Burroughs

TD 730/TD 830 System

REFERENCE MANUAL

PRICED ITEM

Printed in U.S.A.

November 1979

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INTRODUCTION

This manual describes Burroughs TD 830 and TD 730 series of input, output, and display systems, including the system operations and capabilities. In this manual, "enabled by Burroughs" or "installed by Burroughs" mean that Burroughs field engineers perform the functions described.

This manual is written for the user. The user is considered to be a purchaser, a programmer, or an operator. It is recommended that the operator has either typing or keypunch experience. For the programmer, data comm experience is helpful.

This manual is organized as follows:

Section	Title
1	General Description
2	System Characteristics
3	System Concepts
4	Keyboards
5	Magnetic Card Reader
6	Auxiliary Printers
7	Magnetic Tape Cassette
	Appendices

Further information is available in the following manuals:

Form Number	Title
1097805	TD Series Burroughs Data Comm Line Control Procedure Reference Manual
1094901	Binary Synchronous Multipoint IBM 3270 Line Control Procedure for TD 820/TD 800/TD 700 Reference Manual
1086956	Burroughs Basic Data Communications Line Control Procedures Reference Manual
1094117	Magnetic Card Reader Operator Manual
1092632	Personal Identification Number (PIN) Keyboard Operator Manual

SECTION 1
GENERAL DESCRIPTION

GENERAL

The TD 830/TD 730 terminals are input, output, and display systems. Input and output may be remote and/or local.

Display requirements are different for the two TDs. The TD 730 (figure 1-1) has a SELF-SCAN ® II screen. The TD 830 (figure 1-2) has a cathode ray tube (CRT) screen.

Remote data is sent to/from a central system via a data comm line. Local input may be from the keyboard, the magnetic card reader, and/or the magnetic tape cassette. Local output may be to the screen, the auxiliary printer, and/or the magnetic tape cassette. The input/output is alphanumeric data and/or special control characters.

SYSTEM CONFIGURATIONS

Odd numbered units are basic systems (figure 1-3); even numbered styles are peripheral-capable (figure 1-4).

Both basic systems and peripheral-capable systems are further divided by the data comm modes:

Burroughs Asynchronous (TD 832/TD 831/TD 732/ TD 731); Burroughs synchronous (TD 834/TD 833/ TD 734/TD 733); and IBM 3270 binary synchronous (TD 838/TD 837/TD 738/TD 737).

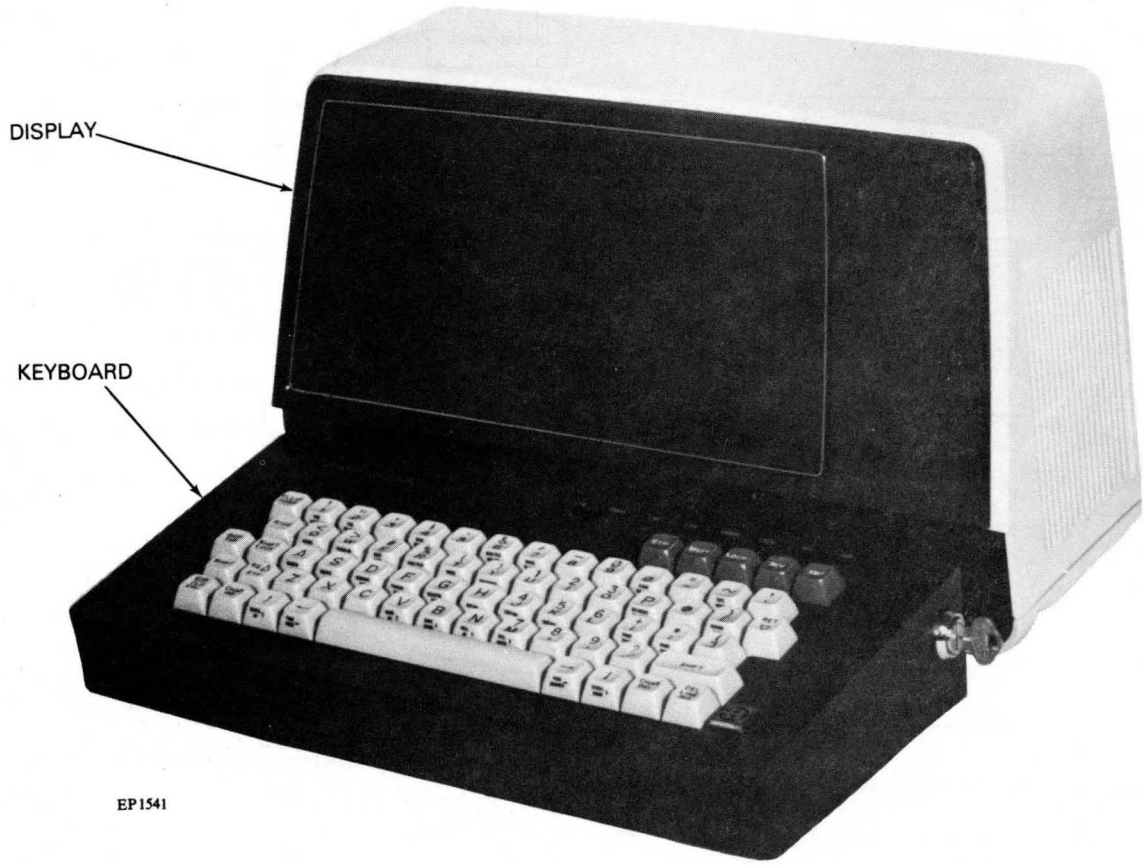

Figure 1-1. TD 730 Series

® Registered Burroughs trademark.

Figure 1-2. TD 830 Series

