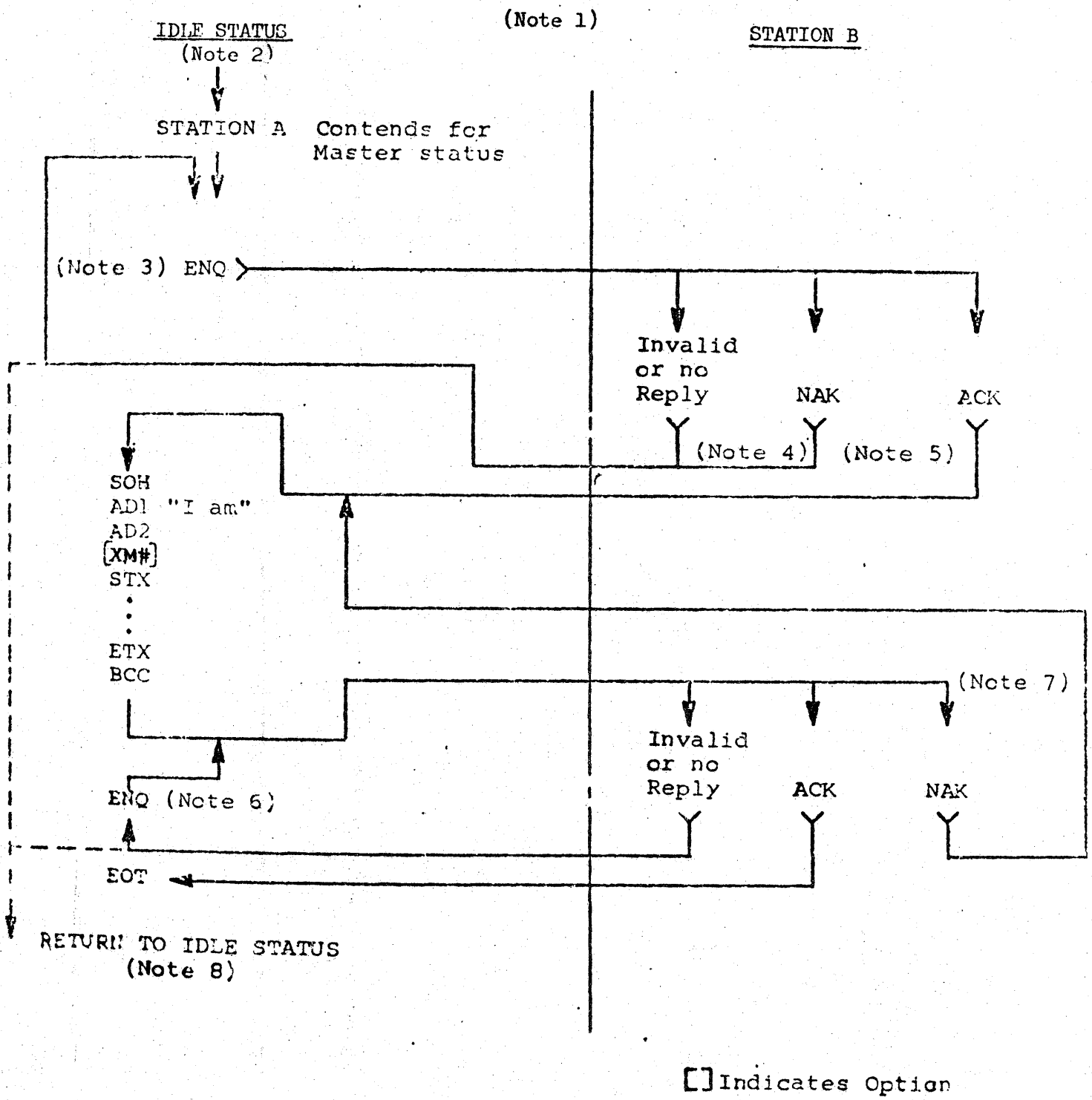
7. Failure of the master station to receive a valid response may result in the actuation of the LOCAL key by the master station operator, thereby, initiating a mandatory disconnect to clear the connection.

8. By systems agreement the operator shall, if no ENQ is sent or received within "n" seconds, send DLE/EOT or initiate a manual disconnect of the circuit by pressing the LOCAL key.

3.7.4.2.2 Dedicated (Contention) Procedure. The point-to-point communications procedure utilizing dedicated (contention) lines shall conform to that given in table 15 and its notes.

LTR	REVISION

TABLE 15. POINT-TO-POINT DEDICATED (CONTENTION)



NOTES TO TABLE 15:

1. This procedure applies when there are two stations on a dedicated point-to-point link, with neither station designated as the master station. Both stations contend for master status and may seize it under the condition that the other station is not seizing it. Staggered re-attempts to achieve master status in the event of an initial simultaneous attempt are based on the variation in the contending terminals operator action and response times. A contention function determines the master-slave relationship of the two stations. A terminate function returns the system to the contention condition.

2. The idle condition on the communication link is that which follows the terminate function of the previous transmission. In this condition, neither station has master status but either or both stations may bid for master status.

3. A station wishing to transmit a message bids for master status by sending the inquiry character (ENQ); after which, it begins the time-out function which is dependent on the operator. To resolve simultaneous bids by both stations, the station which takes the longest time-out interval after having bid for master status will react to a received ENQ character as though it had not bid for master status. Conversely, after having bid for master status, the station which takes the shortest time-out interval will not respond to a received ENQ character. Each station will reinitiate its bids when the designated time-out interval has expired if the master/slave relationship has not been established.

   Upon receipt of the affirmative acknowledge response (ACK), the station bidding for master status assumes master status and proceeds with message transfer.

   Upon receipt of the negative acknowledge response (NAK) character, the station bidding for master status may reinitiate a bid for master status by sending the ENQ character again. The station may reinitiate its bid for master status for as many times as the operator selects.

4. In case of an invalid reply or no reply to the initial ENQ character, the station bidding for master status reinitiates the bid by sending the ENQ character again. The station reinitiates its bid for master status for as many times as the operator selects.

5. If station B is ready to receive, it shall send an ACK character. Station A, detecting the affirmative reply, assumes master status and proceeds with message transmission. If station B is not ready to receive, it sends an NAK character. Station A, detecting the NAK character, may again contend for master status by operator action.

6. If the master station receives an invalid reply or no reply to a transmission, it shall send a reply request character (ENQ). This character may be sent "n" times ("n" may be equal to 0). Carefully note that this use of the ENQ character may result in the loss or duplication of transmission. If, after sending the ENQ character "n" times, a valid acknowledgement is not received, the master station may exit with an EOT character.

7. If a slave station receives a message for which character parity or block check tests fail, an NAK character may be transmitted calling for a repeat of the transmission. This can be repeated "n" times (to be determined for each system), at which time the master station may terminate the procedure.

8. Failure of station A to achieve master status or to receive a valid response may result in transmission of an EOT character and a return to the idle state.

3.7.5 Options to Communications Procedures.

The Terminal shall have available the following options to the multipoint and point-to-point communications procedures.

3.7.5.1 Transmission Number (XM#) Character

The Terminal shall have the option of XM# character available exclusive of the particular communications procedure utilized in that Terminal. When implemented, the XM# character shall immediately precede the STX character as part of the message header. Transmission numbers shall be assigned by sequentially numbering transmissions alternately between two numbers on an odd/even basis. The two transmission numbers shall be either the character codes for 0 and 1 (column 3, rows 0 and 1 respectively of figure 6-1), or may be field adjustable to the character codes for @ and A (column 4, rows 0 and 1 respectively of figure 6-1). Thus, only a one - bit change is required to furnish messages alternately with either odd or even identification. Transmission numbers which may be received from the central processor shall have no significance to the Terminal, but shall be used in the calculation of the block check character (BCC). The Terminal shall accept transmission numbers in any sequence length including 0.

3.7.6 Look-Alike Procedures.

3.7.6.1 IBM 2260 Look-Alike Procedure.

The terminal shall have available the communication capability of the IBM 2260 polling and select procedures. These procedures shall operate at 1200 bps asynchronous with the Burroughs model TA713 or the Western Electric model 202D data sets, or shall operate at 2400 bps synchronous with the Burroughs model TA734-24 or the Western Electric model 201B data sets. The interface leads (circuit DB, pin 15; and circuit DD, pin 17) shall be provided in the asynchronous interface.

3.7.6.1.1 IBM 2260 Polling Procedure. The polling procedure with associated notes is given in table 16.

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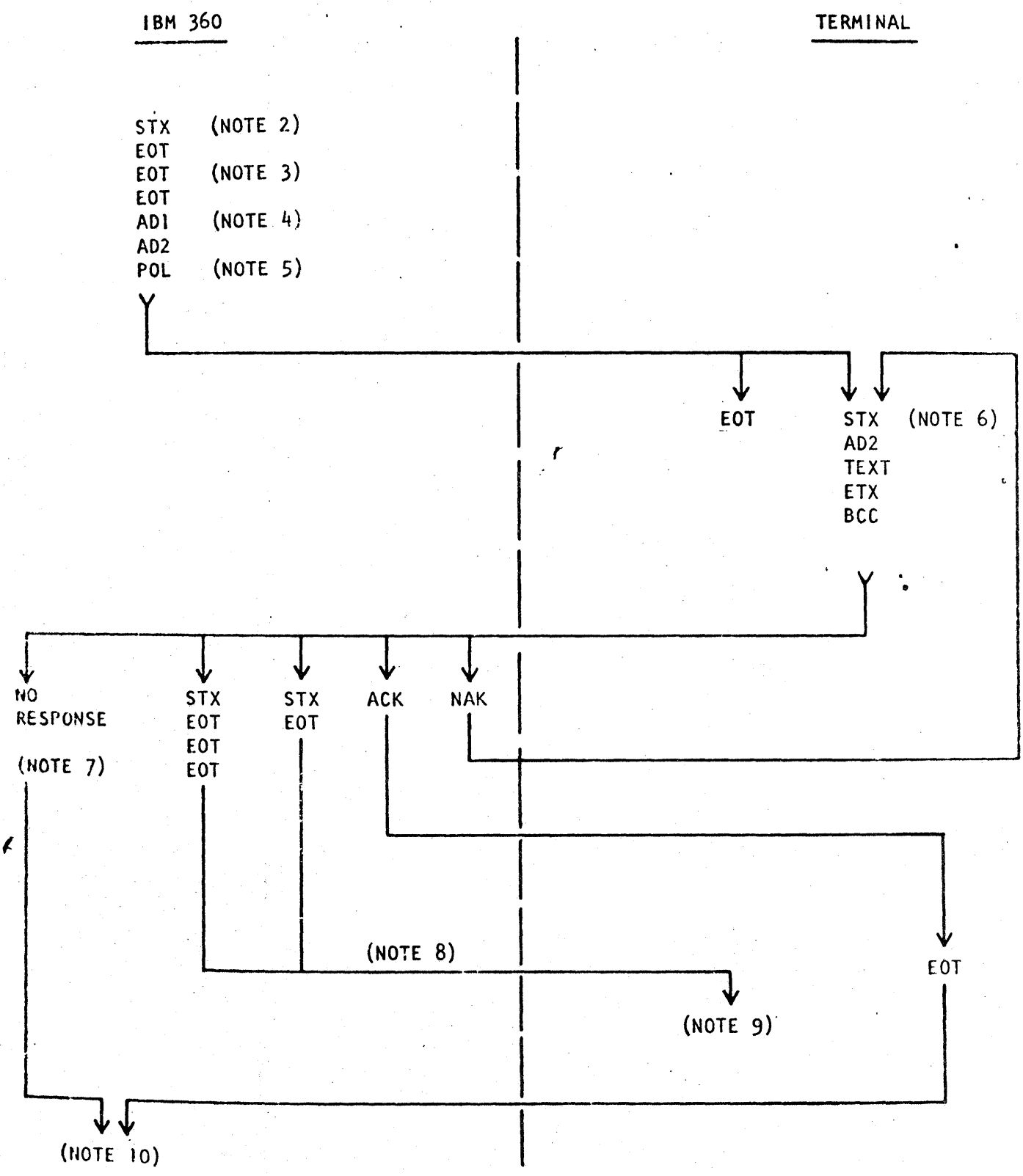
TABLE 16. IBM 2260 POLLING PROCEDURE

(NOTE 1)



NOTES TO TABLE 16:

1. The interface to the system/360 is via a 2701 with type III terminal adapter. The IBM 2260 Display Terminal operates only over leased lines.

2. This STX character may or may not be present in the polling sequence. The determining factor is the 360 environment in which the terminal is operating (BTAM or QTAM). Therefore, the capability of accepting a polling sequence consisting of multiple characters with the STX or without the STX is essential. See note 4 for valid poll or select sequence. The characters in a polling sequence may or may not be contiguous depending on the IBM system environment.

3. The number of EOT characters that precede the address may be either 3 (as shown) or greater. The terminal will be able to operate in either environment.

4. The polling sequence consists of a 4 character sequence starting either with EOT or SOH followed by AD1, AD2 and the control character for poll (space). It may be preceded by a variable number of characters which are ignored.

5. AD1, AD2 can be represented by characters in the modified ASCII set as shown in figure 6-1, columns 2 thru 6.

6. The data message sent to the IBM 360 must begin with the STX character followed by the AD2 value of the terminal.

7. Under this condition, the terminal should become receptive to a new poll or select sequence.

8. The most widely used reply in a Burroughs terminal network would be the ACK character. However, the STX-EOT and STX-EOT-EOT-EOT character sequences are allowed in an IBM 2260 environment, and would probably be the required reply in a mixed IBM 2260/Burroughs terminal system. To develop a true look-a-like interface, the capability of accepting any of the listed responses must be included.

9. If an acknowledgement that ends with STX, EOT, or multiple EOT's is received, the terminal will remain quiet and wait for a new poll or select. The new poll or select sequence must begin with STX. In either case, the terminal considers the transmission successful.

10. At this point, the central computer may poll the terminal, poll another terminal, select the terminal, or select another terminal.

3.7.6.1.2 IBM 2260 Select Procedure. The select procedure with associated notes is given in table 17.

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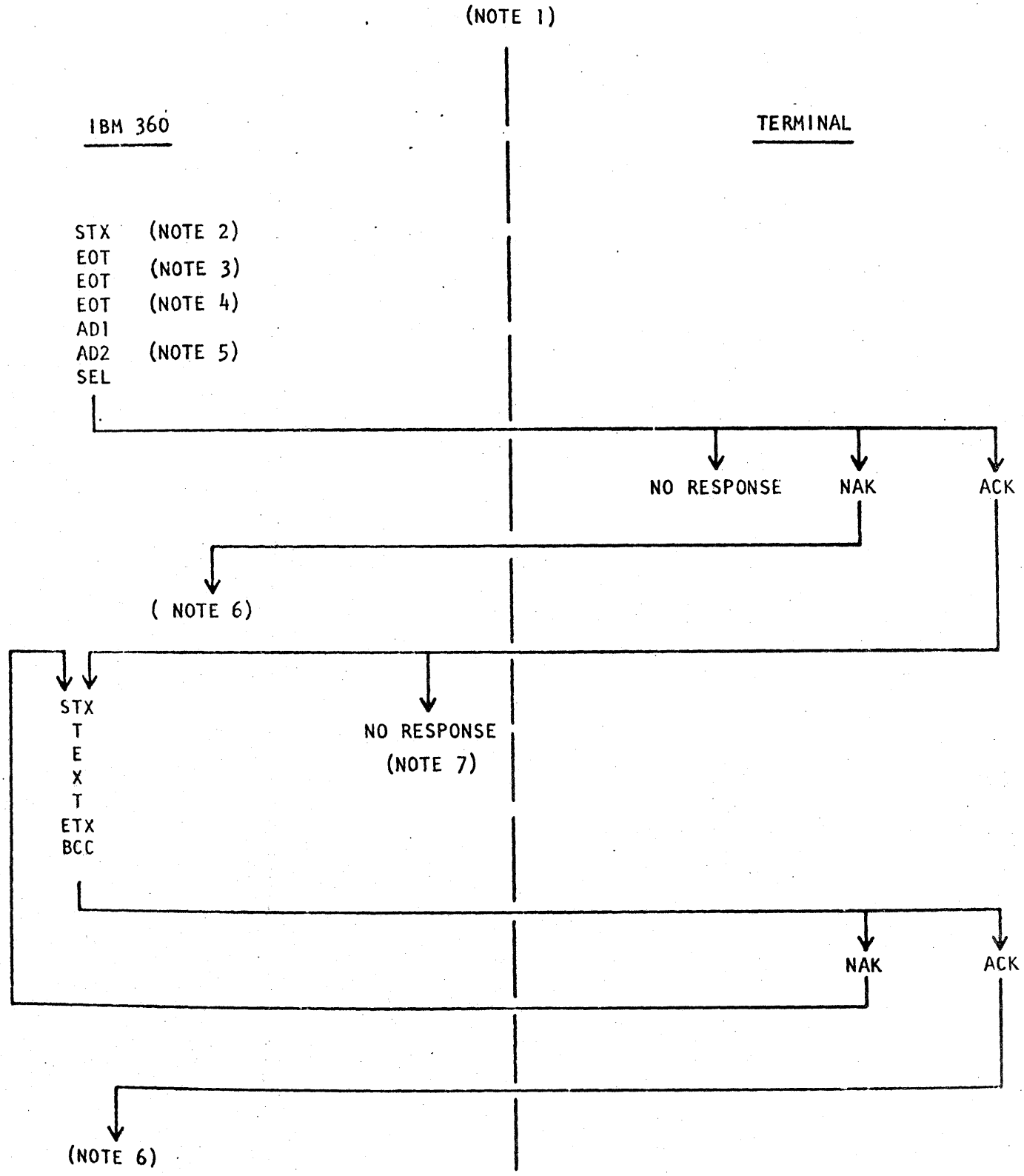
TABLE 17. IBM 2260 SELECTING PROCEDURE



NOTES TO TABLE 17:

1. The interface to the system/360 is via a 2701 with type III terminal adapter. The IBM 2260 Display Terminal operates only over leased lines.

2. This STX character may or may not be present in the selecting sequence. The determining factor is the 360 environment in which the terminal is operating (BTAM or QTAM). Therefore, the capability of accepting a selecting sequence consisting of multiple characters with the STX or without the STX is essential. The characters in a selecting sequence may or may not be contiguous, depending on the IBM system environment.

3. The number of EOT characters that precede the address may be either 3 (as shown) or greater. The terminal will be able to operate in either environment.

4. The selecting sequence consists of a 4 character sequence starting either with EOT or SOH followed by AD1, AD2, and the control character for select (@). It may be preceded by a variable number of characters which are ignored.

5. AD1, AD2 can be represented by characters in the modified ASCII set as shown in figure 6-1, columns 2 thru 6. If ASCII character DEL is used in the AD2 position in a selection sequence, a Broadcast Select function will result with one device being charged with reply responsibility. The Broadcast Select capability requires a concatenated connection.

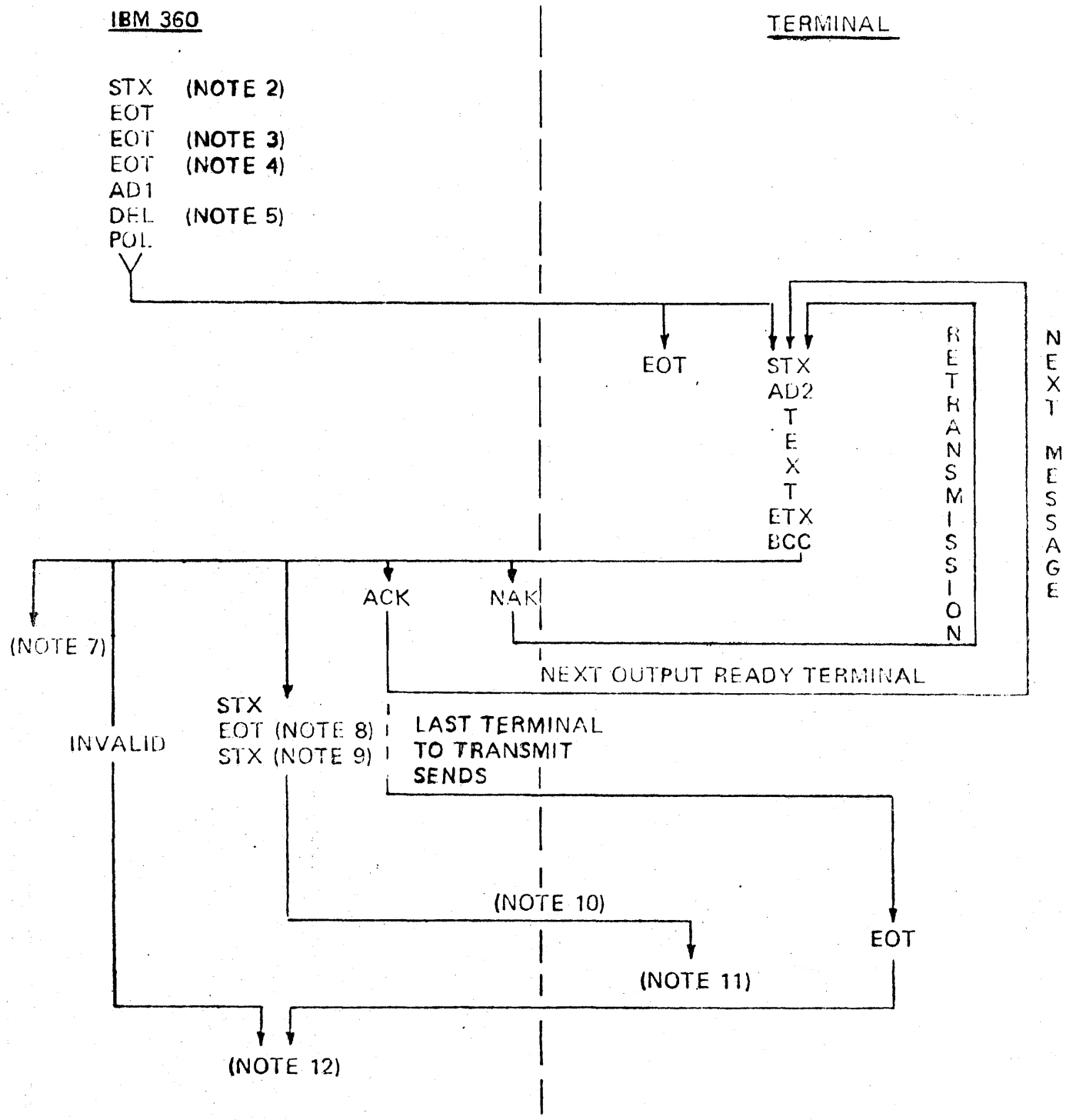
6. At this point, the central computer may poll the terminal, poll another terminal, select the terminal, or select another terminal.

7. Under this condition, the terminal should become receptive to a new poll or select sequence.

3.7.6.1.3 IBM 2260 Group Poll Procedure. The group poll procedure with associated notes is given in table 18.

TABLE 18. IBM 2260 GROUP POLLING PROCEDURE

(NOTE 1)



NOTES TO TABLE 18:

1. The interface to the System 360 is via a 2701 with type III terminal adapter. The IBM 2260 Display Terminal operates only over leased lines.

2. The STX character may or may not be present in the group polling sequence. The determining factor is the 360 environment in which the terminal is operating. Therefore, the capability of accepting a group polling sequence consisting of multiple characters with the STX or without the STX is essential. See Note 4 for valid poll or select sequence. The characters in a polling sequence may or may not be contiguous depending on the IBM system environment.

3. The number of EOT characters that precede the address may be either 3, as shown, or greater. The terminal will be able to operate in either environment.

4. The group polling sequence consists of a 4 character sequence starting either with EOT or SOH followed by AD1, DEL. It may be preceded by a variable number of characters that are ignored.

5. AD1, can be represented by any character in the ASCII set Col. 2, Row 0, through Col. 7, Row 15. When ASCII character DEL is used in AD2 position a group polling function will result with one device being charged with reply responsibility. Any terminal which has as its AD1 character that used in the group poll sequence can reply. Using the standard group polling hardware an order of priority of response will be established and on receipt of ACK for the just sent message the next output ready terminal will transmit. Each terminal will insert in the message that it transmits its own individual AD2 identification. All terminals with the same AD1 address must be grouped on the same concatenation.

6. The data message sent to the IBM 360 must begin with the STX character followed by the AD2 value of the individual terminals.

7. At this point, the terminal should also be receptive to a new poll or select sequence. The terminal, and all others waiting, will retain the message and XMT it on the next poll.

8. The number of EOT characters may be either 1 (as shown) or greater. The terminal will be able to operate in either environment.

9. This STX character must be present and may be the start of another poll or select sequence. This terminal will remain quiet and become receptive to a selection. All others waiting will retain their message and XMT it on the next poll.

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10. The most widely used reply in a Burroughs terminal network would be the ACK character. However, the STX-EOT and STX-EOT-EOT are valid replies in a 2260 environment and in a mixed 2260/Burroughs terminal system would probably be the required reply. To develop a true look-a-like interface, the capability of accepting any of the listed responses must be included.

11. If an acknowledgement is received that ends with EOT, the terminal will remain quiet and wait for a new poll or select. In either case the terminal considers the transmission successful.

12. At this point the central computer may poll the terminal, poll another terminal, select the terminal or select another terminal.

3.7.6.2 Bisynchronous (BSC) Multipoint Procedure (IBM 3270 Look-Alike)

The Terminal shall have available the communication capability of IBM 3270 polling (general and specific) and select procedures. Although tailored for capability with the IBM 3270, these bisynchronous procedures conform to Burroughs standard 1284 9022 to the extent specified. These procedures shall be capable of operating at line speeds of 600, 1200, 2000, 2400, 4800, and 9600 bps bisynchronous. The Terminal shall also have the capability to operate in either a modified USASCII or EBCDIC code environment (field selectable) as given in figures 6-1 and 6-30 respectively.

3.7.6.2.1 Transparent Text Mode. The Terminal shall not be capable of operating in the transparent text mode. Should the Terminal receive the character sequence DLE STX, which indicates the initiation of transparent text mode for the text following, the Terminal shall be set to its idle condition. In idle condition, the Terminal shall be in a halted, non-responsive state which shall be terminated by the receipt of an EOT character. The Terminal shall not be affected by the appearance of the DLE STX sequence on a multipoint network when the Terminal has not been selected.

3.7.6.2.2 Error Checking. The error checks used with the bisynchronous data interface shall be as follows:

VRC - Vertical Redundancy Checking
Vertical Redundance Checking (VRC) consists of generating an odd-parity bit on each character as the data is transmitted and checking for odd-parity as each character is received. This technique is only used in the ASCII normal mode and not with EBCDIC. The test is performed on every character including the LRC.

BCC - Block Check Character
Block Check Character (BCC) is a character used to check or confirm the contents of a particular message by performing a transformation at the sender and receiver on the message, and comparing the calculation at the receiver. An equal compare confirms a correct BCC and thus accurate message (no error). Two types of BCC are described for this procedure in the following paragraphs.

LRC - Longitudinal Redundancy Checking (ASCII Only).
A redundant character added to the end of a basic transmission block for the purpose of error detection and control. LRC is formed by taking a binary sum without carry on each of the seven bits of the transmitted characters following SOH, or STX, including ITB, ETB or ETX, but excluding any SYN characters. The polynomial used in this longitudinal accumulation is $X^8 + 1$. The correct value of the character parity bit (b8) of the LRC is that which makes the sense of character parity the same as for text characters. LRC, transmitted as the block check character (BCC), immediately follows ITB, ETB or ETX in a transmission block.

CRC-16 - Cyclic Redundancy Checking (EBCDIC Only).
A sixteen bit redundant character (CRC-16) is added to the end of a transmission block for the purpose of error detection and control. All characters following STX or SOH except SYN, are included in the CRC accumulation. A cyclic redundancy check is a division performed by both the transmitting and receiving stations using the numeric binary value of the message as a dividend, which is divided by the constant $X^{16} + X^{15} + X^2 + 1$. The quotient is discarded, and the remainder serves as the check character which is then transmitted as the block check character (BCC) immediately following a check-point character (ITB, ETB or ETX). The receiving station compares the transmitted remainder to its own computed remainder, and finds no error if they are equal.

3.7.6.2.3 Bisynchronous Character Formats. The interpretation of character formats used in the bisync communication procedures shall be as follows:

ACK0/ACK1 - Affirmative Acknowledgement
These replies, in proper sequence, indicate that the previous block was accepted without error and the receiver is ready to accept the next block of the transmission. ACK0 is the positive response to selection (multi-point). The BSC procedures specify the alternate use of ACK0 and ACK1 as affirmative replies alternating the 0 and 1 upon transmission or reception of SOH, STX or NAK. The use of ACK0 and ACK1 provides a sequential checking control for a series of replies. Thus it is possible to maintain a running check to ensure that each reply corresponds to the immediately preceding message block. The affirmative response to a poll is the transmission of a message.

DLE - Data Link Escape
DLE is a control character used exclusively to provide supplementary line control characters such as WACK, ACK0, ACK1, RVI and the transparent mode control characters sequence DLE STX.

ENQ - Enquiry

The ENQ character is used for the following:

1. Request for a response from a station.
2. A valid response to WACK.
3. Final character of a TTD sequence.
4. Foward abort when used in the text of a select message.

EOT - End of Transmission

Used to indicate the conclusion of a communication sequence. Receipt of EOT will set the terminal in a control state listening for a polling or selection sequence. EOT may be transmitted by the central processor to abort a transmission sequence including a general poll. To be sure that terminals are in a control state, EOT must precede a communication control sequence. EOT is transmitted by a remote terminal as a "no traffic" response to a poll. The receipt of EOT shall cause the terminal to resync.

ETB - End of Transmission Block

Optionally used when messages are of sufficient length to warrant their being broken into smaller transmission blocks. ETB indicates the end of a block data in the text. ETB requires a reply indicating the receiving station's status. (ETBs are treated as an ETX in the terminal.)

ETX - End of Text

Used to indicate the end of a stream of characters identified as a text. ETX requires a reply indicating the receiving station's status.

ITB - End of Intermediate Transmission Block

The ITB character (table 19) is used to divide a message (heading or text) for error checking purposes without causing a reversal of transmission direction. The block-check character immediately follows ITB and resets the block-check count. After the first intermediate block, successive intermediate blocks need not be preceded by STX or SOH.

Normal line turnaround occurs after the last intermediate block, which is terminated by ETB or ETX. When one of these ending characters is received, the receiving station responds to the entire transmission. If a block-check error is detected for any of the intermediate blocks, a negative reply is sent, which requires retransmission of all intermediate blocks. All BSC stations must have the ability to receive ITB and its attendant BCC.

PAD Characters

To ensure that the first and last characters of a transmission are properly transmitted by the data set, all BSC stations may add a PAD character before and after each transmission. The leading PAD character is a SYN character. The trailing PAD character consists of all "1" bits. (The terminal shall ignore a leading PAD character of HEX 55.)

NAK - Negative Acknowledgement
NAK is a negative response which indicates character parity failure for any character or a block or, in a message, a failure of the BCC. It is also used as a response to a Temporary Text Delay message.

RVI - Reverse Interrupt
The RVI control sequence (table 19) is a positive response used in place of the ACK0 or ACK1 positive acknowledgement. RVI is transmitted by a receiving station to request termination of the current transmission because of a high priority message which it must transmit to the sending station. In case of a multipoint environment, the RVI control sequence indicates that the control station, acting as a receiver, now wishes to communicate with another station on the line. Successive RVIs cannot be transmitted, except in response to ENQ.

The sending station treats the RVI as a positive acknowledgement. In a general poll, the stations waiting to transmit remain silent and await the next poll. The ability to receive RVI is mandatory for all BSC stations.

STX - Start of Text
The STX character is followed by text when the terminal receives a select message. The STX is followed by POL-AD1, D-AD2 and text when the terminal transmits a message in response to a poll.

SOH - Start of Heading
The SOH character may be used optionally in place of the STX. (Select only.)

SYN - Synchronous Idle
The synchronizing pattern for establishing character phase consists of at least two contiguous SYN characters. The terminal shall transmit four SYN characters.

Character phase must be reestablished for each transmission. This is accomplished by the receiving station recognizing at least two contiguous SYN characters in the bit stream. Character phase remains established at the receiving station until either a line turnaround character or the end-of-transmission character is received, or modem carrier detect is false. During the transmission of normal data, insertion of SYN permits a station that is out of step to re-establish character phase. Sync-idle characters are not included in the BCC accumulation, and are stripped from the message at the receiving station.

TTD - Temporary Text Delay
The TTD control sequence (table 19) is sent by a sending station in message transfer state when it wishes to retain the line, but is not ready to transmit. The TTD control sequence (STX ENQ) is normally sent if the sending station is not capable of transmitting within that time.

TABLE 19. CHARACTER CONVERSION CHART

Data Link Character	Code Chart Sequence	
	EBCDIC	ASCII
SYN	nc	nc
SOH	nc	nc
STX	nc	nc
ETB	EOB (ETB)	nc
ETX	nc	nc
EOT	nc	nc
ENQ	nc	nc
ACK 0	DLE '70'	DLE 0
ACK 1	DLE /	DLE 1
NAK	nc	nc
DLE	nc	nc
ITB	IUS	US
WACK	DLE ,	DLE ;
RVI	DLE @	DLE <
TTD	STX ENQ	STX ENQ

nc - no change
'70' - Indicates the hexadecimal representation (no graphic assignment)

The receiving station responds NAK to the TTD sequence, and waits for transmission to begin. If the sending station is still not ready to transmit, the TTD sequence can be repeated one or more times.

The delay in transmission can occur when the sending station's input device has not completely filled the buffer due to inherent machine timings. TTD is also transmitted by a sending station in message transfer mode to indicate to the receiver that it is aborting the current transmission.

After receiving NAK to this TTD sequence, the sending station sends EOT, resetting the stations to control mode (forward abort).

WACK - Wait-Before-Transmit Positive Acknowledgement
WACK allows a receiving station to indicate a "temporarily not ready to receive" condition to the transmitting station. WACK is a positive acknowledgement to the received data block or to selection.

The terminal response to WACK is ENQ. When ENQ is received, transmission will continue.

D-AD2, D-AD2 - Device Address
A two-character address (same character) established as the address of a device or a terminal. For a Group Poll EBCDIC 7F7F or ASCII 22 22 is used in place of the two device address characters.

POL-AD1, POL-AD1 - Poll Address
A two-character address (same character) established as the address for a Poll operation. All terminals with the same Poll Address are required to be in the same concatenated network. The Poll and Select Addresses cannot be the same. The first POL-AD1 is the control address AD1; the second POL-AD1 is the control address AD2.

SEL-AD1, SEL-AD1 - Select Address
A two-character address (same character) established as the address for a select operation. All terminals in the same concatenated network are required to have the same Select Address. The Select and Poll Addresses cannot be the same. The first SEL-AD1 is the control address AD1; the second SEL-AD1 is the control address AD2.

3.7.6.2.4 IBM 3270 Polling Procedure. The polling procedure with associated notes is given in table 20.

3.7.6.2.5 IBM 3270 Select Procedure. The select procedure with associated notes is given in table 21.

DRAWN BY	CHK STD & REC	CHECK F F & F	DSGN	APPROVED
DATE	DATE	DATE	DATE	DATE

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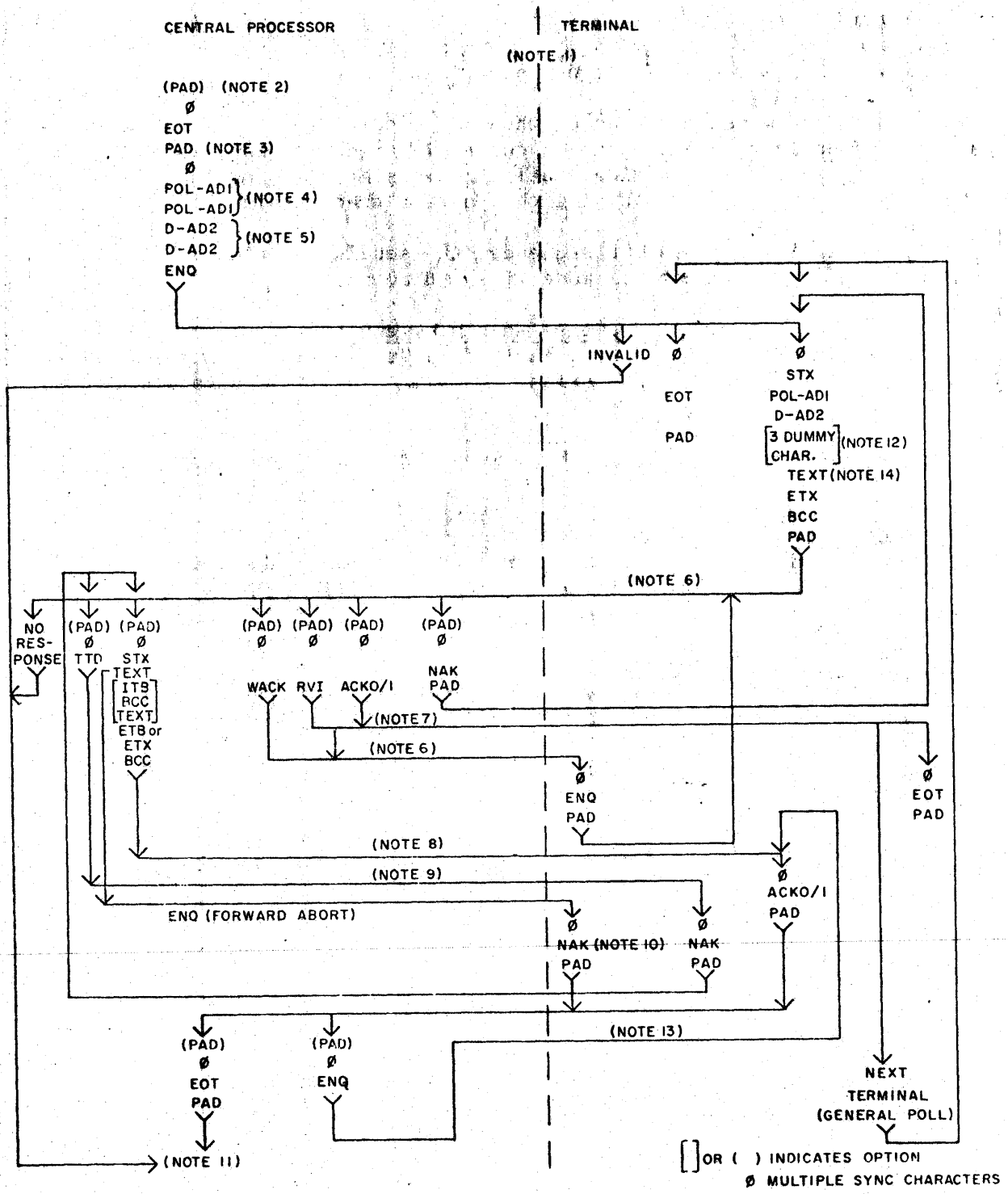
TABLE 20. IBM 3270 POLLING PROCEDURE



NOTES TO TABLE 20:

1. This procedure describes Multipoint operation, where the Central Processor controls traffic in the network by polling (Specific or General) a terminal or terminals.
2. All received data may begin with a leading PAD character of SYN.
3. Trailing PAD characters of all "1"s are optional during reception (No trailing PAD check). The reception of EOT will resync the terminal.
4. POL-AD1 and POL-AD1 sequence is the address for a poll operation. (The control unit address for a poll cannot be the same as for a select.)
5. D-AD2 and D-AD2 sequence is the device address. For a Group Poll, EBCDIC 7F7F or ASCII 22 22 is used in place of the two device address characters. Group Poll requires a concatenated connection.
6. The terminal response to WACK (incorrect ACK 0/1 or invalid character following DLE) is ENQ.
7. ACK0/1 - ACKer flips on receiving or sending of SOH, STX or NAK in response to text. (See Appendix A for code chart sequence of ACK0/1, WACK and RVI).
8. Limited Conversational Mode - The Central Processor may respond with a data message after the reception of a polled message. The Terminal can accept a data message beginning with STX (or SOH) following a sequence of SYN characters (two or more). This terminates a Group Poll.
9. STX ENQ sequence represents TTD in ASCII and EBCDIC.
10. NAK is a valid response to a bad message, TTD, or Forward Abort (ENQ character in heading or text).
11. At this point, the central computer may Poll the terminal, another terminal, Poll terminals (General Poll), Select the terminal or Select another terminal.
12. Certain programs may require an attention identification (AID) character and its parameters to be inserted (IBM "read heading"). The ASCII 27, 20, 20 or EBCDIC 7D, 40, 40 characters will satisfy this requirement.
13. ENQ is a valid response to an incorrect ACK 0/1.
14. Two SYN characters are inserted into text every second to maintain synchronization.

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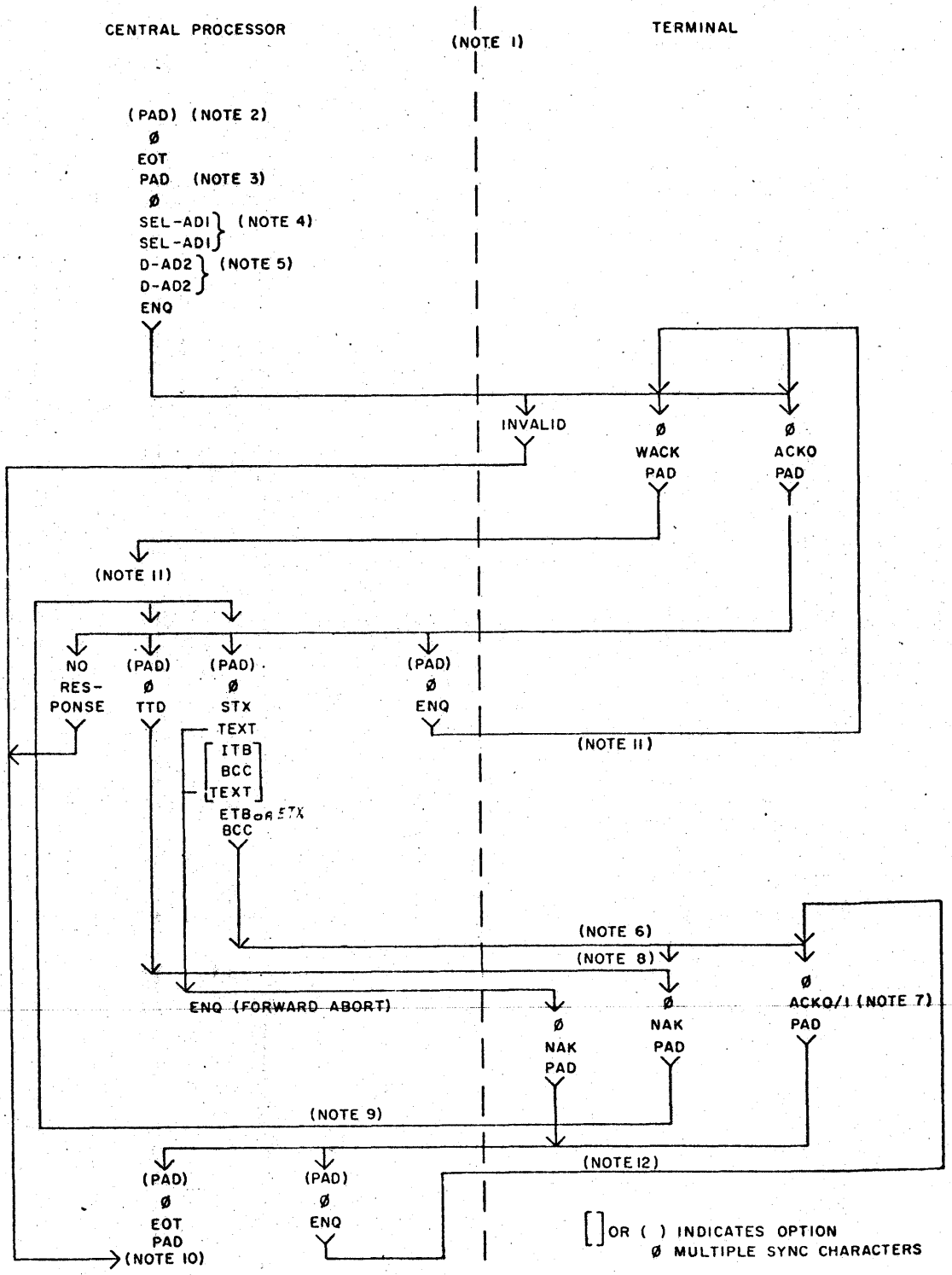
TABLE 21. IBM 3270 SELECTING PROCEDURE



LTR	REVISION

NOTES TO TABLE 21:

1. This procedure describes Multipoint operation, where the Central Processor controls traffic in the network by selecting a terminal.

2. All received data may begin with a leading PAD character of SYN.

3. Trailing PAD characters of all "1"s are optional during reception. (No trailing PAD check.) The reception of EOT will resync the terminal.

4. SEL-AD1 and SEL-AD1 sequence is the address for a Select operation. (The control unit address for a Select cannot be the same as for a Poll.)

5. D-AD2 and D-AD2 sequence is the device address. For a General Select (or Group) D-AD2 D-AD2 is ASCII 22, 22 or EBCDIC 7F7F. General Select requires a concatenated connection.

6. The data message sent by the Central Processor may begin with STX (or SOH) following a sequence of SYN characters (two or more).

7. ACK0/1 - Acker flips on receiving or sending or SOH, STX or NAK in response to text (see table 19 for code chart sequence).

8. STX ENQ sequence represents TTD in ASCII and EBCDIC.

9. NAK is a valid response to a Bad Message, TTD or Forward Abort (ENQ character in heading or text.)

10. At this point, the central computer may Poll the terminal, another terminal, Poll all terminals (General Poll), Select the terminal or Select another terminal.

11. The sequence is transmitted by the central processor in response to WACK or incorrect ACK0 from the terminal.

12. ENQ is a valid response to an incorrect ACK 0/1.

3.7.7 Terminal Interface.

The Terminal shall be capable of operation in a two or four-wire circuit with half-duplex, asynchronous or synchronous data communications interfaces which conform to EIA Standard RS232C, CCITT Recommendation V24 for the international market, the Two-Wire Direct Interfaces (Burroughs Specification 1700 3195), and the Burroughs Direct Interface (Burroughs Specification 1498 5303) to the extent specified herein. Line protection in conformance to BPO Technical Guide No. 25, paragraph 2, shall be provided, as required, in the international interfaces. (See paragraph 3.1.3.)

3.7.7.1 Character Format.

The Terminal shall be capable of operation with either asynchronous or synchronous character format.

3.7.7.1.1 Asynchronous Data Communication. For asynchronous data communication, each transmitted character shall utilize ten nominally-equal time intervals represented by a start bit, eight bits of information, and a stop bit. The start bit shall be a binary "0" (spacing polarity) and shall be followed by seven bits of character code, transmitted with the least significant bit first. The ninth transmitted bit shall be a parity bit (selected to make the number of binary "1" or marking bits even, excluding the start and stop bits). The stop bit shall be a binary "1" (marking polarity).

3.7.7.1.2 Synchronous Data Communication. For synchronous data communication, each transmitted character shall utilize eight nominally equal time intervals represented by eight bits of information. The first seven bits shall represent the seven-bit character code which is transmitted with the least significant bit first. The eighth bit shall be a parity bit (selected to make the number of binary "1" or marking bits of the eight-bit group odd).

3.7.7.1.3 Synchronous Idle Character (SYN). The SYN character is used in the synchronous data communication mode to provide a signal for establishing and retaining synchronism in the absence of any other character. When initiating a synchronous transmission, at least four SYN characters will be transmitted prior to the transmission of any other character to permit the receiving station to acquire synchronization. The Terminal shall purge the SYN character from recognition in the normal character sequence and shall not include the SYN in the summation for BCC.

The terminal shall establish character synchronization upon detection of two contiguous SYN characters and shall maintain this character synchronization until the Received Data Signal is detected as being in the marking condition (1 state) for two character times. After marking for two character times, the terminal must re-establish character synchronization upon receipt of the next two SYN characters.

3.7.7.2 Electrical Interface Circuits.

All interface (interchange) circuits shall comply with electrical requirements of EIA Standard RS232C and CCITT Recommendation V-24.

All interfaces, with the exception of the Two-Wire Direct Interface (TDI), and the Burroughs Direct Interface (BDI) shall conform to Interface Type D of RS232C. The TDI interface requires only one data interchange circuit and one signal interchange circuit. The BDI Interface requires only two data interchange circuits and one signal ground interchange circuit. The Terminal connectors for accommodating the communication interfaces are given in table 22.

TABLE 22. CONNECTOR AND PIN ASSIGNMENTS FOR COMMUNICATIONS INTERFACE CIRCUITS

CIRCUIT	EIA	CCITT	CONNECTOR No. 1	CONNECTOR No. 2	CONNECTOR No. 3
Protective Ground	AA	101	1	1	1
Signal Ground	AB	102	7	7	7
Transmitted Data	BA	103	2	2	2
Received Data	BB	104	3	3	3
Request to Send	CA	105	4	4	4

TABLE 22. CONNECTOR AND PIN ASSIGNMENTS FOR COMMUNICATIONS INTERFACE CIRCUITS (Cont'd)

CIRCUIT	EIA	CCITT	CONNECTOR No. 1	CONNECTOR No. 2	CONNECTOR No. 3
Clear to Send	CB	106	5	5	5
Data Set Ready	CC	107	6	6	6
Data Terminal Ready	CD	108.2	20(4)	20(4)	20(4)
Connect Data Set to Line	-	108.1	-	20(4)	20(4)
Ring Indicator (9)	CE	125	22	22	22
Rec Line Signal Detector	CF	109	8	8	8
Data Signal Rate Selector	CH	111	23(5)	23(5)	11(5)
Select Trans. Frequency	-	126	-	11(6)	11(6)
Transmitter Signal Timing Element	DB	114(7)	15	15	15
Receiver Signal Timing Element	DD	115(7)	17	17	17
Select Standby	-	116(8)	1	24	24

NOTES TO TABLE 22.

1. Connector No. 1 shall consist of Burroughs parts 1694 7244, 1699 4345(2), and 2471 2036, and shall be similar to the Bell connector or equivalent.

2. Connector No. 2 shall consist of Burroughs parts 1694 7244, 1900 2484, or 1900 2534, and shall be similar to the SEL connector or equivalent.

3. Connector No. 3 shall consist of Burroughs parts 1472 0635, 1473 9213 or 1257 0420(2), and shall be similar to the BPO connector.

4. "Data Terminal Ready" and "Connect Data Set to Line" shall be used as follows:

   (a) Switched Lines - Provide positive voltage to maintain connection for duration of call.

(b) Leased Lines - Provide for permanent positive voltage for leased line operation.

5. Certain CCITT data sets provide for the selection of one or two transmission rates. The higher rate requires positive voltage on this lead and is required for leased line operation. Negative voltage on this lead will result in the data set being conditioned for the lower rate. The lower rate is required for operation over switched lines. If the device or terminal is to be used alternately on leased and switched lines, then provisions must be made for the selection of the power voltage level on this lead. It would also be necessary to change the transmission rate of the associated device or terminal.

6. Select Transmit Frequency may be required by certain CCITT data sets; therefore, provisions must be made to provide positive or negative voltage to this lead. This adjustment shall be performed by a field engineer. For connector No. 3, this function and the Rate Select function both appear on pin 11. These two functions are mutually exclusive. The Rate Select function will appear only on CCITT V23 and V26 data sets. The Frequency Select will appear on V21 data sets.

7. Circuits DB and DD are used only with synchronous communications systems.

8. Circuit 116 is defined for the V26 Data Set in paragraph 3.7.7.4.2.3.

9. Circuit CE (Ring Indicator) is not used by the Terminal.

3.7.7.2.1 Sequence of Required Circuits. The sequence of required circuits during the transmit sequence and receive sequence is given in table 23.

TABLE 23. SEQUENCE OF REQUIRED CIRCUITS

CIRCUIT	EIA	CCITT	NOTES
Transmit Sequence:			
Data Terminal Ready or Connect Data Set to Line	CD	108	
Data Signal Rate Selector	CH	111	Required for certain CCITT data sets
Select Transmit Frequency		126	Required for certain CCITT data sets
Data Set Ready	CC	107	-

TABLE 23. SEQUENCE OF REQUIRED CIRCUITS (Cont'd)

CIRCUIT	EIA	CCITT	NOTES
Transmit Signal Element Timing	DB	114	Synchronous data sets
Request to Send	CA	105	
Clear to Send	CB	106	
Transmit Data	BA	103	Transmission on this lead shall be terminated if any of the following three circuits go "off": 1. Request to Send 2. Clear to Send 3. Data Terminal Ready/ Connect Data Set to Line
Receive Sequence:			
Data Set Ready	CC	107	
Receive Line Signal Detector	CF	109	In the event Receive Line Signal Detector goes "off" during reception of data from a synchronous data set, the terminal shall lose synchronism and shall not accept data until synchronism is reestablished.
Receive Signal Element Timing	DD	115	Synchronous data sets
Receive Data	BB	104	

3.7.7.3 Concatenation Connection.

An optional means shall be available for connecting multiple Terminals to a single data set in a synchronous or asynchronous multipoint network through concatenation (series chaining) of the Terminals. The maximum cable length between the data set and the first Terminal and between successive Terminals shall be 100 feet for Burroughs data sets. Other data sets, such as Bell, may be limited to 50 feet, or a length specified by the manufacturer. The interface circuits shall comply with paragraph 3.7.7.2. The Terminal shall provide within its connector an input and output set of connections. The input connections shall accept the interface circuits from the data set or preceding terminal. The interface signals shall be utilized by the Terminal, as appropriate, and shall also be reconstituted to specified levels by driver circuitry before being applied to the output connections for transmission to the succeeding terminal in the string. The Terminal shall provide the interface signal amplification regardless of whether that signal is utilized by the Terminal within itself. The Terminal shall not be responsible for reestablishing timing or phasing degradations which may occur during the transit of the signals along the concatenated terminal chain. Should the final terminal in the chain be the TD820, that terminal shall not require termination for the unused concatenation drivers. Disconnecting or removing power from any TD820 terminal in the chain will disable all terminals beyond the disabled terminal. The cable connectors shall be configured as mating connectors in order to enable continuity of the terminal chain when a terminal is removed as long as the 100 foot maximum cable length between terminals is not exceeded.

The TD820 Terminal shall be capable of compatible operation in this series connection with the Mod 1 TC Series. This mixed concatenation operation is limited to the asynchronous mode only because of the limitation of the MOD 1 TC Series.

3.7.7.3.1 Synthesis of "Clear-to-Send" (CB) Circuit. There exists the possible condition in a concatenated terminal chain which includes the MOD 1 TC Series, that the CB circuit is not propagated by that series. There also may exist the condition where the MOD 1 TC Series may loop the Request-to-Send directly back as Clear-to-Send, thereby, eliminating any delay. A TD820 Terminal located beyond the MOD 1 Series terminal will not receive Clear-to-Send from the data set and shall not properly transmit its data as a result. To overcome the difficulty, the TD820 Terminal shall contain within its concatenation circuitry a delay circuit which shall synthesize the Clear-to-Send signal when actuated by the Request-to-Send signal. The delay shall be adjustable by a field engineer to 50 milliseconds as required by the Bell 202-family data sets; to 265 milliseconds as required by the Bell 103-family data sets; to 200 milliseconds as required by the Datel 1 (V23) operating in 1200 bps, 2-wire or 600 bps, 2 or 4-wire configurations; or to 15 milliseconds as required by the Burroughs data sets TA713 and TA783 and the Datel 1 (V23) operating in the 1200 bps, 4-wire configuration.

The Clear-to-Send circuit shall be capable of three modes of operation:

a. Complete disablement with system reliance upon the true Clear-to-Send from the data set.

b. The synthetic Clear-to-Send delay starting with the terminal Request-to-Send

c. The synthetic Clear-to-Send delay resulting from the loop-back and propagation of Request-to-Send by a TC terminal adjacent to the data set.

3.7.7.3.2 Concatenation Cabling Limitations. The number of TD820 Terminals in a concatenated chain composed solely of TD820 Terminals is not limited electrically by the delay characteristics of the chain. The limit of TD820 Terminals in the chain is limited only by the available AD1 and AD2 addresses within the particular system. In concatenations containing the Mod 1 TC terminal, the limitations on cabling are defined by the requirements of that terminal. For reference, with a 50 card backplane version of the Mod 1 TC Series terminal in the string, the total accumulated cable length shall not exceed 350 feet at a data rate of 1200 bps. With the 60 card backplane version of the Mod 1 TC Series terminal in the string and data rates of 1200 bps on 1800 bps, the total permissible delay (td) shall be no greater than 32.5 usec and 13.3 usec, respectively.

3.7.7.3.3 Concatenation Cables. For concatenating the TD820 family of Terminals, four specific cable types shall be required for complying with the various possible combinations.

a. Terminal to Data Set - a family of cable lengths (15, 25, 50, or 100 ft.) which shall contain a plug on the data set end of connectors No. 1, No. 2, or No. 3 (table 22) depending on the domestic or international market being served, and a jack on the terminal end conforming to connector No. 1. For domestic applications, this cable type (using connector No. 1 on both ends) is identical to the cable of item (b), below.

b. Terminal to Terminal - a family of cable lengths (15, 25, 50, or 100 ft.) which shall contain a plug and jack on the respective ends, conforming to the mating pair of connector No. 1, (table 22).

c. Terminal Concatenation Adapter - A cable assembly consisting of three Type No. 1 connectors and two cables in a "Y" configuration. Each cable shall be one foot in length with a connector on each branch. The left connector shall be capable of mating as a plug with the data set or next Terminal away from data set. The right connector shall be capable of mating as a jack with the succeeding Terminal. The lower central connector shall be capable of mating with the Terminal as a jack.

d. Terminal to Mod 1 TC Series Terminal Adapter - a cable (1 foot in length) which shall consist of a Type No. 1 jack-connector and a Mod 1 TC-Series CLC-plug connector on the respective cable ends. This adapter cable (part number 1470 8786 or 2473 4360) will be supplied by Burroughs Plymouth Plant.

3.7.7.4 Interface Data Rates and Data Sets.

The Terminal shall be capable of operating with both domestic and international data rates and data sets.

3.7.7.4.1 Domestic Applications. The Terminal shall operate with the data sets or equivalents in domestic applications as described in the following paragraphs.

3.7.7.4.1.1 150/300 bps Asynchronous. This interface shall be compatible with the Bell 103 data set family or equivalent.

3.7.7.4.1.2 600/1200 bps Asynchronous. This interface shall be compatible with the Burroughs TA713 data set or equivalent, including Bell 202 family.

3.7.7.4.1.3 1800 bps Asynchronous. This interface shall be compatible with the Burroughs TA783 data set or equivalent, including the Bell 202 family.

3.7.7.4.1.4 2000/2400 bps Synchronous. This interface shall be compatible with the Burroughs TA734-24 data set or equivalent, including the Bell 201 data set family. The synchronous interface circuits shall include DB and DD (see table 22).

The Terminal shall be capable of synchronous data communication in both two-wire and four-wire circuits with these data sets. In four-wire circuits, the Terminal shall be capable of operation with the condition of continuous carrier in which the Transmit and Receive carrier circuits in the data set simultaneously remain in the "on" condition. Provision shall be made for the New Sync signal in the data set interface in order to permit communications interchange at lower turn-around times in the data set.

3.7.7.4.1.5 4800 bps Synchronous. This interface shall be compatible with the Burroughs TA733-48 data set or equivalent, including the Bell 208 data set family.

3.7.7.4.1.6 9600 bps Synchronous. This interface shall be compatible with 9600 bps data sets which conform to the EIA RS232C interface requirements.

3.7.7.4.2 International Applications. The Terminal shall conform to the interface circuit requirements defined by CCITT Recommendation V24 and shall operate with the data sets or equivalents in international applications as described in the following paragraphs. (See paragraph 3.7.7.2 for reference to V24 signal interfaces.)

3.7.7.4.2.1 V21 Data Set. The Terminal shall operate in a compatible interface with the V21 data set or equivalent, including the GPO Datel 2. Operation shall be asynchronous half-duplex at data rates of 150 or 200 bps. Circuit 126 selects the transmit frequency for the data set. A positive voltage is used to select frequency No. 1 and a negative voltage is used to select frequency No. 2. This adjustment shall be made by a field engineer.

3.7.7.4.2.2 V23 Data Set. The Terminal shall operate in a compatible interface with the V23 data set or equivalent, including the BPO Datel 1 and Burroughs TA753. Operation shall be asynchronous half-duplex at data rates of 600/1200 bps. Circuit 111 selects the data rate. A positive voltage is used to select 1200 bps operation and a negative voltage is used to select 600 bps operation. The Datel 1 operates normally on a four-wire connection, but has the capability of being switched to two-wire standby connection. The "Request-to-Send"/"Clear-to-Send" delay in two-wire operation is 200 ms. This delay shall be provided internally by the TD820 Terminal for both 600 and 1200 bps data rates.

3.7.7.4.2.3 V26 Data Set. The Terminal shall operate in a compatible interface with the V26 data set or equivalent, including the GPO Datel 7. Operation shall be synchronous. Using the Facility 3 form of the data set, operation will be at a data rate of 2400 bits/second on a four-wire line with alternative channel data rates of 600/1200 bits per second in either direction (not simultaneously) on a two-wire line. The Standby Select (CCITT Circuit 116) will select the primary or alternative channel, and CCITT Circuit 111 (Data Signal Rate Selector) will select which of the alternative channel data rates will be used. The possible conditions are as follows:

BPS	CKT 116	CKT 111
2400	OFF (-)	Not enabled
1200	ON (+)	ON (+)
600	ON (+)	OFF (-)

3.7.7.5 Options to EIA RS232C and CCITT Interfaces.

3.7.7.5.1 Rate Select Switch (Speed Dial) Option (Factory-Installed). The Terminal shall have the optional capability to operate at a number of data rates which shall be selectable by a multi-position speed dial that is located on the logic and power supply assembly near the data set connector. The speed dial option shall provide for selecting asynchronous data rates in the domestic market and for selecting asynchronous and synchronous data rates through control of data sets in international applications. Overlapping data rate requirements between the two markets shall share the same speed dial position, defining a speed dial with seven positions.

3.7.7.5.1.1 Asynchronous Domestic Systems. For asynchronous domestic applications seven switch positions are required for selecting data rates of 75, 150, 200, 300, 600, 1200 or 1800 bps according to table 24.

TABLE 24. SPEED DIAL DOMESTIC SWITCH SELECTIONS

SWITCH POSITION	DATA RATE
1	75 bps
2	150 bps
3	200 bps
4	300 bps
5	600 bps
6	1200 bps
7	1800 bps

3.7.7.5.1.2 International Synchronous and Asynchronous Systems. For international synchronous and asynchronous systems five switch positions are required for selecting the operating data rates for certain data sets according to table 25.

TABLE 25. SPEED DIAL INTERNATIONAL SWITCH SELECTIONS

SWITCH POSITION	DATA RATE	DATA SET	MODE	CCITT CIRCUIT	CIRCUIT LEVEL*
2	150	V21	Async.		
3	200 bps	V21	Async.		
5	600 bps**	V23	Async.	111	Low (-)
6	1200 bps	V23	Async.	111	High (+)
5	600 bps	V26	Sync.	111	Low (-)

TABLE 25. SPEED DIAL INTERNATIONAL SWITCH SELECTIONS (Cont'd)

SWITCH POSITION	DATA RATE	DATA SET	MODE	CCITT CIRCUIT	CIRCUIT LEVEL*
				116	High (+)
6	1200 bps	V26	Sync.	111	High (+)
				116	High (+)
7	2400 bps	V26	Sync.	111	Low (-)
				116	Low (-)

*The circuit level voltages shall be as follows:

High (+) + +5 to +15 volts DC

Low (-) = -5 to -15 volts DC

**The 600 bps asynchronous data rate switch position shall include the function of the Request-to-Send/Clear-to-Send delay of 200 MS (paragraph 3.7.7.3.1)

3.7.7.6 Modem Expanders.

The Terminal communications interface shall be capable of connecting to and operating with the TA800 series of Burroughs Modem Expanders, or their equivalents. These are the TA800-1 (4 terminals), TA800-2 (8 terminals), TA800-3 (12 terminals), and TA800-4 (16 terminals).

3.7.7.7 Two-Wire Direct Interface (TDI) Communications.

The Terminal shall be capable of meeting the requirements of Two-Wire Direct Interface (TDI) Specification 1700 3195, with the conditions and exceptions given in the following sub-paragraphs:

3.7.7.7.1 Conditions. The conditions under which specification 1700 3195 will be met are as follows:

a. Character format shall be 10 bits (asynchronous).

b. Data transmission rate for asynchronous data shall be at any of the following rates:

1. 1200 bits/second
2. 1800 bits/second
3. 2400 bits/second
4. 4800 bits/second
5. 9600 bits/second

c. The connector used for the two-wire connector on the terminal end shall be that specified in table 22 of this specification as connector No. 1.

d. The characters of a message sequence shall be in accordance with the following Terminal multipoint communications procedures: POL (paragraph 3.7.4.1.1); SEL (paragraph 3.7.4.1.2); FSL (paragraph 3.7.4.1.3); CON (paragraph 3.7.4.1.4); BSL (paragraph 3.7.4.1.5) and GSL (paragraph 3.7.4.1.6) to the extent applicable to the Terminal.

e. The cable used for the TDI connection shall be twisted two wire and shall have a maximum length of 1000 feet. This cable shall be a single cable with multiple drops along its length. The TDI cable characteristics including gauge and shielding shall conform to Burroughs drawing 1110 0062. The number of terminals in a TDI installation is limited to a maximum of nine on 1000 ft. cable.

3.7.7.7.2 Exceptions. The exceptions to Specification 1700 3195 are as follows:

a. Circuit AA-Protective Ground (reference paragraph 3.4.1 of Specification 1700 3195). This conductor shall be electrically connected to the equipment frame. The TDI cable shield will be connected through pin 1 of the RS232 connector.

b. Circuit AB-Signal Ground (reference paragraph 3.4.2 of Specification 1700 3195). This conductor shall be the dc circuit ground to establish the ground reference for circuit BA. Circuit AB shall not be connected to circuit AA. The black conductor of the TDI cable will be connected through pin 7 of the RS232 connector.

c. Circuit BA-Data (reference paragraph 3.4.3 of Specification 1700 3195). This circuit shall be the half-duplex serial data interchange. The white conductor of the TDI cable shall be connected through pin 2 of the RS232 connector.

d. The ZERO (spacing) state of circuit BA shall be 0 to -3 volts when measured at the terminal connectors (reference paragraph 3.7.7 of Specification 1700 3195).

e. When the Terminal transmits the ONE state, circuit BA shall be more negative than -10 volts when measured at the Terminal connectors (reference paragraph 3.7.3 of Specification 1700 3195). Up to 100 milliamperes of current shall be drawn for a maximum of 20 microseconds (reference paragraph 3.7.4 of Specification 1700 3195).

f. When the Terminal transmits the ZERO state, up to 500 milliamperes of current shall be supplied to circuit BA (reference paragraph 3.7.6 of Specification 1700 3195).

g. When the Terminal receives the ZERO state, it shall draw a maximum of 2 milliamperes of current from circuit BA (reference paragraph 3.7.8 of Specification 1700 3195).

h. The effective open-circuit shunt capacitance between circuit BA and circuit AB shall not exceed 50 pfd. (reference paragraph 3.7.11 of Specification 1700 3195).

3.7.7.8 Burroughs Direct Interface (BDI)

The Terminal shall be capable of meeting the requirements of the Burroughs Direct Interface Specification 1498 5303 in serial, asynchronous connections. Data rates of up to 64K bps, including 1.2K, 1.8K, 2.4K, 4.8K, 9.6K, 19.2K, 38.4K 48K and 56K at a maximum cable distance of 15,000 feet shall be provided. The combination of the parameters of data rate, maximum installed cable length and cable wire size provide the limits which govern each BDI installation. The inter-relationship of these parameters is given in Specification 1498 5303. The Terminal BDI interface shall meet the requirements of the BDI specification, but shall not necessarily duplicate the circuits given in that specification. The number of terminals in a BDI installation containing a single multipoint line shall be limited to a maximum of twenty.

With BDI, the connection from each customer-installed BDI cable and junction box to each terminal in the multipoint network shall be with the BDI Device Connection Kit (Plymouth #1537 3657).

3.7.8 I/O Interfaces

3.7.8.1 General

The Terminal shall be capable of providing input/output (I/O) interface compatibility with certain peripheral equipment or devices performing the functions of local data storage/retrival through magnetic tape cassette recorders, mini-disks and magnetic card reader, as well as hard copy output of display data through several types of printers. All types of printers will operate dedicated to a terminal, while certain types may be shared between a number of terminals on a random access, non-priority basis. The I/O interfaces to the Terminal shall provide for both local and unattended modes of operation and shall be achieved through the control logic of the display subsystem. The control logic shall contain a data bus for the transfer of data in both directions between the display subsystem memory and all I/O interfaces. Connector space shall be provided in the control unit for the Magnetic Credit Card Reader, the Magnetic Tape Cassette or the Mini-disk, and one of the printer devices. All I/O interfaces are factory-installed.

3.7.8.2 Magnetic Tape Cassette Interface

An I/O interface shall be available to the Terminal for connection of a Shared Cassette Controller which can be shared by up to four TD820 Terminals, and which can control up to four A9490-25 cassette drives with each drive dedicated to a particular TD820. The Controller may be located up to 8 feet from the Terminal, and the cassette drives may be located up to 12 feet from the Controller. The Controller is housed in a separate enclosure from the Terminal and contains its own power supply for providing power to the tape drive and logic, and the driver read/write and control logic.

The cassette controller will operate the subsystem at the following rates in both the attended and unattended modes:

Read, Write, Backspace, operations - 10 ips
Search - 30 ips
Rewind - 60 ips

With either controller, only one cassette drive may be accessed at a time, and all data written to tape will be in blocks of 256 characters. All tape controller functions are operated through the TD820 either by use of the keyboard or through software control. The control character sequences for the tape cassette subsystem are given in Table 6A of this specification.

When the Terminal requests access to a cassette drive via the Cassette Controller through the use of a control code, the cursor shall disappear from the display screen until the requested cassette action is complete. At that time the cursor shall reappear. The keyboard, except for LOCAL, shall be disabled during this time. In the shared controller configuration, where a delay in cassette access may occur due to prior access by another terminal, the terminal operator shall be able to cancel his request by switching his terminal to LOCAL mode. The cancel action shall be recognized only if no cassette action has started and shall result in the reappearance of the cursor and a brief sounding of the audible alarm to confirm the cancellation. The Rewind command cannot be cancelled.

3.7.8.3 Mini-Disk Interface

An I/O interface shall be available to the Terminal for operation of a controller interfacing to either one or two industry-compatible, Mini-Disks. The mini-disk will accept data entered via the TD820 keyboard or data communication line and record it on the disk. Provision will also be made to read data from the disk, display it on the TD820, and when conditioned, transmit the data on the data communication line. Appropriate control modes will be provided which will be controlled through use of either the keyboard or software control.

The mini-disk(s) will be housed separately from the TD820.

3.7.8.4 Magnetic Credit Card Reader (1691 5548)

An I/O interface shall be available to the Terminal for connection to the Magnetic Credit Card Reader. The Magnetic Credit Card Reader is a separately contained unit which accepts magnetic cards conforming to ABA standards. Upon insertion of the card in the reader and depression of the read key on the reader the data encoded in the ABA stripe shall be read into a peripheral memory. This data is not displayed; the Terminal is then automatically placed in the Transmit mode and the data in the peripheral memory is transmitted. The Magnetic Credit Card Reader can be located up to 15 feet from the TD820.

3.7.8.5 Auxiliary Printers

The Terminal shall provide I/O interfaces for connection to three classes of printers: serial, current loop; parallel, TTL voltage levels; and serial, balanced differential.

3.7.8.5.1 B 9354-6 Printer Interface. The I/O interface from the Terminal for providing output data to the Burroughs B 9354-6 printer shall be serial data, current loop of either 20 ma or 60 ma, selectable by field engineering on the TD820 backplane. Other printer types which shall operate compatibly on the interface are the Teletype ASR38, the Terminet 300 printers, or equivalent. The basic data rate for the B 9354-6 is 110 bps; however, the interface card in the Terminal shall be adjustable by field engineering to include higher data rates including 150, 200, 300, 600, 1.2K, 2.4K, 4.8K, and 9.6K bps.

Printing of all or only unprotected data stored in the memory may be initiated from the keyboard via the control key followed by ; or :, respectively, or may be initiated automatically by receipt of the ESC character followed by the same respective characters. (See Table 6A) Optional DLE P and ESC 4 sequences can also be enabled to initiate a print operation in the TD700/TD800 and B9352 environments.

Printing will start following transmission of the ACK character to the central processor signifying that a good message was received. If a DC1 character has been received by the Terminal to hold the Terminal in the Receive mode (programmatic mode control) following the receipt of a message, the Terminal will be placed in Local mode by the printer interface during printing and will be returned to its Receive mode at the completion of the print cycle.

Printing of data stored in the memory is from home to the position of the cursor at the time the printer is activated. A CR, CR, LF sequence shall be sent to the printer by the Terminal at the end of each display line.

3.7.8.5.2 A9249 Auxiliary Printer, 85/165/250 LPM. The TD820 shall provide an I/O interface for connection to the A9249 Auxiliary Printer. This interface shall permit either the operation of a single TD820 to a dedicated A9249, or the shared operation of up to three Terminals with an A9249 Printer on a random access, non-priority basis.

The A9249 Printer uses a parallel data interface consisting of seven data lines and one data strobe line from the Terminal interface, and provides Machine Status, Ready and Acknowledge signals to the Terminal interface. The interface exchange is asynchronous by character with the printer signals determining when the Terminal may access the printer with the next character. The control characters, which the Terminal shall provide to the A9249 Printer Interface, are as follows:

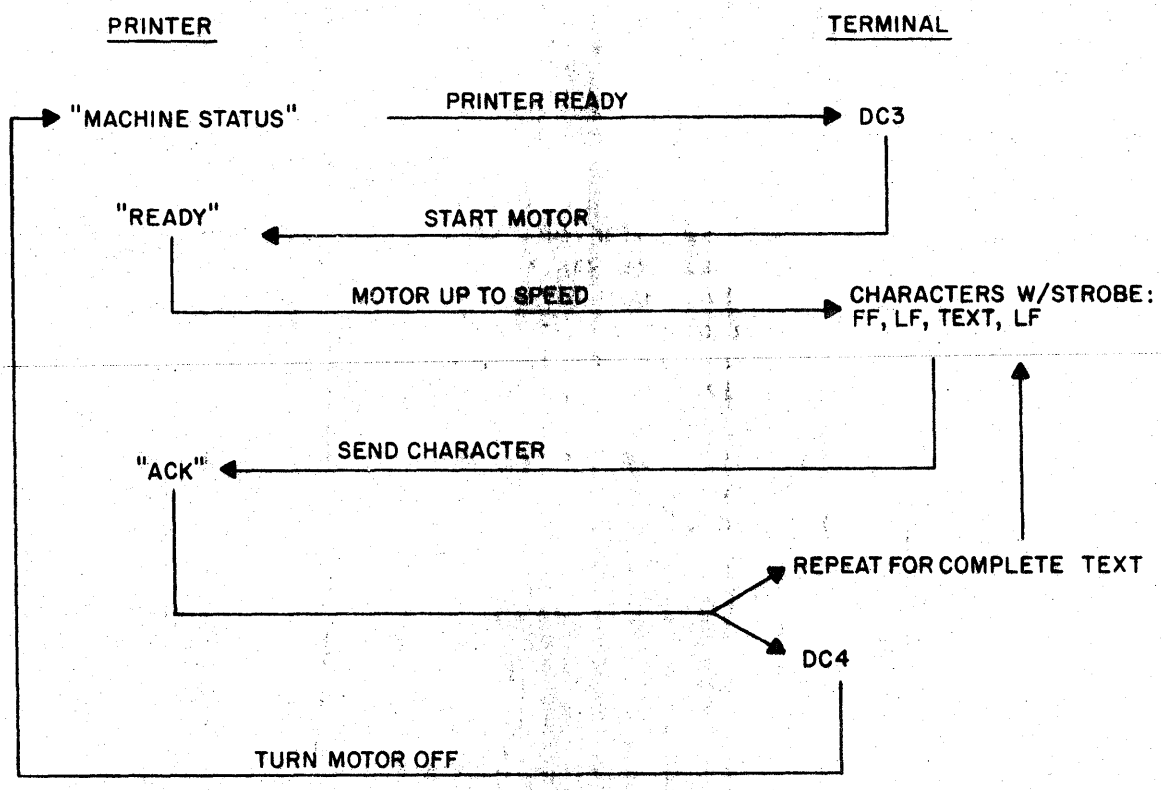
DC3, (ASCII 13) - Start chain drive motor

DC4, (ASCII 14) - Turn off chain drive motor

FF (ASCII OB) - Advance the form to the top of the next form.

LF (ASCII OA) - Causes the Printer Interface to send CRLF Sequence to the Printer

The exchange sequence between the Printer and the TD820 is illustrated in the following diagram:



In the shared printer configuration, each of a maximum of three TD820 Terminals shall have random, non-priority access to the printer. Terminal requests for print service during periods of printer activity shall be stored in a queue in the Printer interface, and print service will be supplied the terminals in the order of their requests. Any terminal requesting printer service shall be able to cancel its request by being switched to Local mode without disruption of the other queued requests.

The A9249 Printer is limited by its TTL interface to a maximum of 50 feet total cable separation from the terminal(s) driving it. Up to three cable types shall permit the connection of the terminal(s) in the dedicated or shared printer configuration:

a. TD/A9249 Interface Cable, 15 feet - this cable shall have mating connectors for the Printer and the Terminal on its respective ends, providing a dedicated connection to a single terminal, or the connection from the Printer to the first terminal in the shared, multidrop configuration.

b. Shared A9249 Connection Cable - this adapter cable, configured as a "T" for multidrop connection of up to 3 terminals to a shared printer, shall have a mating terminal connector and two 25-pin connectors for mating with the cables connecting the preceding terminal and the succeeding terminal or printer. The cable length from the terminal connector to either of the other connectors shall be 1 foot.

c. U.S. Data Set Cable, 15 feet (1696 4975) - this standard cable shall be used to connect adjacent terminals in the shared configuration. The connectors on the respective ends of this cable shall mate with the terminal printer interface connector and the Shared A9249 Connection Cable. A secondary use of this cable shall be to extend the TD/A9249 Interface Cable up to 45 feet in a dedicated connection by the use of two sections.

3.7.8.5.3 TC4001 RO Auxiliary Printer. The TD820 shall provide an I/O interface for connection to the TC4001 RO Auxiliary Printer. This interface shall permit either the operation of a single TD820 to a dedicated TC4001 RO, or the shared operation of up to 15 Terminals with a TC4001 RO Printer on a first-in first-out basis.

The TC4001 RO Printer uses a serial data interface consisting of the Burroughs Direct Interface (BDI), defined in Para 3.7.7.8 and 1498 5303. The Printer is considered to be ready at all times for terminal access; therefore, the interface consists only of data and format control characters from the Terminal to the Printer. There are no status, acknowledgment or other handshake signals provided by the Printer. The Terminal shall provide data to the Printer at 300 bps using 10-bit characters.

In the shared configuration, the TD-to-TD connection will use a 3-wire twisted-pair cable with a maximum separation of 100 feet (cable) between terminals. The printer to terminal cable length can be up to 13,000 feet.

The TC4001 RO Printer requires printer functions, such as margins, tab stops, etc., be set by a means external to the Printer. Therefore, the Terminal I/O Interface shall be capable of providing two classes of messages: control and data. These messages must be separate and unique. Control messages cannot be included in data messages.

The control message shall condition the printer interface to accept characters which shall be translated to control codes which the Printer will use to set its functions. The control message to the interface shall be capable of being generated by either the control processor, using the ESC prefix, or by the Terminal keyboard, using the CTRL key, in preface to each control code.

The control character, ESC, shall cause the printer interface to accept and translate the displayed characters which follow it as control codes which set printer functions. Table 26 provides a list of these characters, their translation to the Printer and the function they perform.

TABLE 26. TC4001 RO CONTROL CODES

Terminal Characters	Control Code	Function
A	ESC 1	Set horizontal tab stop at present carrier position, clearing all previously set stops to the right.
B	ESC 2	Clear all horizontal tab stops and enable standard tab stop.
C	ESC 3	Set left margin stop, the carrier having been moved to correct position by space codes.
D	ESC 4	Set vertical tab stops, the paper having been brought to correct position by successive paper advances using LF code.
E	ESC 5	Clear all vertical tab stops.
F	ESC 6	Synchronize the electronics with the form beginning, the paper being set manually to the beginning of the form. Also clears all vertical tab stops.

TABLE 26. TC 4001 RO CONTROL CODES (Cont'd)

Terminal Characters	Control Code	Function
G	ESC 7	Memorize the length of the form, the paper being moved from the beginning to the end of the form by successive paper advances using the LF code. This control code is used following ESC 6 and LF characters.
H	ESC 8	Command the line feed mode to change between single and double line paper feed.
I	ESC 9	Set right margin at present carrier position.
@	ESC Ø	Cancel right margin
J	ESC LF	Initiate 1/2 line (1/12") forward paper movement.
K	ESC VT	Initiate 1/2 line (1/12") reverse paper movement.
M	ESC CR	Initiate carrier return to position zero..

The data message to the printer shall be the data displayed on the screen of the TD820 including the positional/format control characters and translate them to codes which will cause the printer to perform the required positional/format control actions. Table 27 provides a list of these characters, their translation to the Printer, and the function they perform.

TABLE 27. TC4001 POSITIONAL/FORMAT CONTROL CODES

Terminal Characters	Control Code	Function
CR (▽)	CR LF	Carriage return and line feed
HT (→)	HT	Horizontal tab
ETX (X)	FF	Form feed to start of next form
&	VT	Vertical tab

The positional/format control codes given in table 27 will cause the Printer to react to the respective codes when the Terminal is either in the non-forms mode, or under CPU instruction (ESC ;) to print the total displayed data in the forms mode. When the Terminal has been instructed by the CPU to print only unprotected data in the forms mode (ESC :), the control characters in table 27, except for ETX (X) shall be interpreted by the I/O interface as spaces. Also, while under instruction to print only unprotected data, the I/O interface shall interpret all characters prior to a US (▷) or GS (△) character as spaces. The data following US or GS shall be printed until an RS (◁) character occurs, returning the character translation to spaces. The ETX character shall be obeyed in all cases through its FF translation for advancing the printer paper to the top of the next form. If in transmitting data to the printer no CR/LF is included, a CR will be inserted following the 80th character.

With either the dedicated connection of one TD820 Terminal to the TC4001 RO Printer, or the shared connnection of up to 15 terminals on a multidrop line to one TC4001 RO, the connection shall conform to the requirements of 1498 5303 and shall be capable of operating with up to a total of 15,000 feet interconnecting cable. The connection from each customer-installed BDI cable and junction box to each terminal and the printer shall be with the BDI Device Connection Kit (Plymouth #1537 3657).

In the shared printer connection, each terminal shall have access to the printer on a random, non-priority basis. As each terminal requests printer service, the requests are queued and ultimately completed. A terminal shall be able to cancel a printer service request by being switched to its Local mode without disrupting the other terminals in the queue.

3.8 POWER SUPPLY

3.8.1 General.

The power supply subsystem shall be contained in the logic and power supply assembly of the Terminal. The power supply shall provide all necessary direct-current regulated voltages to all functions of the terminal except the display monitor, which contains its own power supply. The dc power is generated from the ac input line voltage and shall be derived from a single transformer. The primary side of the transformer shall be capable of adjustment to accept a number of discrete values of ac line voltages typical of both the domestic and international markets. The power supply shall operate with 50Hz or 60Hz input voltages. Output voltages shall be adjustable for maintenance. The load shall be continuous with a 100% duty cycle. One power on/off switch shall control all outputs. Paragraph 5 of Burroughs Technical Standard B2-05 shall apply to the extent specified. Burroughs specification 1691 2503 provides the detailed characteristics of the power supply.

3.8.2 Electrical Characteristics.

3.8.2.1 Outputs.

The power supply shall provide the outputs given in table 28.

TABLE 28. POWER SUPPLY OUTPUTS

Nominal Voltage	Total Variation	Current Capacity (AMPS)
+5.1	±2.5%	8.0
+12	±5%	0.225
+16	±5%	0.6
+19	±2.5%	0.01
*+24	Unregulated	0.3 peak for 10 MS; .08 sustained
-12	±5%	0.6

NOTE: Unless otherwise specified TA = 25°C
*Used only with Magnetic Credit Card Reader peripheral (3.7.8.4)

3.8.2.2 Temperature Range.

The environmental temperature requirements of the power supply shall be as follows:

a. Operating: 0 to 60°C (32 to 140°F)

b. Storage: -34 to 70°C (-29 to 150°F)

3.8.2.3 Input Voltage.

The power supply shall operate in accordance with the requirements of paragraph 5 of Burroughs Technical Standard B2-05 and shall accept the following inputs: single phase, 50 Hz ±1% or 60 Hz ±1% with sufficient taps for 100V, 100, 115V, 120V, 127V, 200V, 208V, 220V, 230V, 240V, ±10%, primary voltage operation.

3.8.2.4 Outages and Transients.

The power supply subsystem shall conform to Burroughs Technical Standard B2-05, paragraph 5.4.2, relative to transients on the input power line.

3.8.2.5 Protection.

The +5,1V output shall have an active over voltage protection at +7V (nominal). The other outputs shall be self-limiting.

3.8.2.6 Cooling.

The power supply subsystem shall be cooled by convection.

3.9 DESIGN

3.9.1 Packaging.

The Terminal shall be packaged as a free-standing, self-contained unit which is intended principally for desk or table-top installations. The Terminal shall consist of two physical units: display unit and keyboard unit. The two units shall be designed to operate as two separate units interconnected by cables. The packaging design shall permit the keyboard unit to be located up to six feet away from the display unit or shall permit the display unit to operate without a keyboard.

3.9.1.1 Display Unit Design.

The display unit shall contain the display monitor assembly and the logic and power supply assembly. The display monitor shall contain the CRT and associated drive electronics. The logic and power supply assembly shall contain the necessary provisions for the inclusion of the standard Terminal electronics, together with the electronics required to implement the various options available with the

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+12	±5%	0.225
+16	±5%	0.6
+19	±2.5%	0.01
*+24	Unregulated	0.3 peak for 10 MS; .08 sustained
-12	±5%	0.6

NOTE: Unless otherwise specified TA = 25°C
*Used only with Magnetic Credit Card Reader peripheral (3.7.8.4)

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3.9.1.1 Display Unit Design.

The display unit shall contain the display monitor assembly and the logic and power supply assembly. The display monitor shall contain the CRT and associated drive electronics. The logic and power supply assembly shall contain the necessary provisions for the inclusion of the standard Terminal electronics, together with the electronics required to implement the various options available with the

Terminal. With the exception of the power supply, all electronic circuitry shall be mounted on printed circuit cards which shall plug into a back plane assembly. There shall be a standardized back plane assembly which shall be capable of accommodating the addition of options without modification or retrofit operations.

3.9.1.2 Keyboard Unit.

The keyboard unit shall contain a keyboard assembly which includes the decoding circuitry required to develop the data codes, and an indicator assembly which contains status indicators.

3.9.2 Physical Characteristics.

The physical characteristics of the units which comprise the Terminal are given in table 29.

TABLE 29. PHYSICAL CHARACTERISTICS

Unit	Height	Width	Depth	Weight
Display Unit	14.8 inches (37.59 cm)	16.4 inches (41.66 cm)	18.2 inches (46.23 cm)	75 lbs (34 kg.)
Keyboard Unit	3.2 inches (8.1 cm)	14.3 inches (36.3 cm)	6.9 inches (17.5 cm)	6 lbs (2.7 kg.)
Auxiliary Keypad	3.5 inches (8.9 cm)	5.6 inches (14.2 cm)	6.6 inches (16.8 cm)	2 lbs (.91 kg.)

The Display Unit and Keyboard Unit have a combined shipping weight of 95 lbs. (43.1 kg) and utilize a shipping carton of 8.7 cubic feet. (30.6 l x 23.9 w x 20.6 h inches)

3.9.3 Cooling.

The Terminal shall be self-cooled by convection in a standard environment and shall contain no fans or blowers.

3.9.4 Adjustments.

Operator and maintenance adjustment controls shall be provided.

3.9.4.1 Operator Adjustment Controls.

Operator adjustment controls shall consist of a volume control for the audible alarm, a brightness control, a vertical-hold control, and a horizontal-hold control. A data-rate selection control (speed dial) shall be available as an option. It shall not be possible to damage the Terminal by misadjustment of the operator controls. The operator controls shall be readily accessible to the operator.

3.9.4.2 Maintenance Adjustment Controls.

Maintenance adjustment controls shall consist of a contrast control, width control, vertical size control, vertical linearity control, horizontal linearity control, focus control, video bias control, and a voltage regulator adjustment control. These controls are located within the display monitor. Each of the five d.c. output voltages shall have an adjustment control. These controls are located within the power supply.

3.9.5 Component Standardization.

All Terminals of the same model number and design level shall be identical in the card types used, the actual values and types of components mounted on these cards, and the values and types of components mounted in the chassis. Cards and components mounted within a Terminal shall be capable of being replaced by other cards and components of same designation without degradation of performance. All circuit schematics will have actual component values, tolerances, and ratings listed, and will not deviate from unit to unit.

3.10 ENVIRONMENTAL CHARACTERISTICS.

3.10.1 Temperature and Humidity Range.

The Terminal shall meet the environmental temperature and humidity requirements given in the following subparagraphs.

3.10.1.1 Operating Environments.

The Terminal shall meet or exceed the requirements of Burroughs Technical Standard B2-05 for operating environments as defined in paragraphs 3.1.1.1, 3.1.1.2, and 3.1.1.3 of B2-05. The conditions of relative humidity shall not include condensation.

3.10.1.2 Non-Operating Environments.

The Terminal shall meet or exceed the requirements of Burroughs Technical Standard B2-05, paragraph 3.1.2.1 for non-operating environments of transportation and storage. The conditions of relative humidity shall not include condensation.

3.10.2 Barometric Pressure Range.

The Terminal shall meet or exceed the requirements of Burroughs Technical Standard B2-05, paragraph 3.2, for barometric pressure ranges both in the operating and non-operating environments.

3.10.3 Atmospheric Pollutants.

The Terminal shall meet or exceed the requirements of Burroughs Specification 66984, paragraph 9, as given in the following subparagraphs.

3.10.3.1 Dust (Non-Conductive and Non-Corrosive).

The Terminal shall meet the requirements for class A conditions.

3.10.3.2 Corrosion and Rust.

The Terminal, either operating or non-operating, shall not be subjected to atmospheric conditions in which materials causing corrosion or rust are present in concentrations exceeding normal metropolitan - area levels.

3.10.3.3 Fungus.

The Terminal shall not necessarily meet specifications regarding fungus non-nutrient materials.

3.10.4 Vibration and Shock.

The Terminal shall meet or exceed the requirements of Burroughs Technical Standard B2-05, paragraph 4, for vibration and shock in both operating and non-operating environments.

3.10.5 Electrical Power Line Transients.

The Terminal shall meet or exceed the requirements of Burroughs Technical Standard B2-05, paragraph 5.4.2, for electrical power line transients.

3.10.6 RFI Requirements.

The Terminal shall meet the requirements of Burroughs Technical Standards B2-08 and B2-09 for suppression and control of generated radio frequency interference. Standard B2-08 is derived from VDE0875 and VDE0871.

3.10.7 Electrostatic Interference Protection.

Susceptibility to electrostatic interference shall be minimized within the Terminal through design precautions. These precautions shall include, but not be limited to, appropriate grounding provisions in the package design and the buffering of high input impedance circuits.

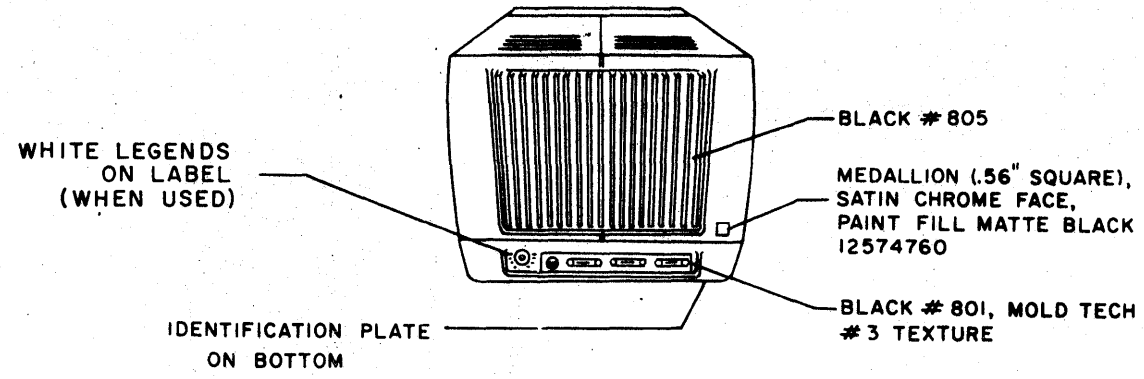
3.10.8 Acoustical Noise Level.

The Terminal shall meet the acoustical raise level limitations specified by NR35 noise-level rating curve of Burroughs Specification 1257-4703.

3.11 MARKING.

Terminal markings shall be in accordance with figure 3-1.

LTR	REVISION



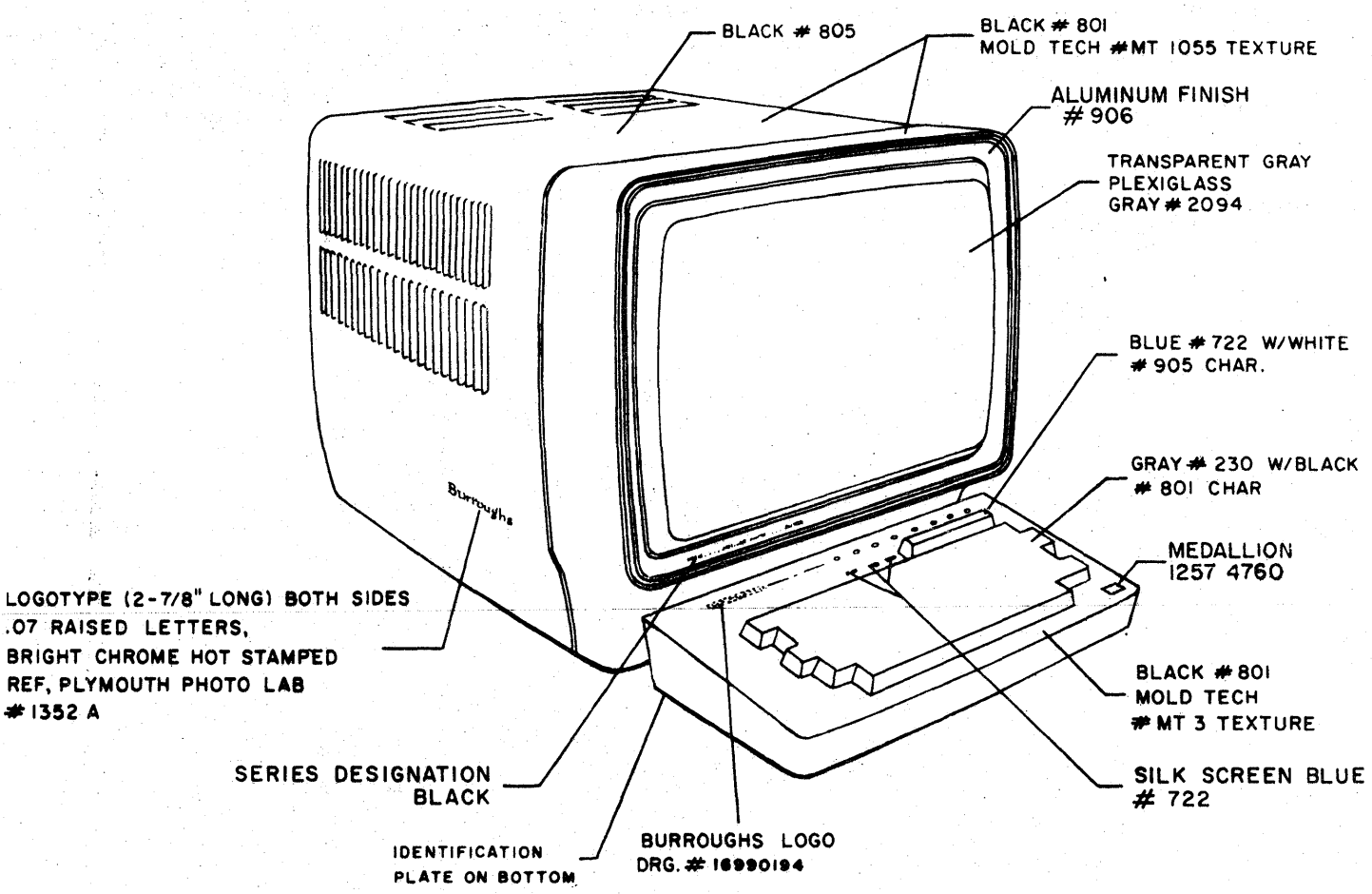


FIGURE 3-1. TERMINAL MARKINGS

3.12 RELIABILITY.

3.12.1 Definition of Terms.

The terms used herein relative to the topic of reliability are defined in Burroughs Specification 60445, Reliability Standards.

3.12.2 General.

The standard Terminal shall have a target mean-time-between-failures (MTBF) of 1800 hours minimum. Detailed MTBF predictions shall be formulated using the parts failure rates specified in MIL-HDBK-217A or equivalent. The predictions shall state the electrical and mechanical stress ratios and temperature upon which the failure rate for each part is based. Individual MTBF estimates for the display unit, the keyboard, and each option shall also be calculated to provide reliability data relative to the individual portions of the Terminal.

3.12.3 Reliability Demonstration Test.

A reliability demonstration test shall be conducted to demonstrate that the required reliability has been achieved in the Terminal design. The reliability demonstration test procedure shall be submitted to TIO for review and approval prior to the testing. The test results shall be provided to TIO for review and approval prior to customer deliveries of the Terminal except for units designated for approved field tests.

3.12.4 On-Going Quality Assurance.

A plan for on-going quality assurance shall be established to insure that the product performance level is maintained as established. Units shall periodically be withdrawn from the finished goods inventory on a sample basis, to be tested by Quality Assurance. Sample quantities of Terminals shall also be subjected to continued conformance to the 1800 hour MTBF requirement. The on-going quality assurance procedures shall be employed for the duration of terminal production.

3.13 MAINTAINABILITY.

3.13.1 General.

The design and construction of the Terminal shall provide for maximum maintainability. Corrective maintenance shall utilize a repair to component level philosophy. The Terminal shall have a mean-time-to-repair (MTTR) equal to or less than 120 minutes at the component level. In order to achieve this, suitable maintenance procedures shall be provided to identify the failed module.

3.13.2 Maintenance Philosophy.

The Terminal, excluding the power supply and display monitor, shall consist largely of plug-in subassemblies and printed circuit board modules. On-site repair of all subassemblies to the component level (I-C chips, transistors, key switches etc.) shall be effected by a field engineer.

3.13.3 Personnel Requirements.

The Terminal can be serviced and maintained on site by a field engineer with an electronic background in solid-state devices, digital circuitry, and CRT displays, together with one week's training on the equipment.

3.13.4 Maintenance Equipment and Tools.

Effective on-site maintenance of the Terminal shall require a printed-circuit board extender, spare components, an oscilloscope, a multimeter, and normal hand tools (pliers, screw-driver, etc.)

3.13.5 Special Test Equipment.

No special test equipment is required to maintain the Terminal.

3.13.6 Preventive Maintenance.

Preventive maintenance for the Terminal is not anticipated.

3.13.7 Maintenance Switches.

To facilitate maintenance troubleshooting, the Terminal shall contain three diagnostic switches which shall be located inside the electronics unit on the top of the printed circuit card enclosure.

3.13.7.1 Screen Saturation Switch.

When actuated, this switch shall cause the $ character (column 2, row 4 of figure 6-1) to be displayed at all screen locations.

3.13.7.2 Parity Defeat Switch.

When actuated, this switch shall cause the Terminal to accept all incoming data without regard to the correctness of parity.

3.13.7.3 Communication Monitor Switch

All data in a multipoint network will be accepted without regard to address (AD1, AD2) or block check (BCC) characters until a buffer overflow error condition is reached. All transmission of data from the terminal is inhibited. New data shall be accepted following actuation of the LOCAL key.

3.14 DOCUMENTATION

Documentation shall be provided for support of the Terminal and shall include the Field Engineering Technical Manual, Parts Catalog and Field Test and Reference Document, Operator Manual and Reference Manual. The Terminal design section will provide assistance as required. The documentation shall be prepared in accordance with format and content requirements defined in the Operation Management section of the Field Marketing Manual, and paragraph 7.0 of the Field Engineering Technical Literature Standards.

3.15 TESTING REQUIREMENTS

The tests described in the following subparagraphs are in addition to reliability and maintainability test requirements.

3.15.1 Unit Tests

Unit testing of the Terminal by design engineering shall be provided. This test shall be performed on a Terminal (or Terminals) whose design level is at least equal to that of the first units received from production. The unit test shall be used to validate the design, verify that the design objectives have been met, and that all specified functional capabilities including the data communication interfaces have been properly implemented. In addition, unit testing shall be used to establish the integrity of the design, a measure of which is the absense of undesireable or otherwise incorrect response to valid stimuli.

3.15.1.1 Unit Test Plan

A unit test plan shall be developed by the design group and shall include descriptions of equipment configurations, test methods, test procedures, and any special or extraordinary test equipment (simulators, data processing equipment, etc.). The test plan shall be comprehensive in its scope, containing the objectives of each test or series of tests along with the evaluation criteria.

3.15.2 Acceptance Tests.

The acceptance tests shall demonstrate during the production phase that the Terminal, as designed and demonstrated in the Unit Tests, continues to meet all of the requirements of this specification, including the functional, reliability, quality assurance, environmental, and other requirements.

3.15.2.1 Acceptance Test Procedure

Design engineering shall prepare the Acceptance Test Procedure which shall form the basis for the Acceptance Tests in production.

3.15.3 Systems Tests.

Systems testing of the Terminal is required. These tests will be performed by the various Engineering or Systems M & E Groups. Data communications compatibility according to Burroughs Standard 1284-9006, and 1284 9022 as applicable, is required with the L 8000 system, DC 1000 Series, B 700, B 1700, B 2500/B 3500, B 4700, B 5500/B 5700, B 6500/B 6700, and B 7700 systems. In addition, data communications compatibility with various terminal concentrators, multiplexors, etc., to be specified, is required. Data communications integration tests with these devices will be required when specified. Terminal design engineering will be required to provide unit test documentation to these groups upon request. In preparation for systems testing, terminal design engineering will provide product familiarization and training for personel from these groups to the extent required to allow them to devise and perform systems tests and to perform routine maintenance on the terminals during these tests at their respective facilities. Design engineering may be required to provide design level assistance and support during these tests.

3.15.4 Field Tests.

The Terminal will be field tested. Field testing at a location to be designated by Marketing is intended to evaluate the Terminal in an applicational environment. Design engineering shall provide design level assistance and support during these tests, as required.

3.15.5 Static Electricity Susceptibility Test.

The Terminal shall be subjected to a specific unit performance test to evaluate its susceptibility to the effects of static electricity. This special test may be conducted at a selected arid location in the U.S. where the environment is conducive to severe static electricity effects through very low humidity and high altitude. Laboratory conditions may be substituted for the natural environment if practical or preferable.

3.16 SYSTEM CONFIGURATOR.

The design organization shall prepare a systems configurator reflecting style numbers and options of each required and optional component (line controls, adapters, modem expanders, etc.). The configurator shall indicate maximum drive distances and cabling style numbers where applicable. The configurator shall indicate each system interface and each applicable communication interface (paragraph 3.7).

3.17 COMPATIBILITY WITH OTHER BURROUGHS DATA DISPLAY TERMINALS

The TD820 shall have the capability of compatible operation in networks which contain any one type of the following Burroughs Data Display Terminals: B 9353, B 9352, TD700 Design Level One, and TD700/800 Design Levels Two through Four. Compatibility of the TD820 with any one of these terminal types at one time shall be defined as the capability to operate in a communications network with the other terminal without disruption to the network and without requiring physical modifications to the other terminal. Duplication of all features and characteristics of the other terminal type by the TD820 shall not be implied. The TD820 capability for compatible operation shall be achieved by field engineering adjustments to the TD820. Section 6.2 of this specification provides compatibility requirements for features contained by the terminals with which the TD820 shall be able to operate.

4. QUALITY ASSURANCE PROVISIONS.

4.1 RESPONSIBILITY FOR TESTING.

The Terminal design organization shall be responsible for all inspections and testing, except for systems testing (paragraph 3.15.3) and field testing (paragraph 3.15.4). Unless otherwise specified, testing shall be performed at the design group's plant according to approved test procedures. The design group shall maintain adequate records of all testing performed, and such records shall be made available to corporate representatives upon request.

4.2 QUALIFICATION INSPECTION.

The design group shall specify tests to be performed for product qualification. These tests will include verification of the parameters given in paragraph 3. (paragraph 3.15.1)

4.3 QUALITY CONFORMANCE INSPECTION.

The design group shall specify tests and inspections to be performed to assure continuing and uniform product quality. (paragraph 3.15.2)

4.4 REJECTION AND RETEST.

Failure of Terminals to comply with the requirements of this specification shall be cause for rejection. Rejected items may be reworked and retested for acceptance.

5. PREPARATION FOR DELIVERY.

5.1 HANDLING, SHIPPING AND TRANSPORTATION.

The packaging, design, handling, and shipping requirements shall be coordinated to ensure successful distribution and safe delivery of the Terminal to world wide markets. The non-operating environment (transportation) shall conform to paragraph 4.3 of Burroughs Standard B2-05.

5.1.1 Evaluation of Shipping Container.

The shipping container shall be evaluated by the following tests:

a. Free fall drop test as per Federal Standard 101B, Method 5007, level B (22 inch drop on each side and each corner).

b. Shipping vibration test as per Federal Standard 101B, Method 5019 (one hour per each of 3 axis). Increase frequency until package clears table by 1/16" - and "bounce" for one hour - each axis.

6. NOTES

6.1 ILLUSTRATIONS, KEYBOARDS

Figure 6-1 is a character coding chart which lists all possible characters and their data codes. Figure 6-2 is a chart which illustrates the United States character generator set along with the international variations. Figures 6-3 thru 6-4 are illustrations of the United States keyboards. Figure 6-5 is the auxiliary numeric keyboard. Figures 6-6 thru 6-25 are illustrations of the various keyboards which can be used with the Terminal. Figures 6-26 and 6-27 are illustrations of the Japanese (Katakana) character set and keyboard, respectively. Figures 6-28 and 6-30 are illustrations of the Latin/Cyrillic (Russian) character set and keyboard, respectively. Figure 6-30 is a coding chart which lists the EBCDIC codes that are used with the IBM-3270 Communications Procedures. Figures 6-31 and 6-32 are illustrations of the optional USASCII character set and typewriter-style keyboard, respectively.

6.2 COMPATIBILITY WITH OTHER BURROUGHS DISPLAY TERMINALS

Appendix 1 lists those features and characteristics of the B 9353, B 9352, TD700 Design Level 1 and TD700/800 Design Levels 2-4 which differ from the basic characteristics of the TD820, and for which the TD820 shall have the capability through field engineering changes to emulate. Appendix 2 provides more detailed information of the TD820 compatibility requirements for each display terminal, together with characteristics which must remain incompatible between the TD820 and the other terminal in question.

b_7 → b_6 → b_5 →					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b_4 ↓	b_3 ↓	b_2 ↓	b_1 ↓	COL → / ROW ↓	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	Ø	@	P		p/POL
0	0	0	1	1	SOH	DC 1	!	1	A	Q	a	q/SEL
0	0	1	0	2	STX	DC 2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC 3	#	3	C	S	c	s/FSL
0	1	0	0	4	EOT	DC 4	$	4	D	T	d	t/BSL
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL*	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF		*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	
1	1	0	0	12	FF		,	<	L	~	l	-
1	1	0	1	13	CR	GS	-	=	M	]	m	
1	1	1	0	14	SO	RS	.	>	N	{	n	
1	1	1	1	15	SI	US**	/	?	O	}	o	DEL

36839

*CON - ALTERNATE CODE FOR CONTENTION. **US=ITB FOR IBM 3270 LOOK-ALIKE.

NOTE:
SEE 3.3.1.2. IN REFERENCE TO LOWER CASE ALPHABETIC CHARACTERS.

FIGURE 6-1. CHARACTER CODING USASCII/ECMA MODIFIED

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USA MODIFIED ASCII

ROW \ COLUMN →	2	3	4	5
0	Sp	Ø	@	P
1	!	1	A	Q
2	"	2	B	R
3	#	3	C	S
4	$	4	D	T
5	%	5	E	U
6	&	6	F	V
7	'	7	G	W
8	(	8	H	X
9	)	9	I	Y
10	*	:	J	Z
11	+	;	K	[
12	,	<	L	~
13	-	=	M	]
14	.	>	N	}
15	/	?	O	{

NOTE: INTERNATIONAL CHARACTER SETS DO NOT INCLUDE LOWER CASE.

INTERNATIONAL VARIATIONS

COUNTRY GROUP	COL. 2, ROW 3	COL. 2, ROW 4	COL. 4, ROW 0	COL. 5, ROW 11	COL. 5, ROW 12	COL. 5, ROW 13	COL. 2, ROW 1
FRANCE / BELGIUM		FR			\		
ITALY					£		
SPAIN / LATIN AMER.	Ps				Ñ		
UNITED KINGDOM	£				\		
GER./AUS./SWITZ.			§	Ä	Ö	Ü	
PORTUGAL / BRAZIL				Õ	Ã	Ç	
SOUTH AFRICA				ʼN	Ê	Ö	
SWEDEN / FINLAND	£		È	Ä	Õ	Å	
NORWAY / DENMARK	Æ	Å	Ø		Ü		¦

18325

FIGURE 6-2. CHARACTER SETS

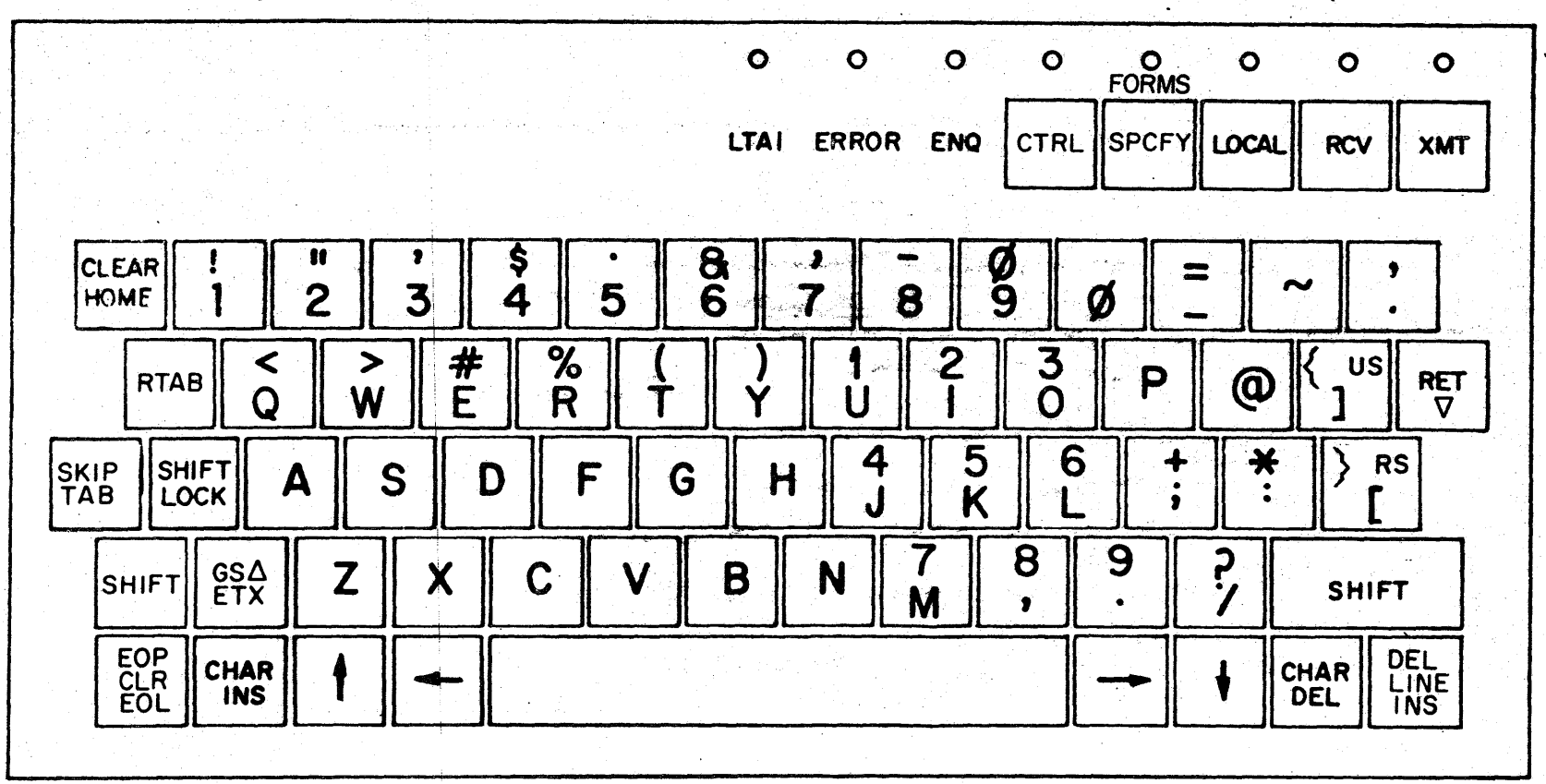

FIGURE 6-3. U.S.A. DATA PREPARATION KEYBOARD

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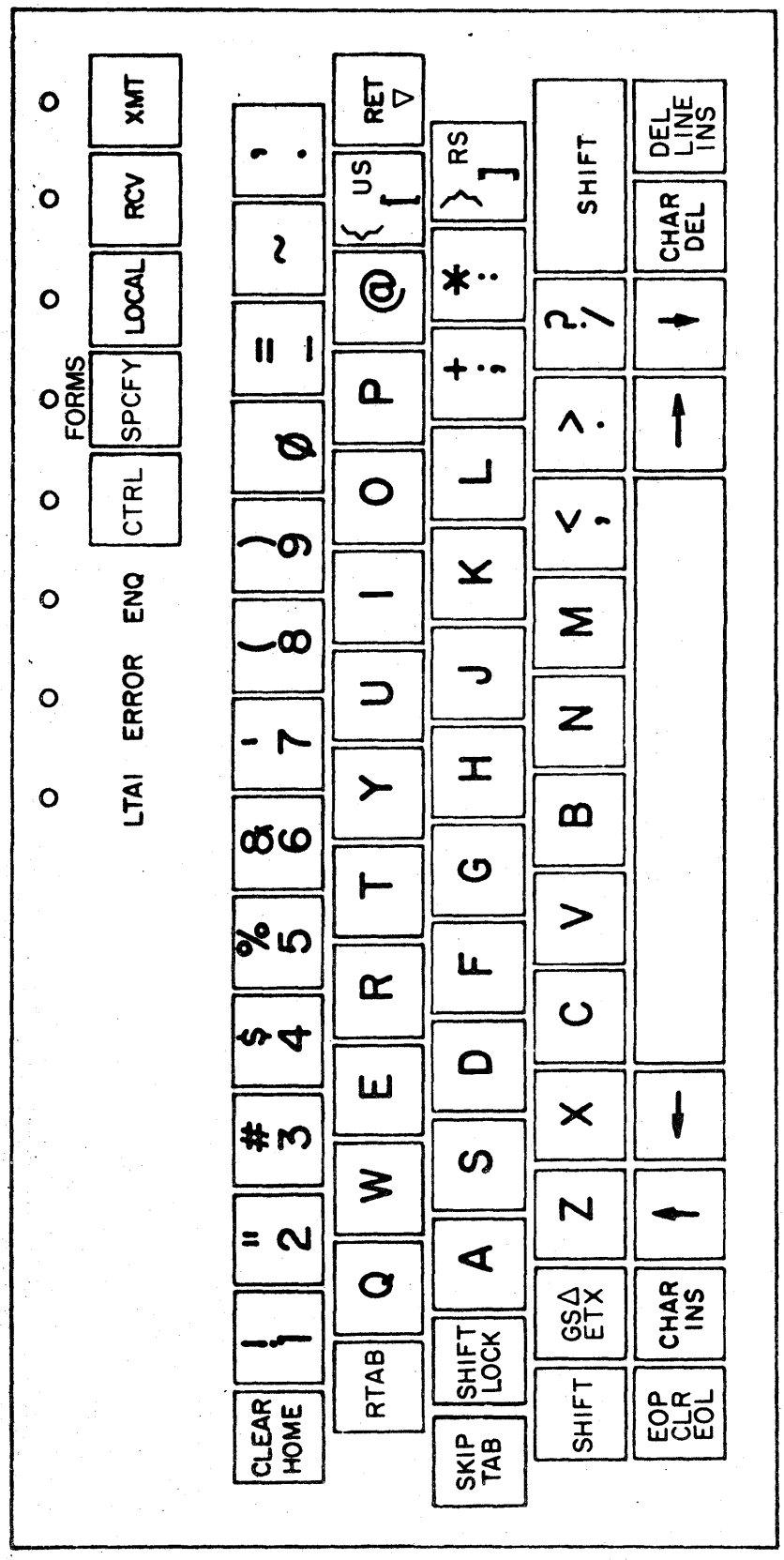

FIGURE 6-4. U.S. TYPEWRITER KEYBOARD

LTR	REVISION

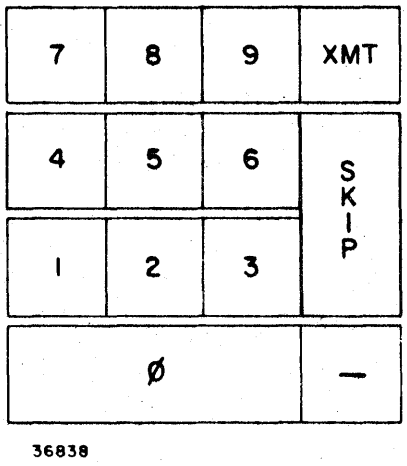

FIGURE 6-5. AUXILIARY NUMERIC KEYPAD

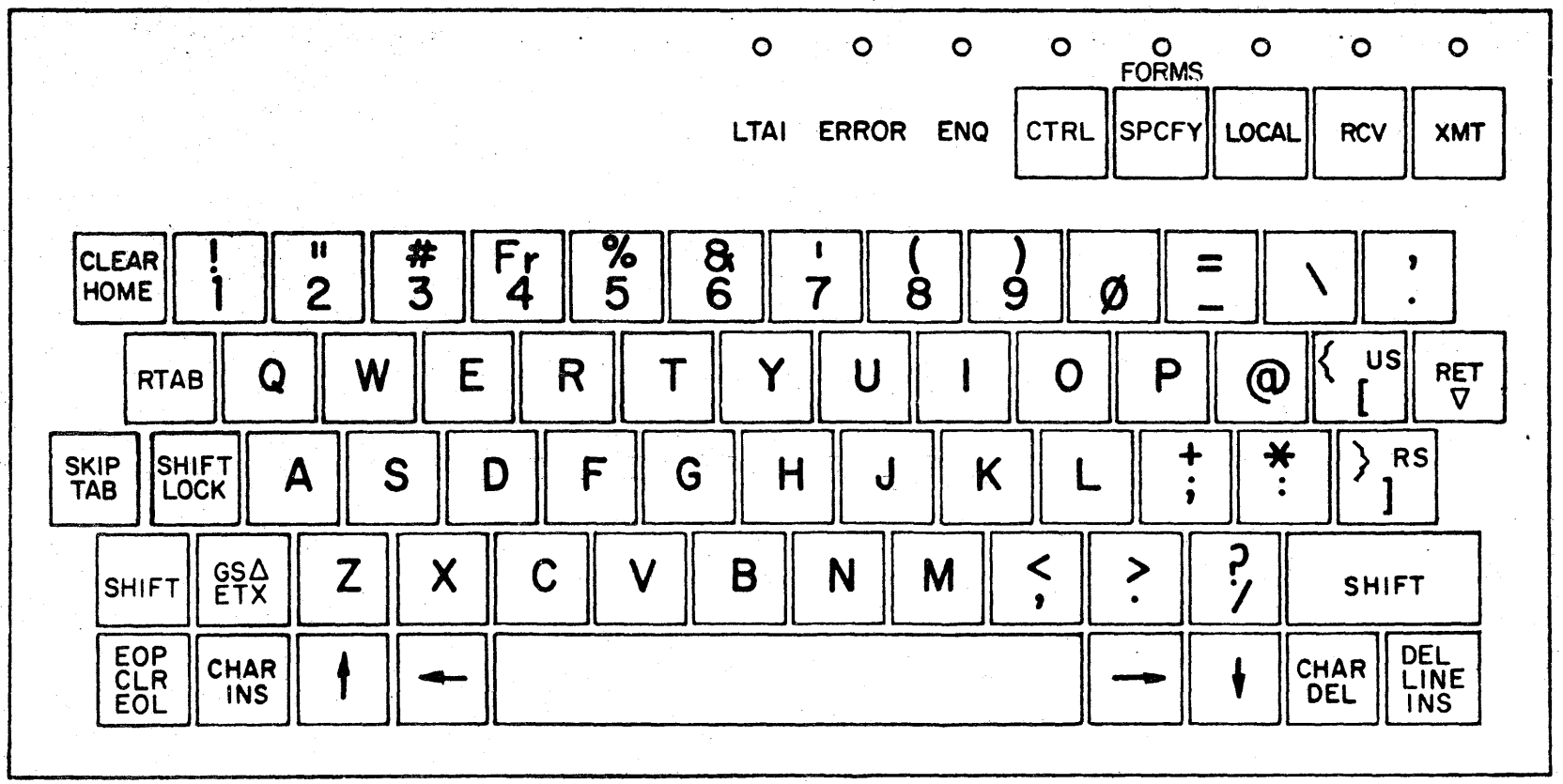

FIGURE 6-6. FRANCE AND BELGIUM TYPEWRITER KEYBOARD

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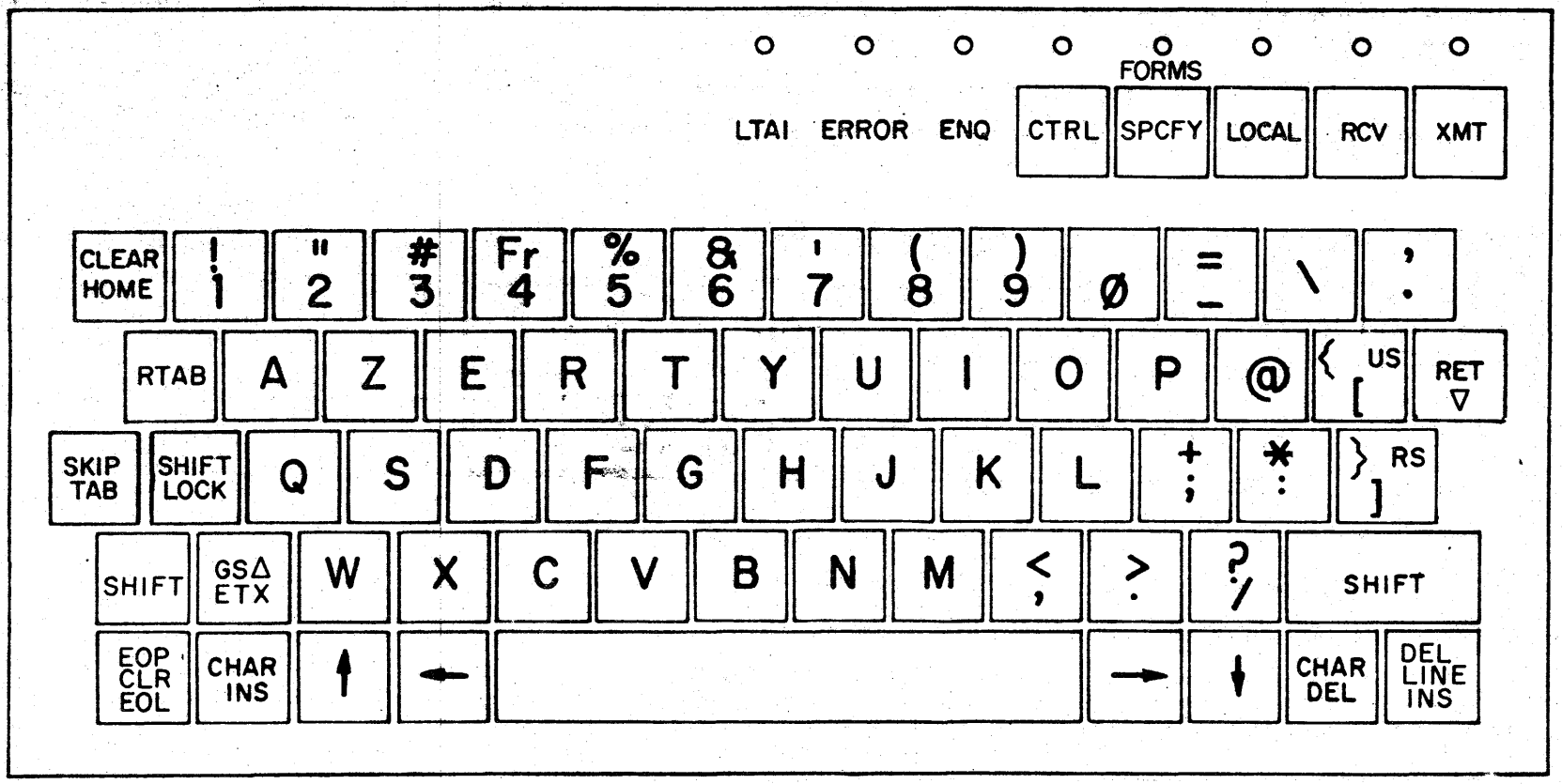

FIGURE 6-7. FRANCE AND BELGIUM TYPEWRITER KEYBOARD (OPTION)

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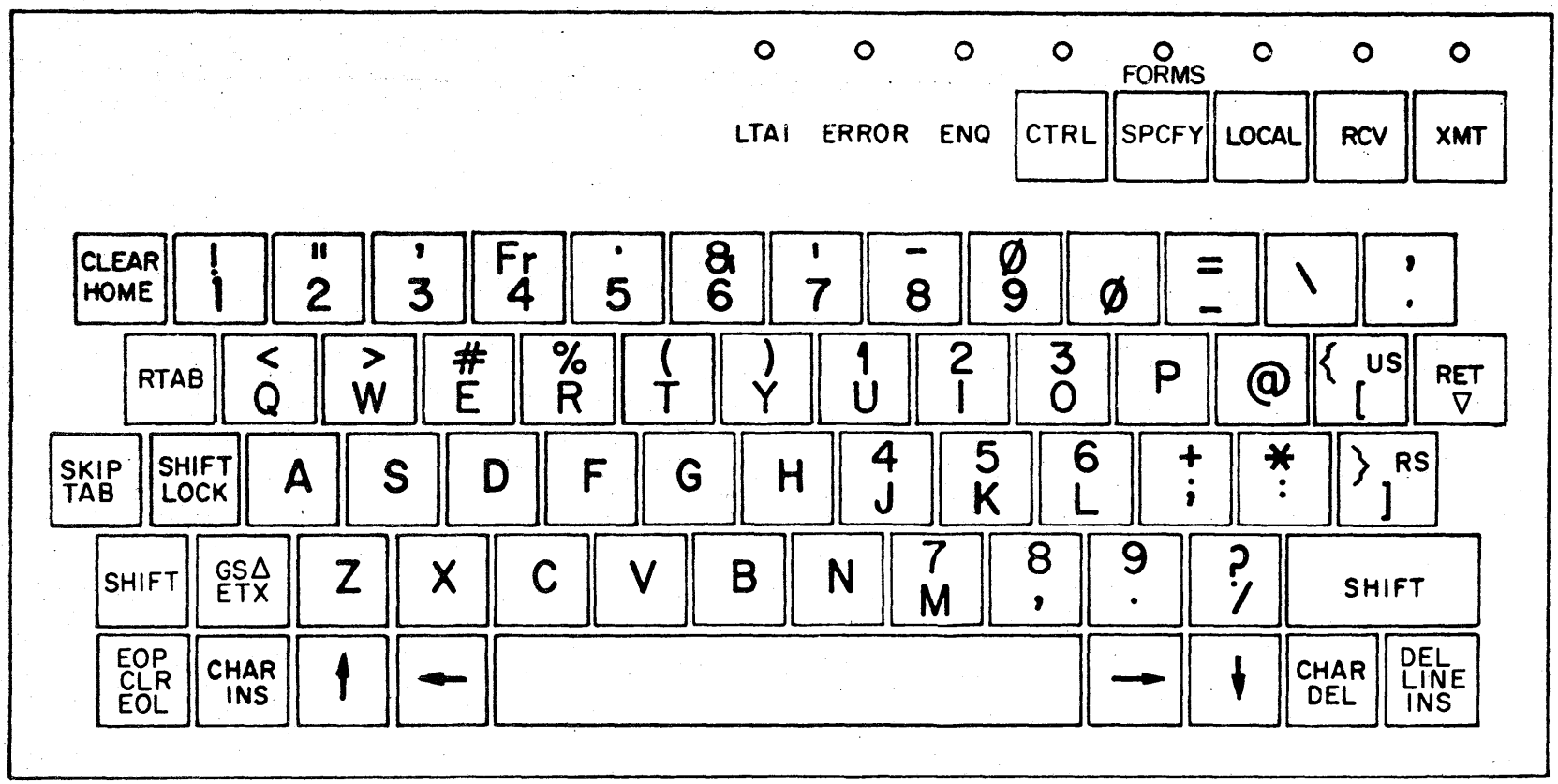

FIGURE 6-8. FRANCE AND BELGIUM DATA PREPARATION KEYBOARD

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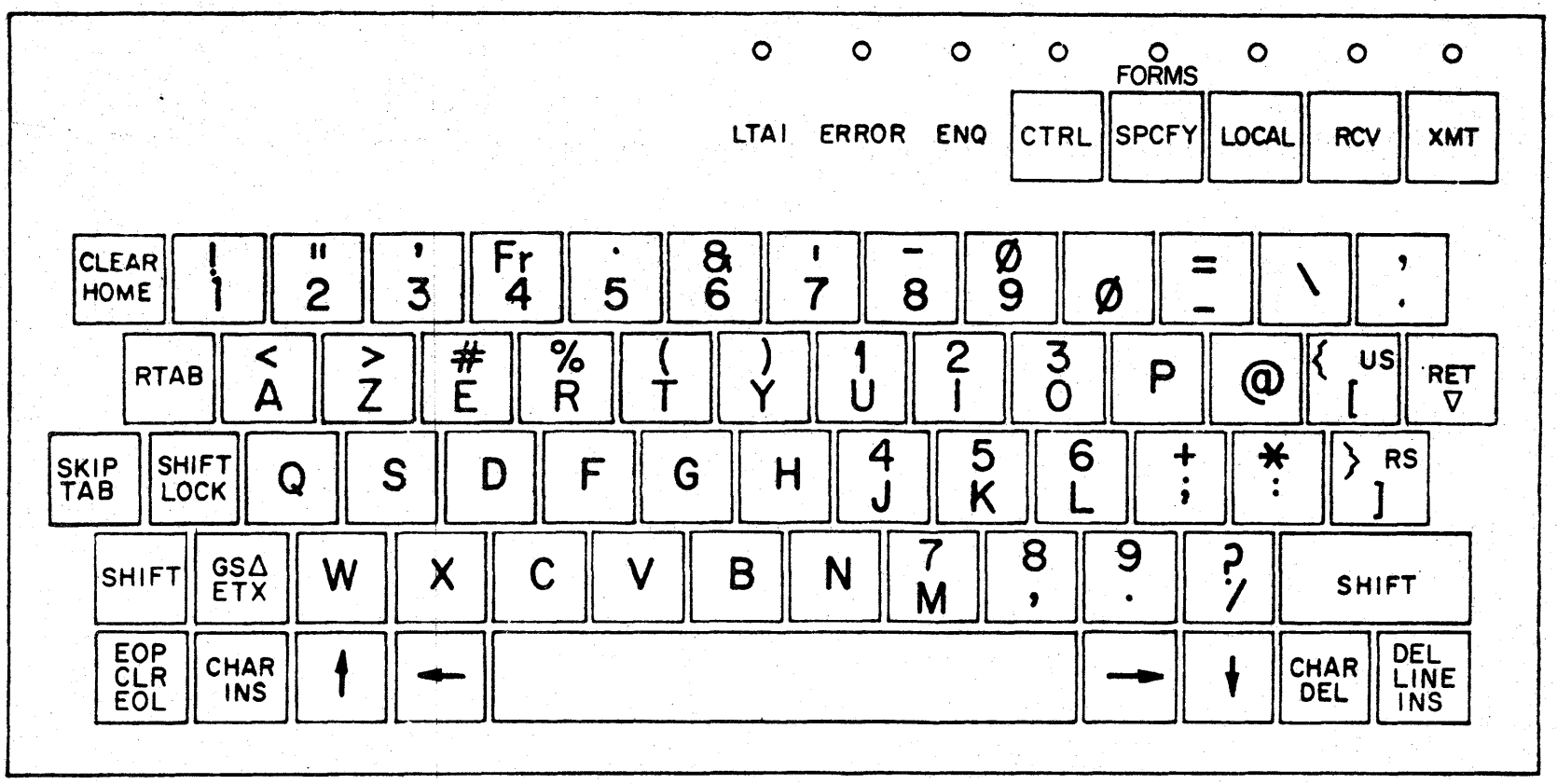

FIGURE 6-9. FRANCE AND BELGIUM DATA PREPARATION KEYBOARD (OPTION)

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TITLE ENG. SPEC. TD820 SERIES TERMINALS;
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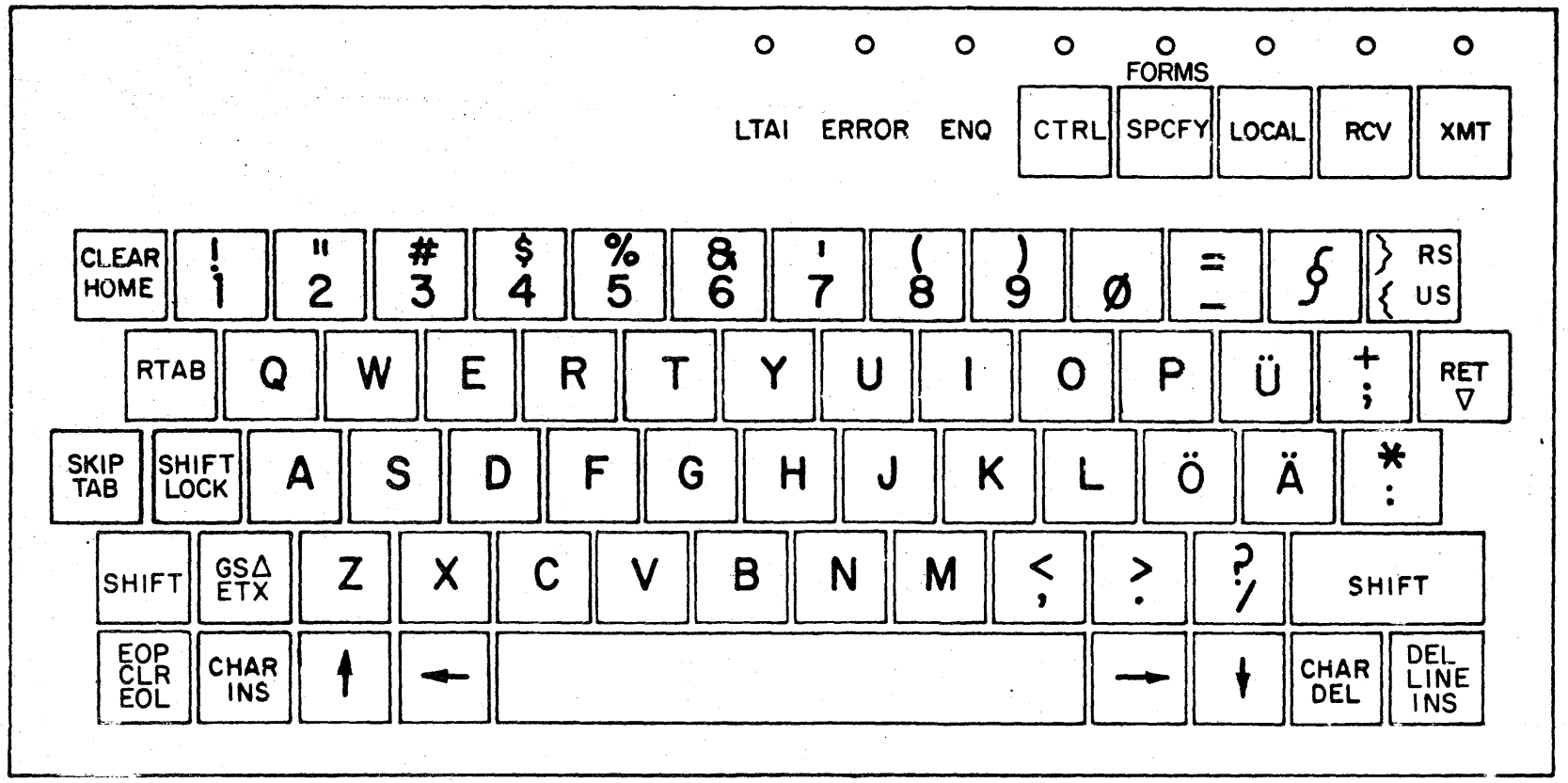

FIGURE 6-10. GERMANY, AUSTRIA, AND SWITZERLAND TYPEWRITER KEYBOARD

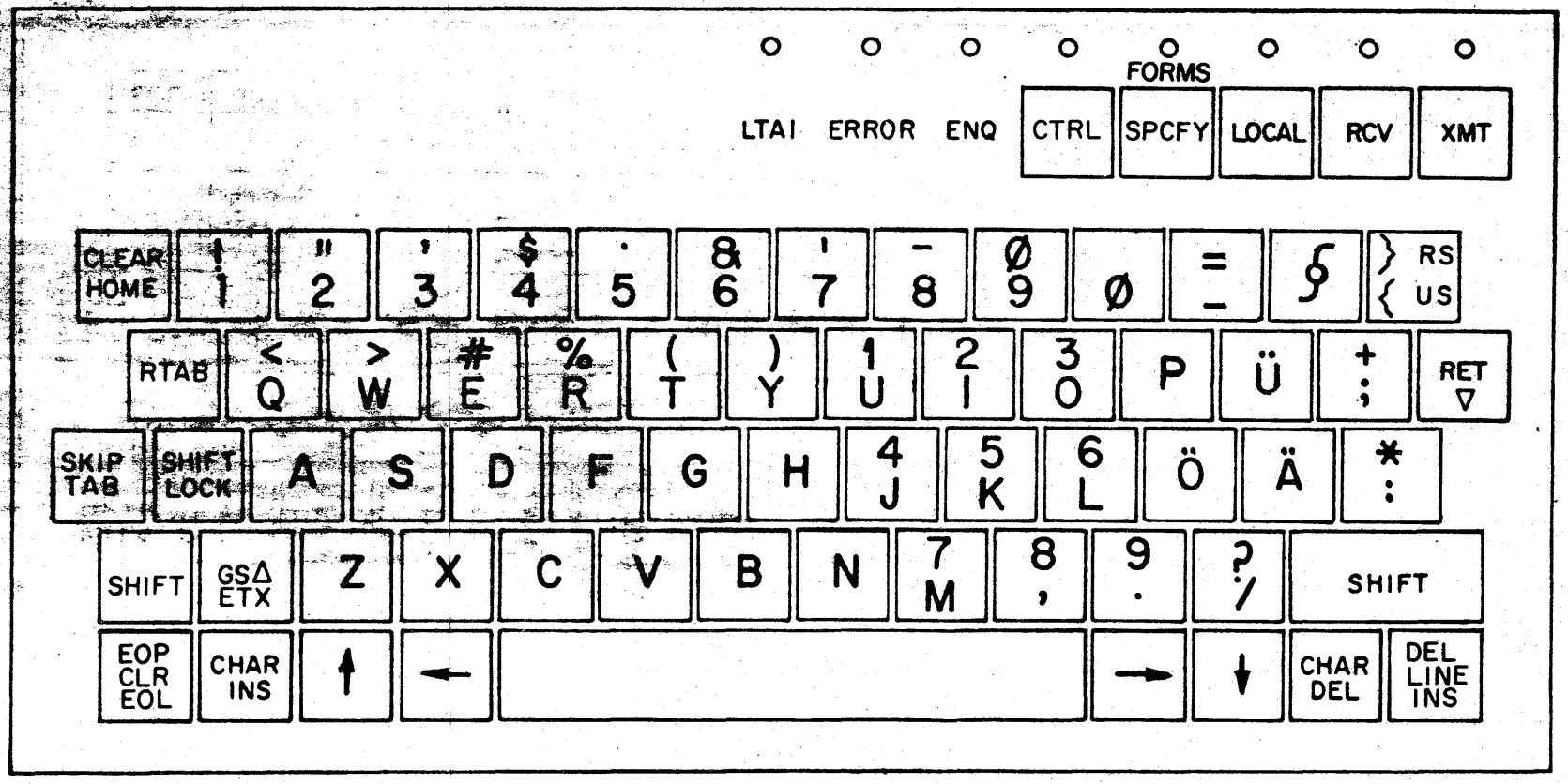

FIGURE 6-11. GERMANY, AUSTRIA, AND SWITZERLAND DATA PREPARATION KEYBOARD

LTR | REVISION

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CHECK F F & F | DATE
DSGN | DATE
APPROVED | DATE

CLASS CODE | TITLE ENG. SPEC. TD820 SERIES TERMINALS
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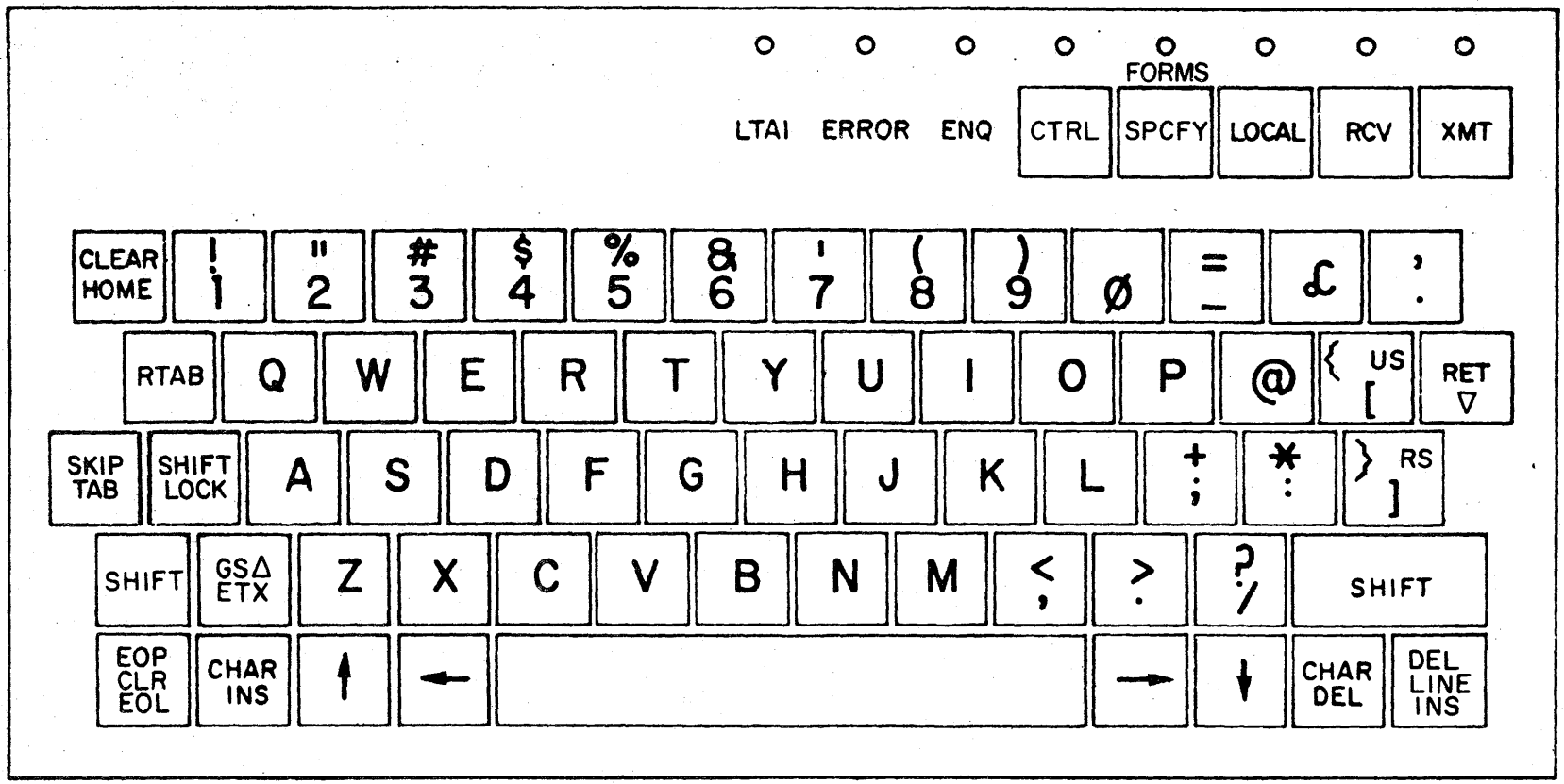

FIGURE 6-12. ITALY TYPEWRITER KEYBOARD

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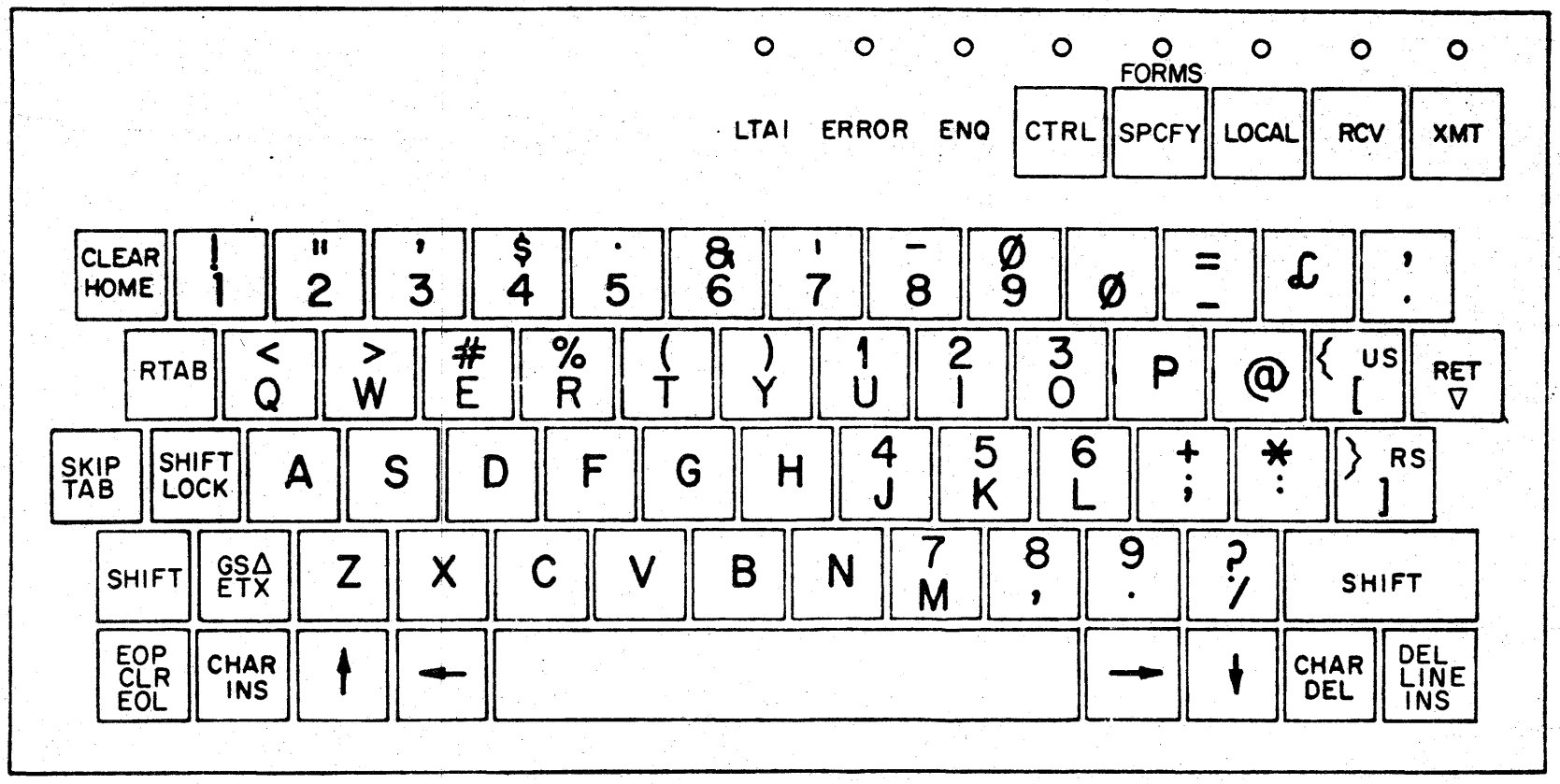

FIGURE 6-13. ITALY DATA PREPARATION KEYBOARD

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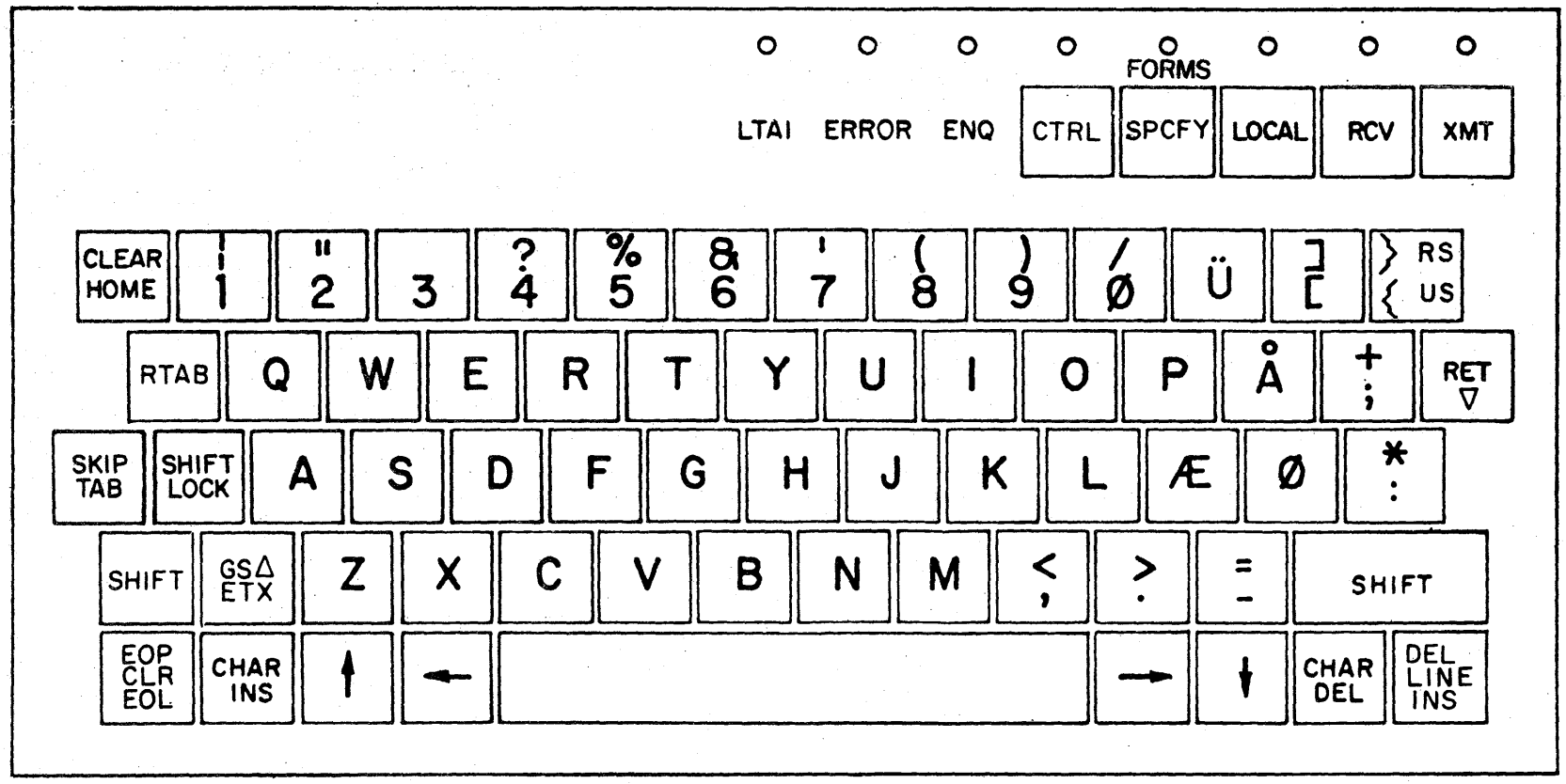

FIGURE 6-14. NORWAY AND DENMARK TYPEWRITER KEYBOARD

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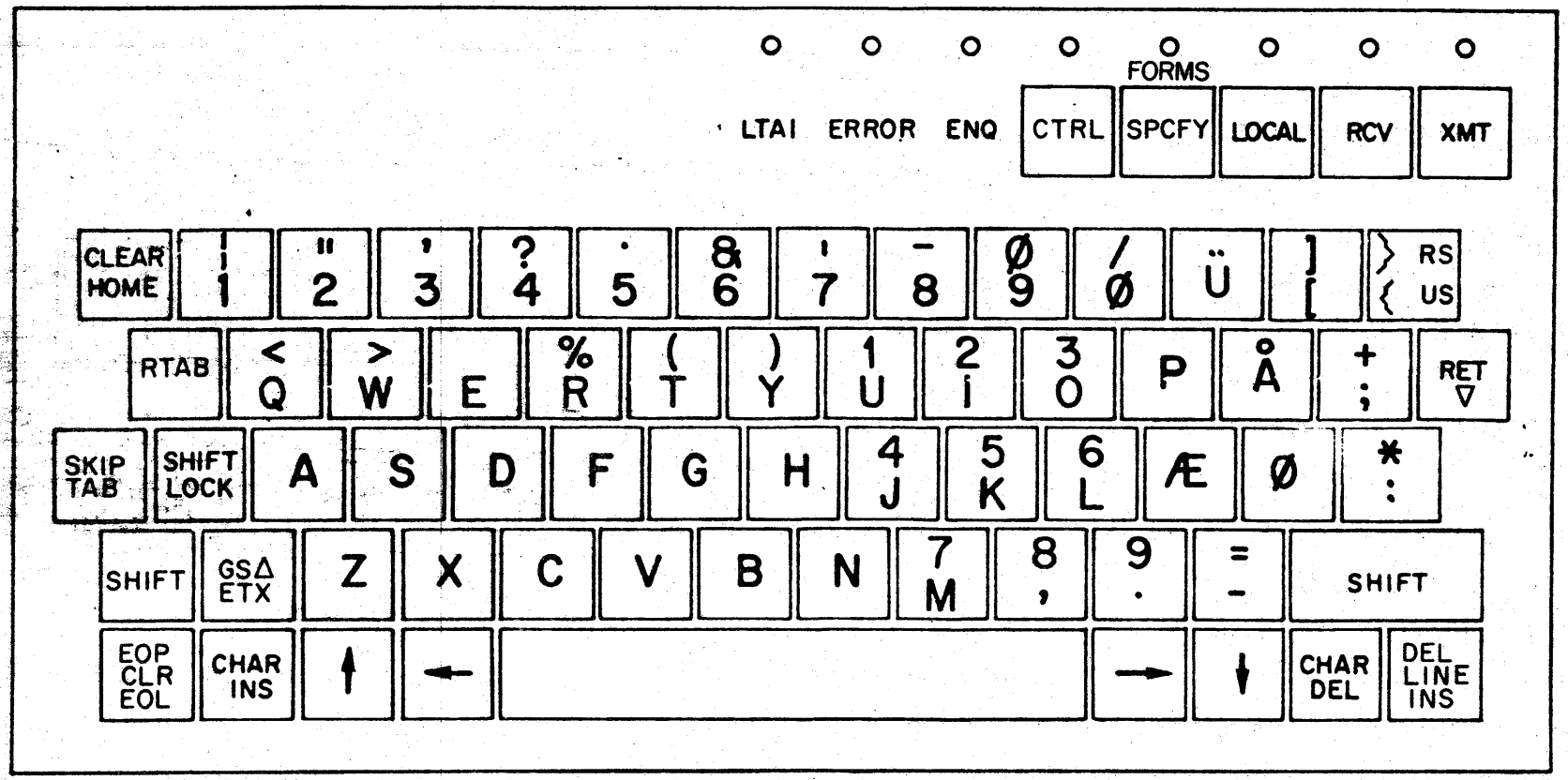

FIGURE 6-15. NORWAY AND DENMARK DATA PREPARATION KEYBOARD

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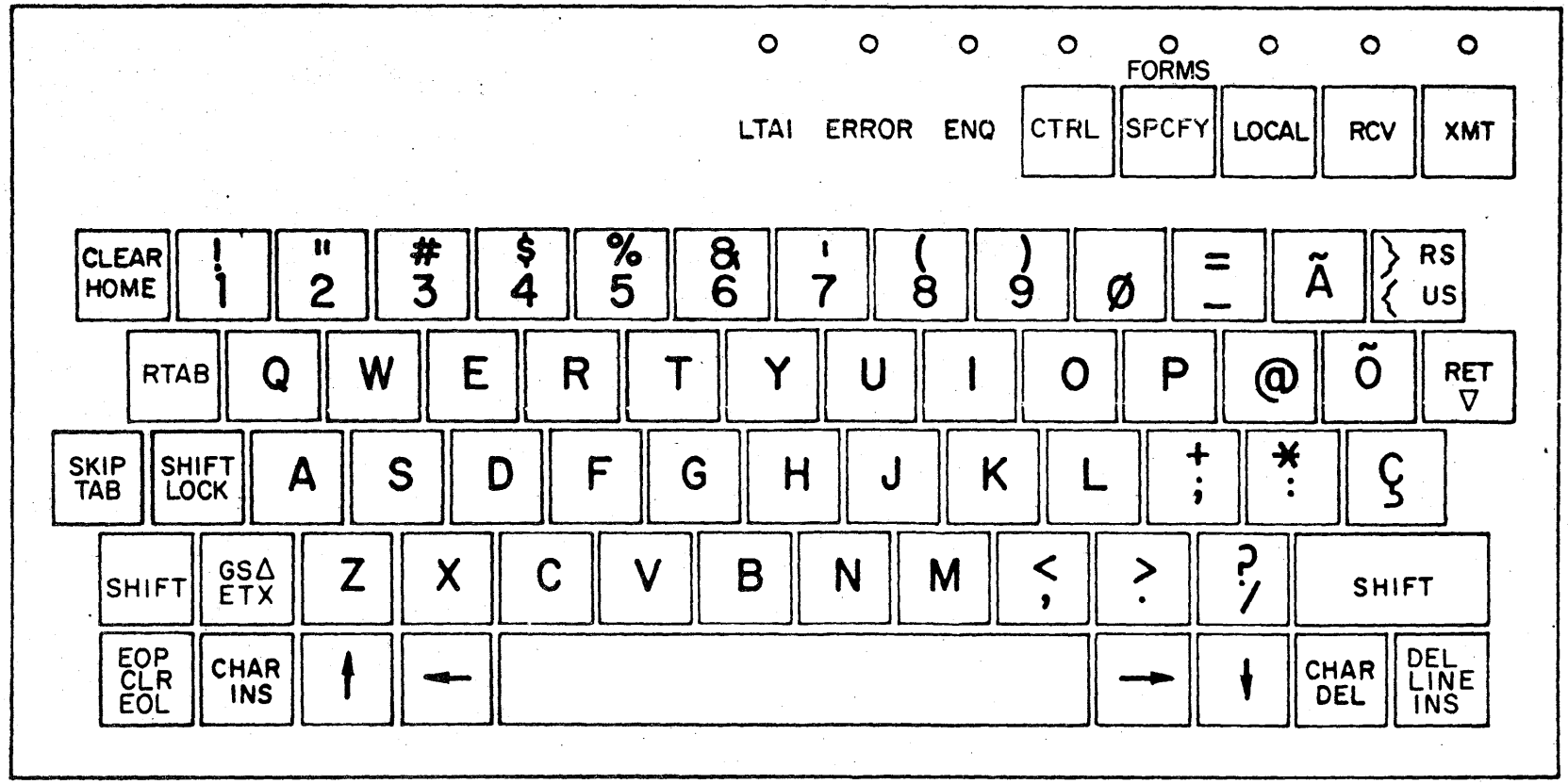

FIGURE 6-16. PORTUGAL AND BRAZIL TYPEWRITER KEYBOARD

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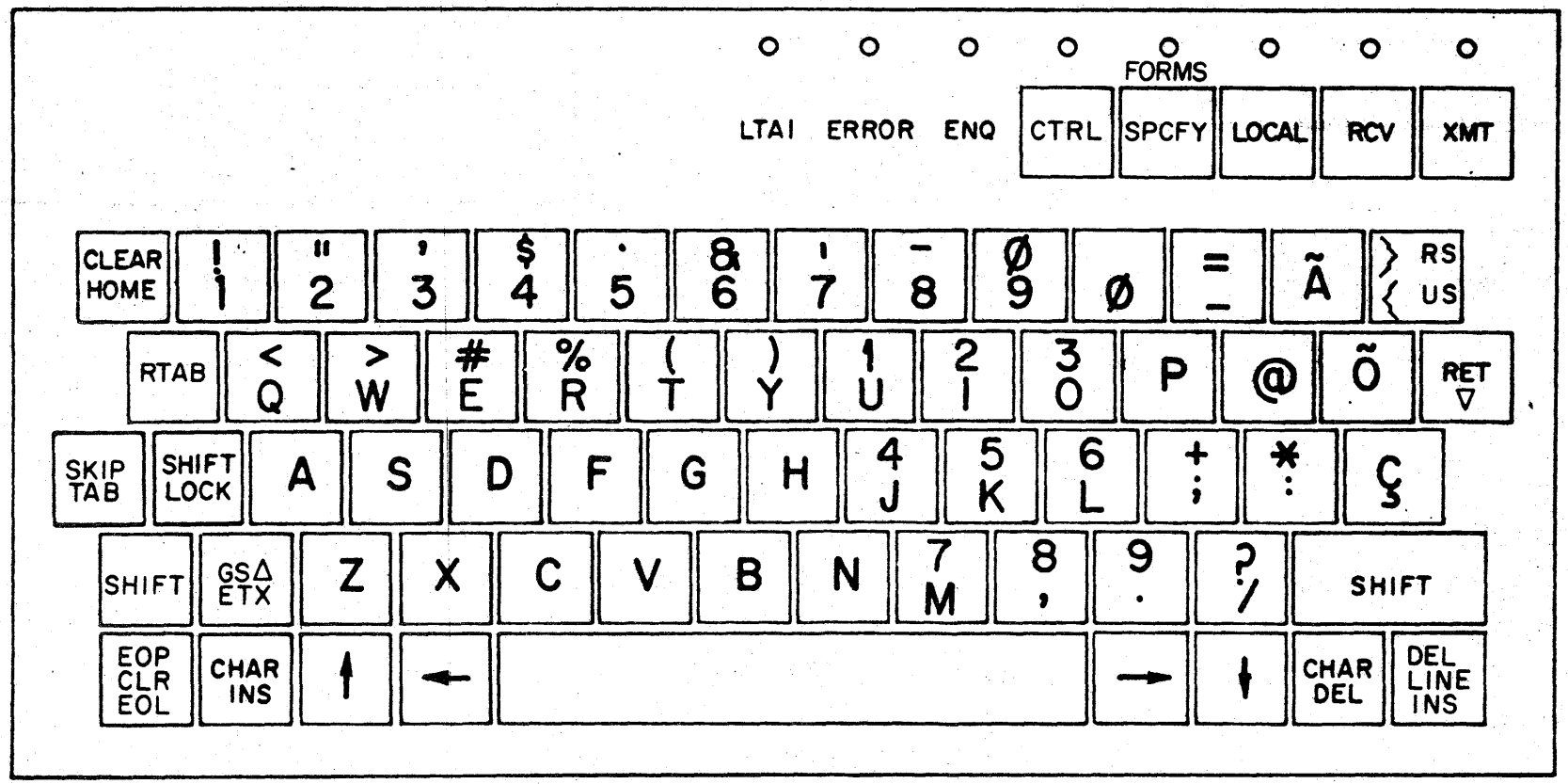

FIGURE 6-17. PORTUGAL AND BRAZIL DATA PREPARATION KEYBOARD

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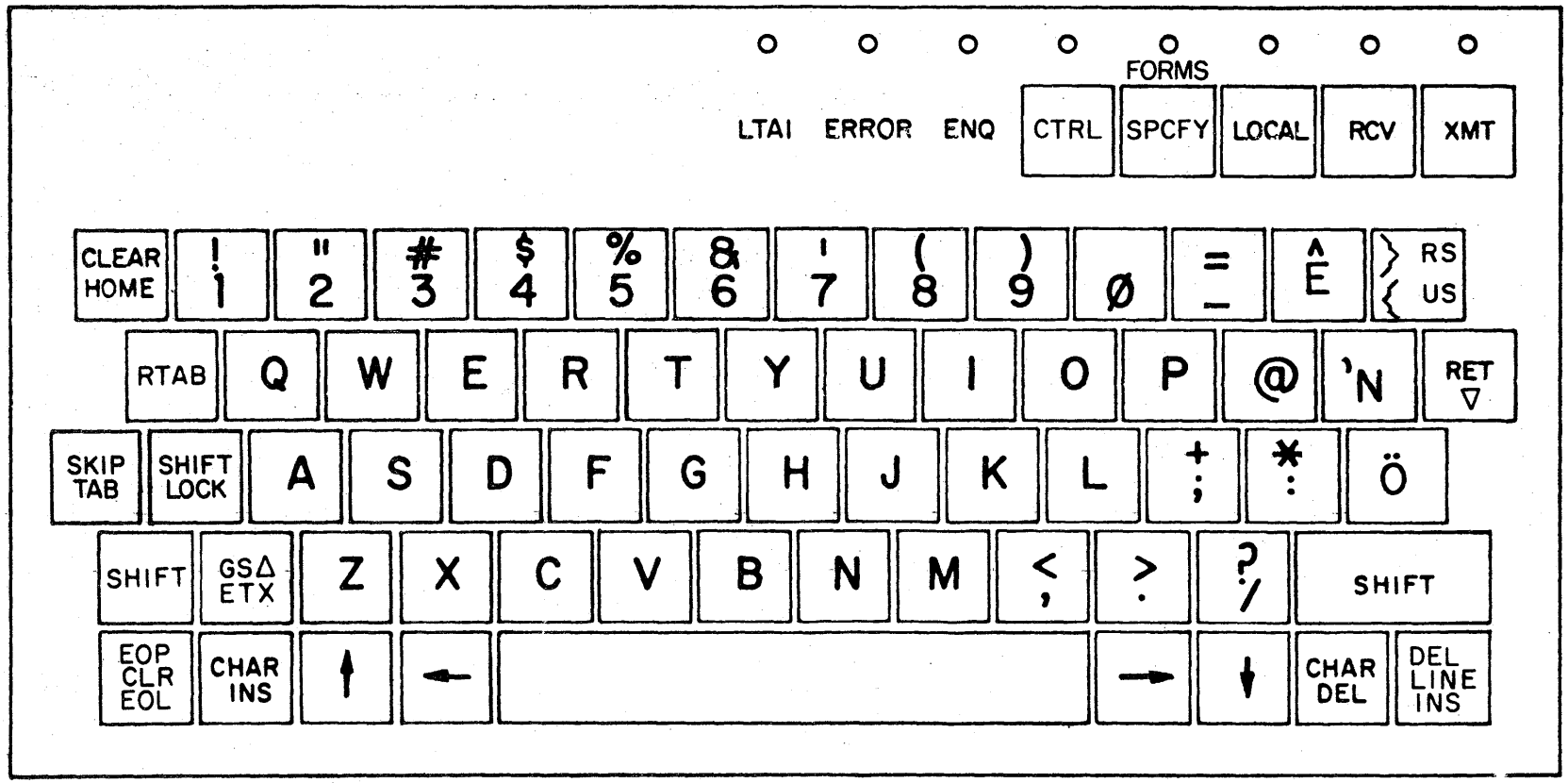

FIGURE 6-18. SOUTH AFRICA TYPEWRITER KEYBOARD

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LTR REVISION DATE DRAWN BY DATE CHK STD & REC DATE CHECK FF & F DATE DSGN DATE APPROVED

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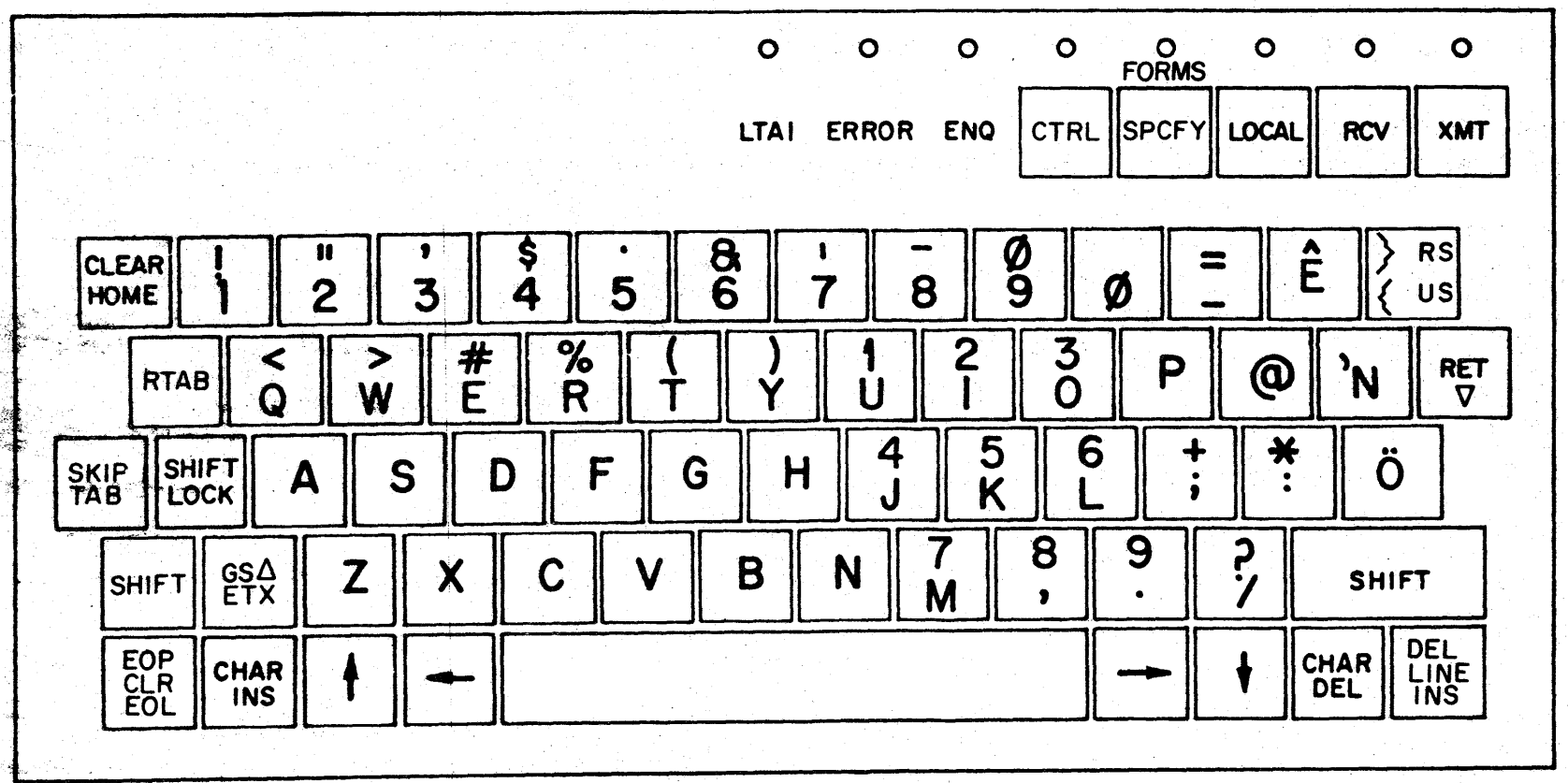

FIGURE 6-19. SOUTH AFRICA DATA PREPARATION KEYBOARD

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LTR REVISION

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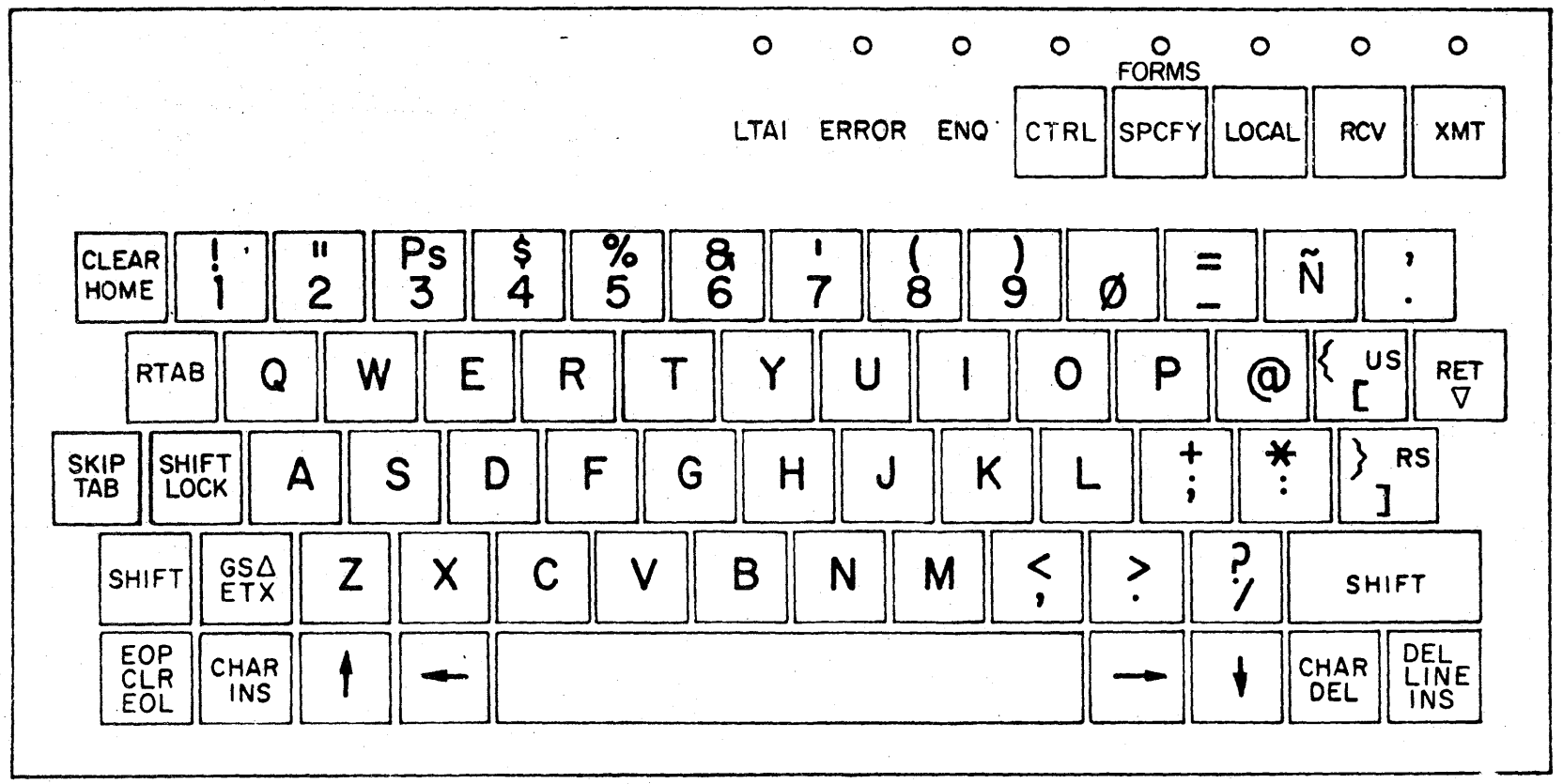

FIGURE 6-20. SPAIN AND LATIN AMERICA TYPEWRITER KEYBOARD

Burroughs Corporation
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LTR | REVISION | DATE | DRAWN BY | DATE | CHK STD & REC | DATE | CHECK F F & F | DATE | DSGN | DATE | APPROVED

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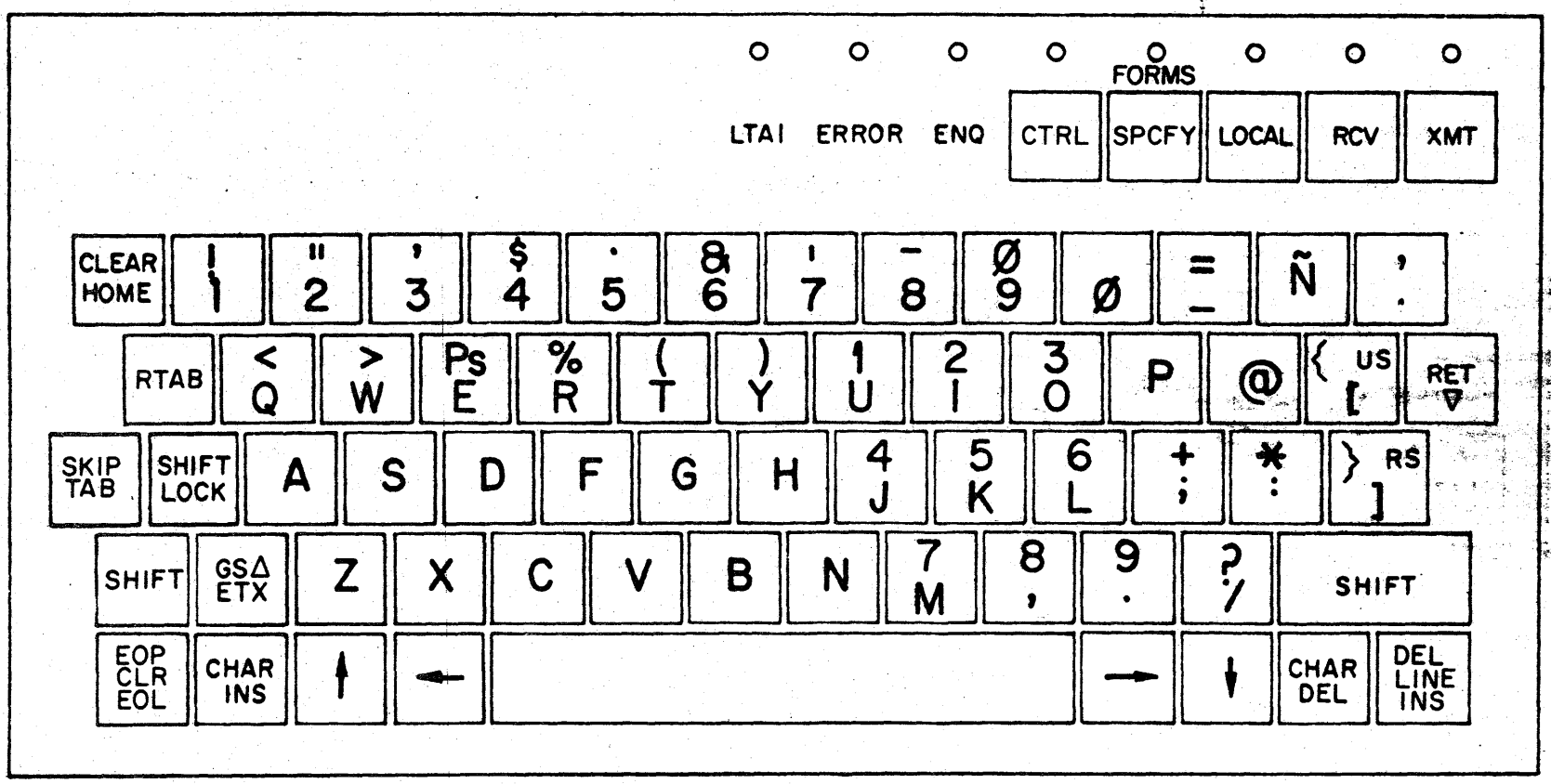

FIGURE 6-21. SPAIN AND LATIN AMERICA DATA PREPARATION KEYBOARD

Burroughs Corporation
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DRAWN BY DATE
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APPROVED DATE

CLASS CODE TITLE ENG. SPEC. TD820 SERIES TERMINALS
SIZE A
DWG NO 2553 2870
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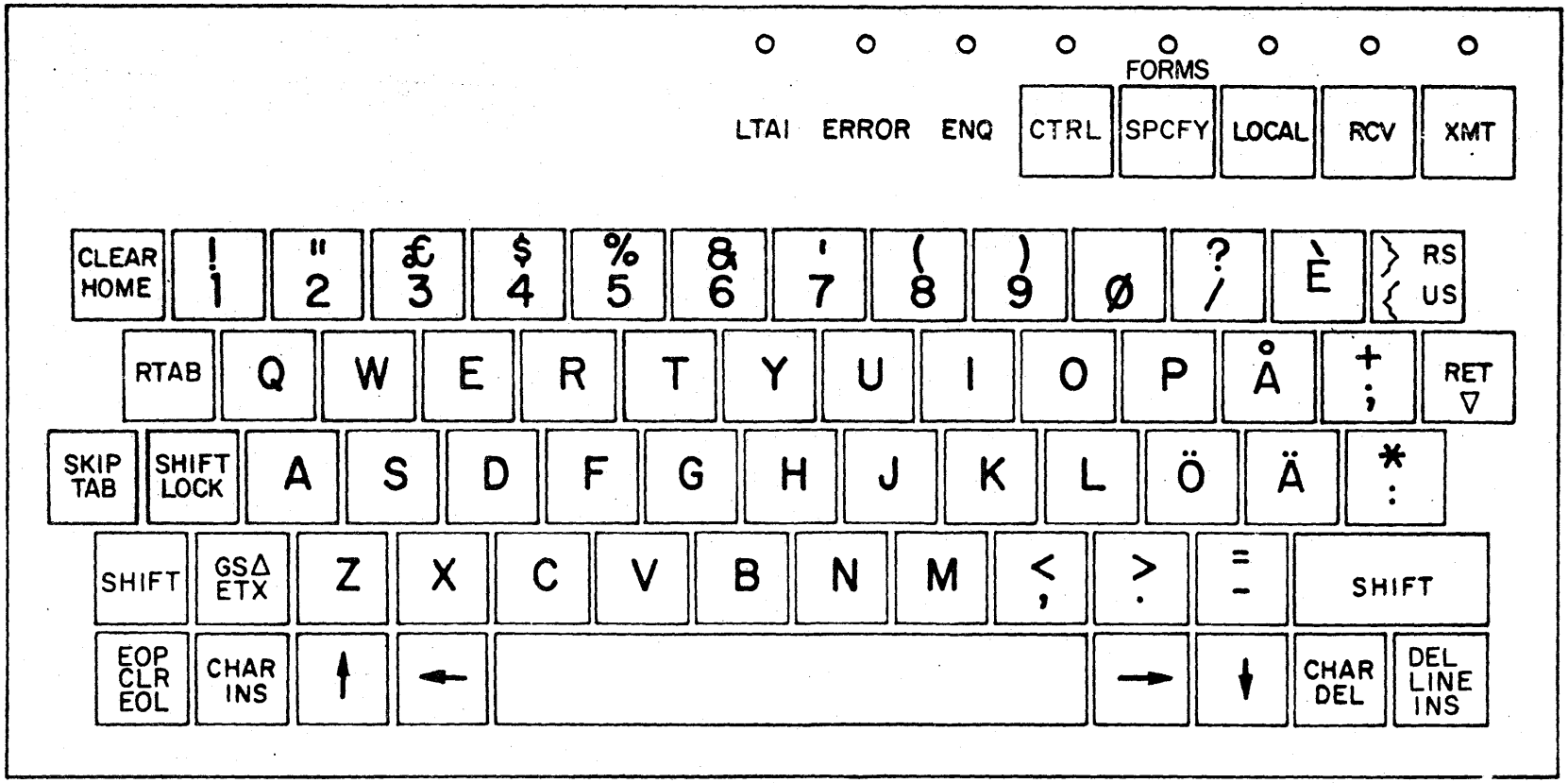

FIGURE 6-22. SWEDEN AND FINLAND TYPEWRITER KEYBOARD

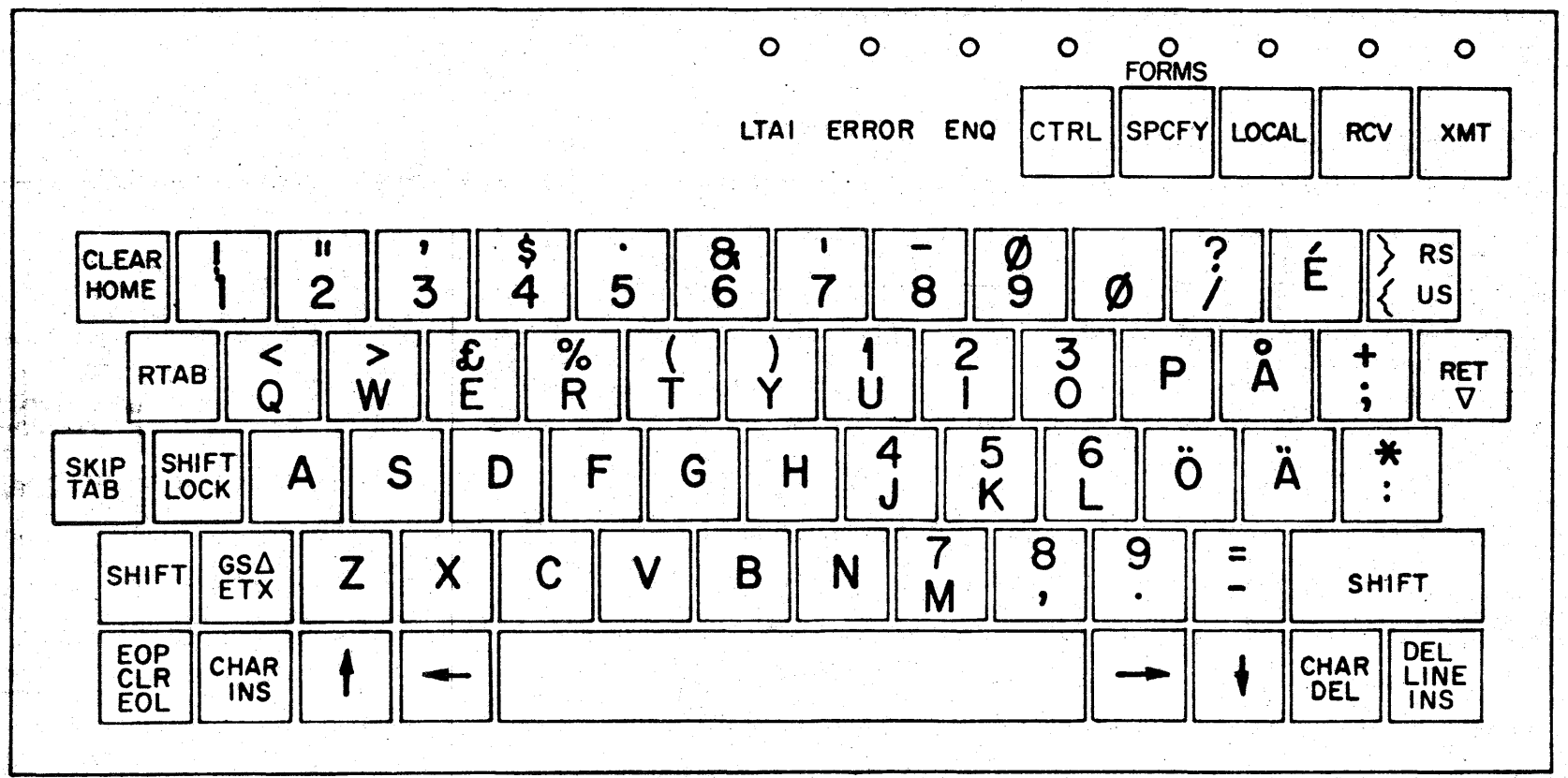

FIGURE 6-23. SWEDEN AND FINLAND DATA PREPARATION KEYBOARD

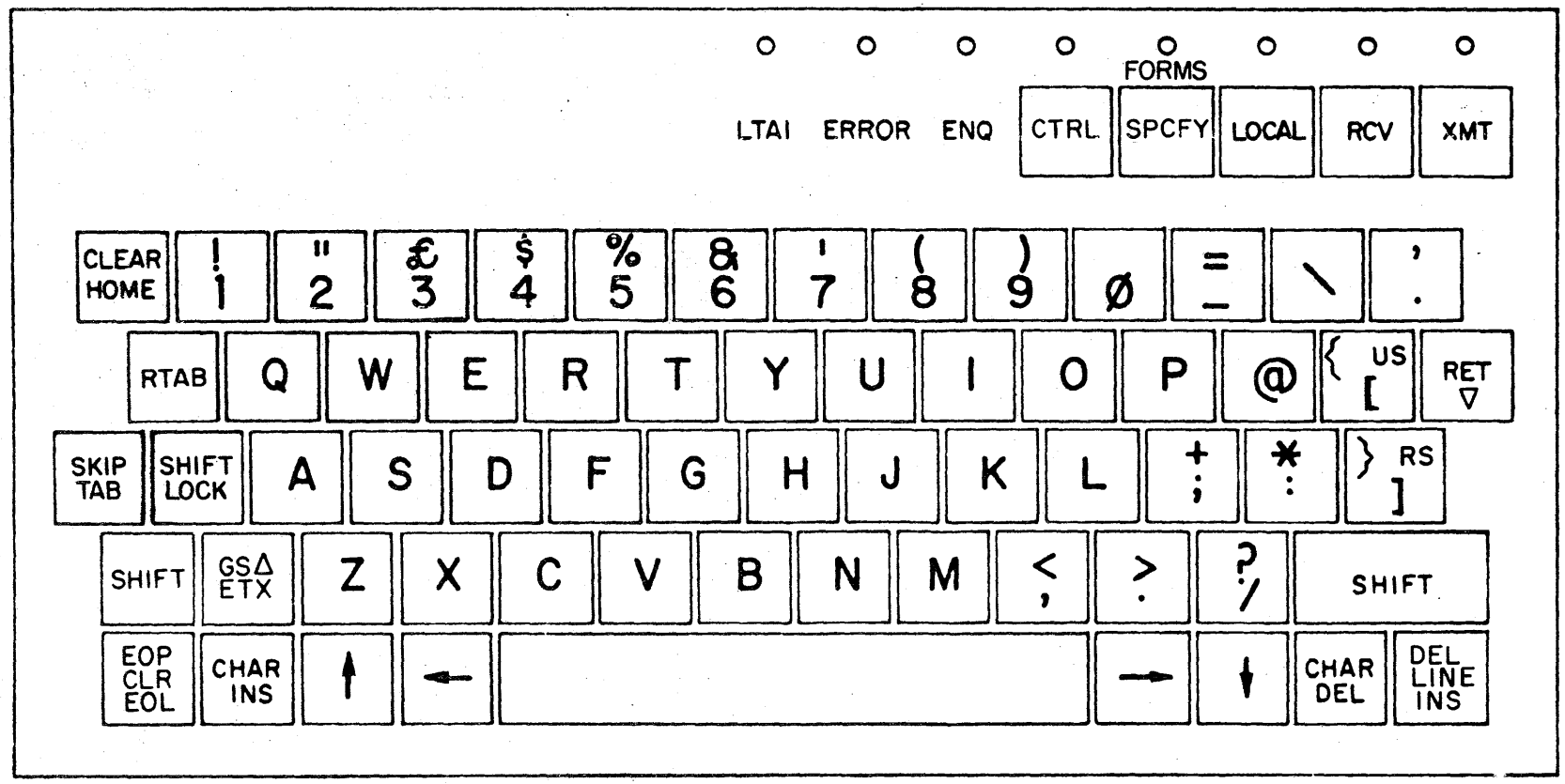

FIGURE 6-24. UNITED KINGDOM TYPEWRITER KEYBOARD

Burroughs Corporation
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PLAINFIELD, NEW JERSEY 07061 U.S. AMERICA

LTR REVISION DATE DRAWN BY DATE CHK STD & REC DATE CHECK F F & F DATE DSGN DATE APPROVED

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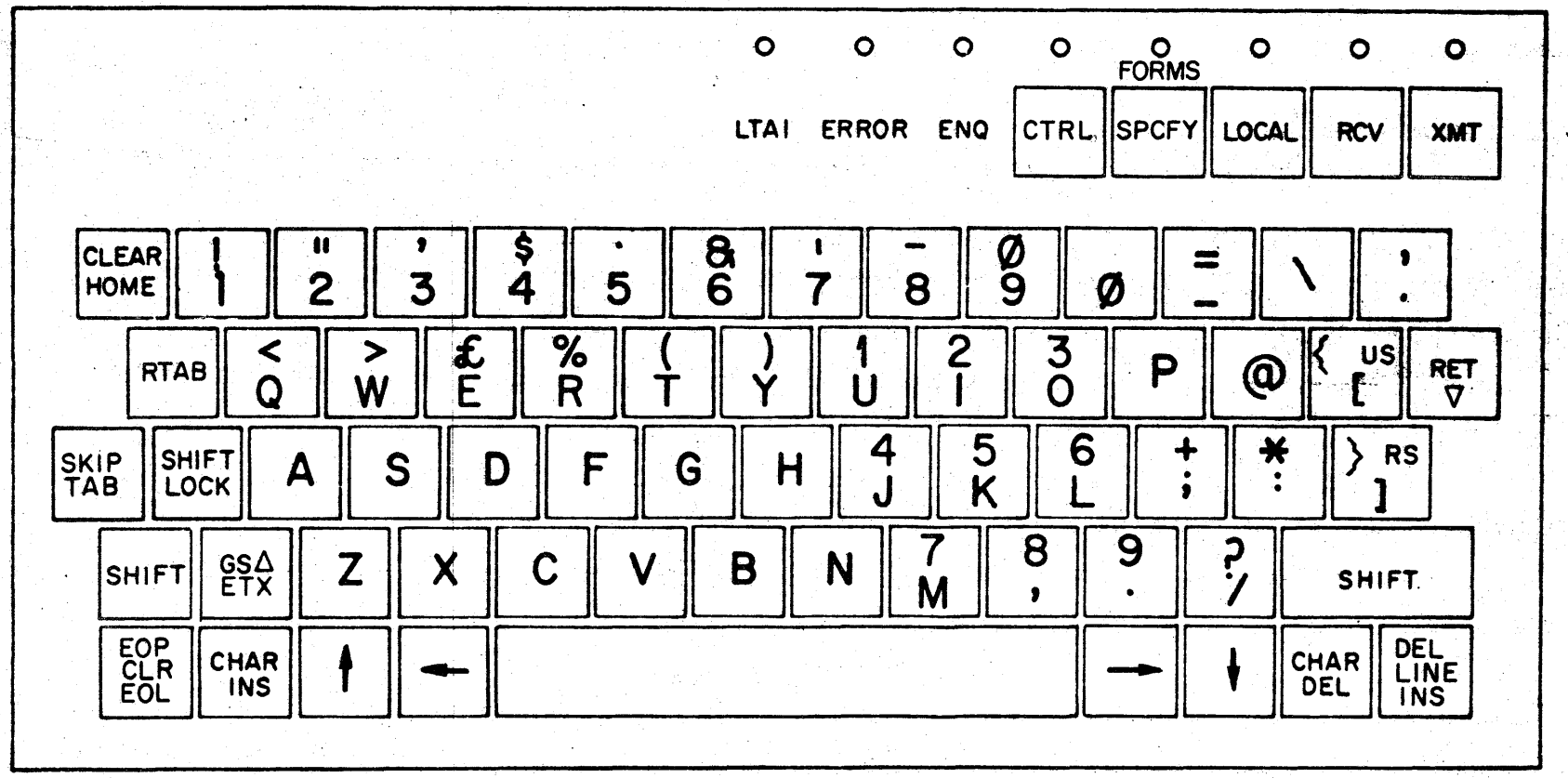

FIGURE 6-25. UNITED KINGDOM DATA PREPARATION KEYBOARD

Burroughs Corporation
ELECTRONIC COMPONENTS DIVISION
PLAINFIELD, NEW JERSEY 07061 U.S. AMERICA
LTR REVISION
DRAWN BY DATE
CHK STD SPEC DATE
CHECK FF&F DATE
DSGN DATE
APPROVED DATE
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COLUMN → / ROW ↓	2	3	4	5	6	7
0	Sp	0	ケ	P	ソ	マ
1	＊	1	A	Q	タ	ミ
2	゛	2	B	R	チ	ム
3	#	3	C	S	ツ	メ
4	o	4	D	T	テ	モ
5	¥	5	E	U	ト	ヤ
6	ア	6	F	V	ナ	ユ
7	イ	7	G	W	ニ	ヨ
8	ウ	8	H	X	ヌ	ラ
9	エ	9	I	Y	ネ	リ
10	オ	カ	J	Z	ノ	ル
11	＋	キ	K	コ	ハ	レ
12	,	(	L	サ	ヒ	ロ
13	−	=	M	シ	フ	ワ
14	.	)	N	ス	ヘ	ン
15	／	ク	O	セ	ホ	?

18326

FIGURE 6-26. JAPANESE (KATAKANA) CHARACTER SET

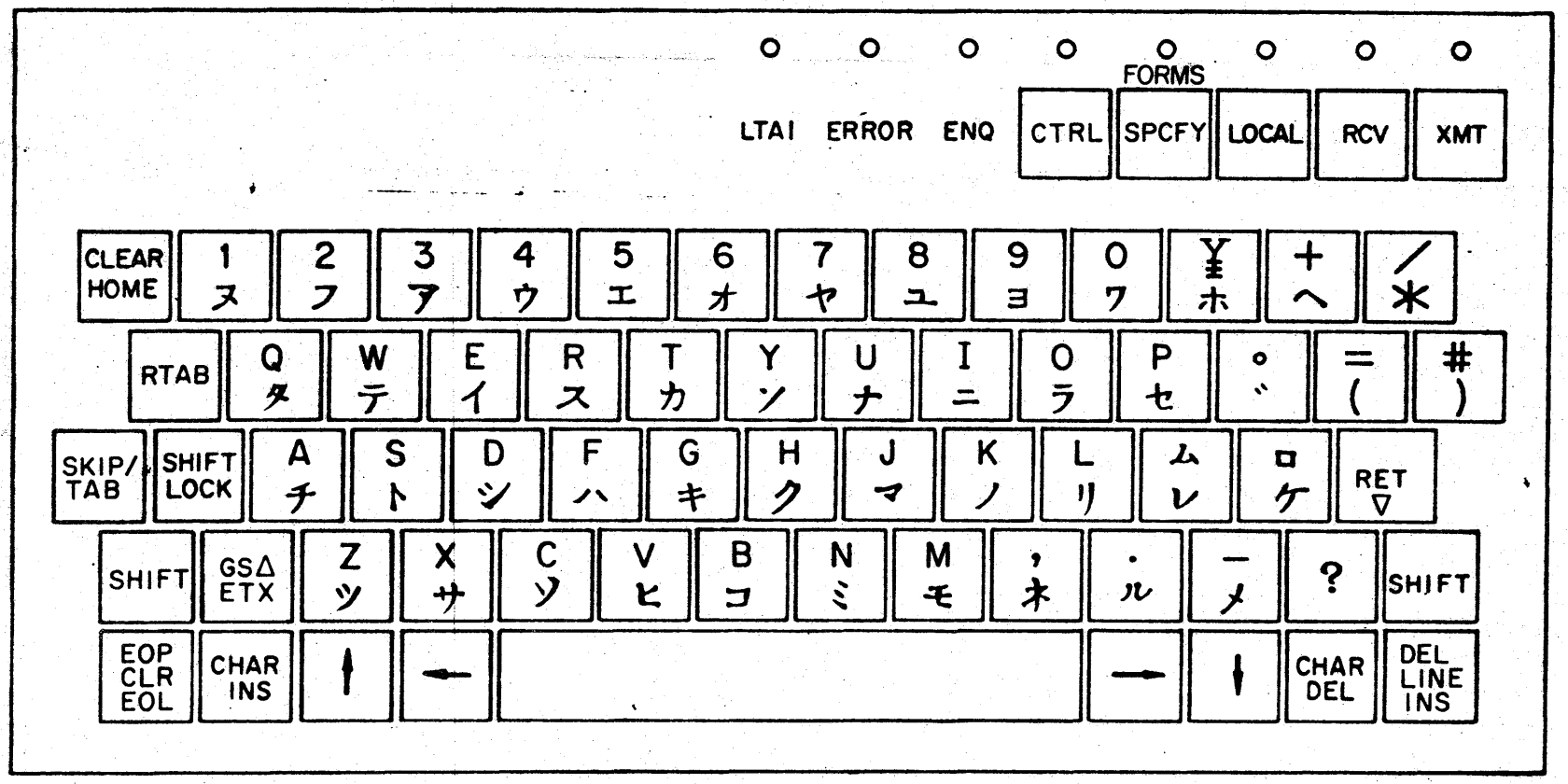

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FIGURE 6-27. JAPANESE (KATAKANA) KEYBOARD

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Row \ Column →	2	3	4	5	6	7
0	SP	Ø	@	P	Ю	П
1	!	1	A	Q	А	Я
2	"	2	B	R	Б	Р
3	#	3	C	S	Ц	С
4	$	4	D	T	Д	Т
5	%	5	E	U	Е	У
6	&	6	F	V	Ф	Ж
7	'	7	G	W	Г	В
8	(	8	H	X	Х	Ь
9	)	9	I	Y	И	Ы
10	*	:	J	Z	Й	З
11	+	;	K	[	К	Ш
12	,	<	L	\	Л	Э
13	-	=	M	]	М	Щ
14	.	>	N	^	Н	Ч
15	/	?	O	_	О	DEL

FIGURE 6-28. LATIN/CYRILLIC (RUSSIAN) CHARACTER SET

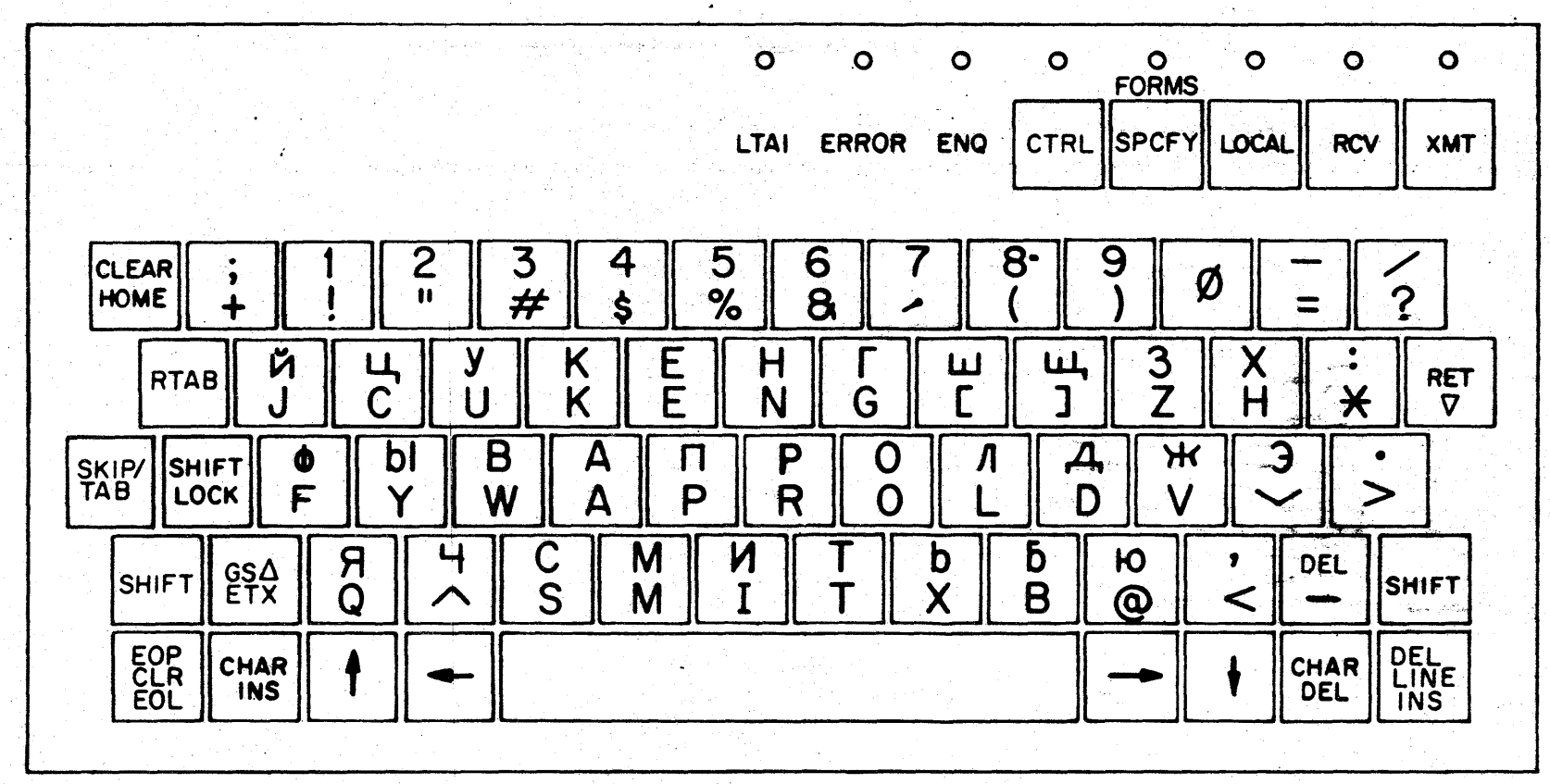

FIGURE 6-29. LATIN/CYRILLIC (RUSSIAN) KEYBOARD

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ELECTRONIC COMPONENTS DIVISION
PLAINFIELD, NEW JERSEY 07061 U.S. AMERICA

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CLASS CODE TITLE ENG. SPEC. TD820 SERIES TERMINALS

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ECD674

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	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
	HEX	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000	0	NUL	DLE			SP	&	-									0
0001	1	SOH	DC1					/		a	j			A	J		1
0010	2	STX	DC2		SYN					b	k	s		B	K	S	2
0011	3	ETX	DC3							c	l	t		C	L	T	3
0100	4		RES*							d	m	u		D	M	U	4
0101	5	HT	NL*		BYP*					e	n	v		E	N	V	5
0110	6		BS	ETB	LF	RS*				f	o	w		F	O	W	6
0111	7	DEL		PRE / ESC	EOT					g	p	x		G	P	X	7
1000	8		CAN							h	q	y		H	Q	Y	8
1001	9		EM							i	r	z		I	R	Z	9
1010	A						!		:								
1011	B	VT				.	$	,	#								
1100	C	FF				<	*	%	@								
1101	D	CR	IGS*	ENQ	NAK	(	)	_*	'			[	]				
1110	E	SO	IRS*	ACK		+	;	>	=								
1111	F	SI	IUS*	BEL*		¦	¬*	?	"								

* BEL = CON
NL = ~
IGS = GS
IRS = RS
IUS = ITB
BYP = ESC
RS = DC4
¬ = }
_ = {
RES = `

36841

FIGURE 6-30. IBM 3270 EBCDIC CHARACTER CODING

b_7 → b_6 → b_5 →					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b_4 ↓	b_3 ↓	b_2 ↓	b_1 ↓	COL → / ROW ↓	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	ø	@	P	`	p/POL
0	0	0	1	1	SOH	DC 1	!	1	A	Q	a	q/SEL
0	0	1	0	2	STX	DC 2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC 3	#	3	C	S	c	s/FSL
0	1	0	0	4	EOT	DC 4	$	4	D	T	d	t/BSL
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL*	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF		*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF		,	<	L	\	l	|
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

36839

*CON - ALTERNATE CODE FOR CONTENTION.

NOTE:
SEE 3.3.1.2. IN REFERENCE TO LOWER CASE ALPHABETIC CHARACTERS.

FIGURE 6-31. CHARACTER CODING, USASCII

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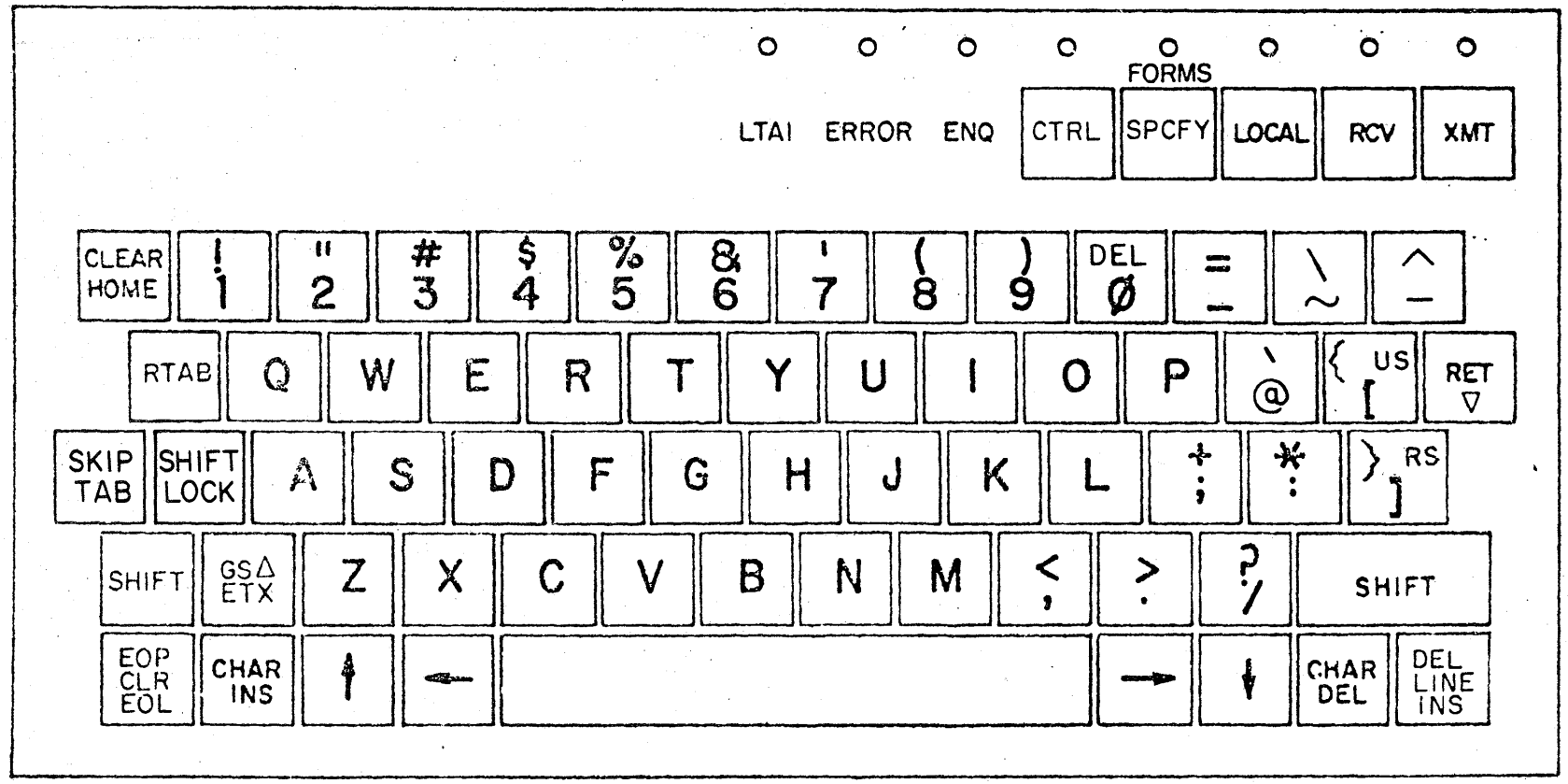

FIGURE 6-32. U.S. TYPEWRITER KEYBOARD, ASCII

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TITLE ENG. SPEC. TD820 SERIES TERMINALS
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EDC274

APPENDIX 1. TD820 COMPATIBILITY FEATURES

	REQUIRED TD820 FEATURES FOR COMPATIBILITY			
	B 9353	B 9352	DL1	DL2-4
DATA TRANSMISSION				
Non-Forms				
Cursor to End of Screen	x	x		
Forms				
All Unprotected Data	x	x	x	
RECEIVED DATA				
ETX Char. not Stored			x	x
SOH Clears data and Homes Cursor				x
STX Clears data and Homes Cursor			x	
DELIMITERS CODES				
Braces ({ , })				x
Brackets ([,])			x	
CONTROL CHARACTERS				
VT Set variable TABs		x		
CR Character not stored			x	x
LF Following CR active				x
DC2 Enable Forms			x	x
LF New Line, Character Not Stored	x			
DC1 Clear to End of Line		x		
DC2 Cursor space Right		x		
FF Clear variable Tabs		x		
DLE P Print Control Char.				x (DL3 and DL4)
ESC 4 Print Control Char.		x		
OTHER				
Inhibit Lower Case	x	x	x	
Local/Receive Switch Action		x		
Variable tabulation		x		
Fixed tabulation	x		x	x

APPENDIX 2. BETWEEN TD820 AND OTHER BURROUGHS DISPLAY TERMINALS

1. B 9353

(Note in order not to exceed screen capacity, style TD822 must be applied. If AIC application, TD820 requires Search Feature and Auxiliary 10-key pad)

DATA TRANSMISSION

Non-Forms - Select One

Cursor to End of Screen or GS
or
Home to cursor

CONTROL CHARACTERS

New Form, LF character not stored in memory.

OTHER

Inhibit lower case

INCOMPATIBLE FEATURES

a.

Keyboard and Display Code	Character B 9353	Differences TD820
2/1	≥	!
2/7	≤	'
5/12	χ	~
5/14	≠	}
5/15	←	{
7/12	↑	¦

b. TD820 does not recognize control character VT in B 9353 environment.

c. B 9353 provides 25 lines of display VS 24 lines with TD820.

d. TD820 does not provide option of AD1-AD2 before ACK and NAK.

e. Programmable Cursor is ESC " POS LINE on TD820, and ESC : POS LINE on B 9353.

f. Print Option is ESC : on TD820 and Bit 3 in Address on B 9353.

LTR	REVISION

APPENDIX 2 (Cont'd)

2. B 9352

DATA TRANSMISSION

Non-Forms - Cursor to ETX or end of screen

Forms - Unprotected data, complete screen

CONTROL CHARACTERS

VT sets variable tab position

DC1 Clear to end of line

DC2 Cursor space right

FF Clear variable column tab stops

ESC4 Activates printer

OTHER

Variable column tabulation

Inhibit lower case

Local/Receive switch action - Field Engineering Set-up

INCOMPATIBLE FEATURES

a.

Keyboard and Display Code	Character B 9352	Differences TD820
2/1	≥	!
2/7	ı	'
5/12	χ	~
5/14	≠	}
5/15	←	{

b. B 9352 has capability of not requiring message header before STX

APPENDIX 2 (Cont'd)

3. TD 700 DL1

DATA TRANSMISSION

Non-Forms - Home to Cursor

Forms - All unprotected data

RECEIVED DATA

STX Clears data and Homes the cursor

ETX Character is not stored in memory

DELIMITERS

[ ] (Displays as ▷ ◁ on TD820)

CONTROL CHARACTERS

DC2 Enable Forms

CR character not stored in memory

OTHER

Inhibit lower case

INCOMPATIBLE FEATURES

a.

Keyboard and Display Code	Character TD700 DL1	Differences TD820
5/14	{	}
5/15	}	{

APPENDIX 2 (Cont'd)

4. TD700 DL2 thru DL4 and TD800 DL2 thru DL4

DATA TRANSMISSION

Non-Forms: Home to Cursor

Forms: All unprotected data Home to Cursor

DELIMITERS

{ } or US, RS (Displayed as ▷ ◁ from CPU; as { } from keyboard)

CONTROL CHARACTERS

VT - No effect

Fixed tab 1, 9, etc.

CR same as New Line; character not stored

LF following CR is not ignored

DLE used as prefix in control sequence

DLE P activates printer (DL3 and DL4)

Transmission Number

@ and A or 0 and 1 or None

Received Data

ETX character not stored.

LTR	REVISION

APPENDIX 2 (Cont'd)

3. TD 700 DL1

DATA TRANSMISSION

Non-Forms - Home to Cursor

Forms - All unprotected data

RECEIVED DATA

STX Clears data and Homes the cursor

ETX Character is not stored in memory

DELIMITERS

[ ] (Displays as ▷ ◁ on TD820)

CONTROL CHARACTERS

DC2 Enable Forms

CR character not stored in memory

OTHER

Inhibit lower case

INCOMPATIBLE FEATURES

a.

Keyboard and Display Code	Character TD700 DL1	Differences TD820
5/14	{	}
5/15	}	{

APPENDIX 2 (Cont'd)

4. TD700 DL2 thru DL4 and TD800 DL2 thru DL4

DATA TRANSMISSION

Non-Forms: Home to Cursor

Forms: All unprotected data Home to Cursor

DELIMITERS

{ } or US, RS (Displayed as ▷ ◁ from CPU; as { } from keyboard)

CONTROL CHARACTERS

VT - No effect

Fixed tab 1, 9, etc.

CR same as New Line; character not stored

LF following CR is not ignored

DLE used as prefix in control sequence

DLE P activates printer (DL3 and DL4)

Transmission Number

@ and A or 0 and 1 or None

Received Data

ETX character not stored.

DOWLER

TABLE I.1-5. SOFTWARE CONTROLLABLE ESC FUNCTIONS

Notes: 1. ESC - Used as a prefix in a control sequence from communication control.

2. CTRL Key - Used as a prefix in a control sequence from the keyboard.

3. * - Column = $(32)_2 + (n)_2$ where $0 \leq n \leq 79$

Row = $(32)_2 + (n)_2$ where $0 \leq n \leq 23$

4. ** - N identifies tape drive: 0 = Drive 1, 1 = Drive 2

5. *** - Block numbers on tape range between 000 and 999.

1	2	3	4	Function
CTRL or ESC	!			Character insert/line
CTRL or ESC	@			Character insert/page
CTRL or ESC	%			Character delete/line
CTRL or ESC	P			Character delete/page
CTRL or ESC	S			Roll up
CTRL or ESC	T			Roll down
CTRL or ESC	M			Line delete
CTRL or ESC	L			Line insert
CTRL or ESC	K			Clear to end of line
CTRL or ESC	J			Clear to end of page
CTRL or ESC	#			Clear all variable tab stops
CTRL or ESC	"	Pos	Line	Programmable cursor*
CTRL or ESC	;			Print complete screen
CTRL or ESC	:			Print unprotected data
CTRL or ESC	4	N**		Write received data on tape
CTRL or ESC	5	N**		Read record from tape

TABLE I.1-5. SOFTWARE CONTROLLABLE ESC FUNCTIONS (Cont)

1	2	3	4	Function
CTRL or ESC	0	N**		Rewind tape
CTRL or ESC	1	N**		Write tape mark
CTRL or ESC	2	N**		Backspace one tape record
CTRL or ESC	6	N**		Read tape record and transmit
CTRL or ESC	7	N**		Read tape file and transmit
CTRL or ESC	8	N_1	N_2	Search tape drive 1 to selected block ***
CTRL or ESC	9	N_1	N_2	Search tape drive 2 to selected block ***
CTRL or ESC	3	N**		Tape mark search
CTRL or ESC	Y			Lock out lower case
CTRL or ESC	Z			Enable lower case
CTRL or ESC	E			Search enable
CTRL or ESC	F			Search disable
CTRL or ESC	N			Negative video "on"
CTRL or ESC	O			Negative video "off"
CTRL or ESC	W			Forms enable
CTRL or ESC	X			Forms disable
CTRL or ESC	C			Space right
CTRL or ESC	-	(char)		Search character change
CTRL or ESC	?			Activate audible alarm
CTRL or ESC	.			Set/Reset tab stop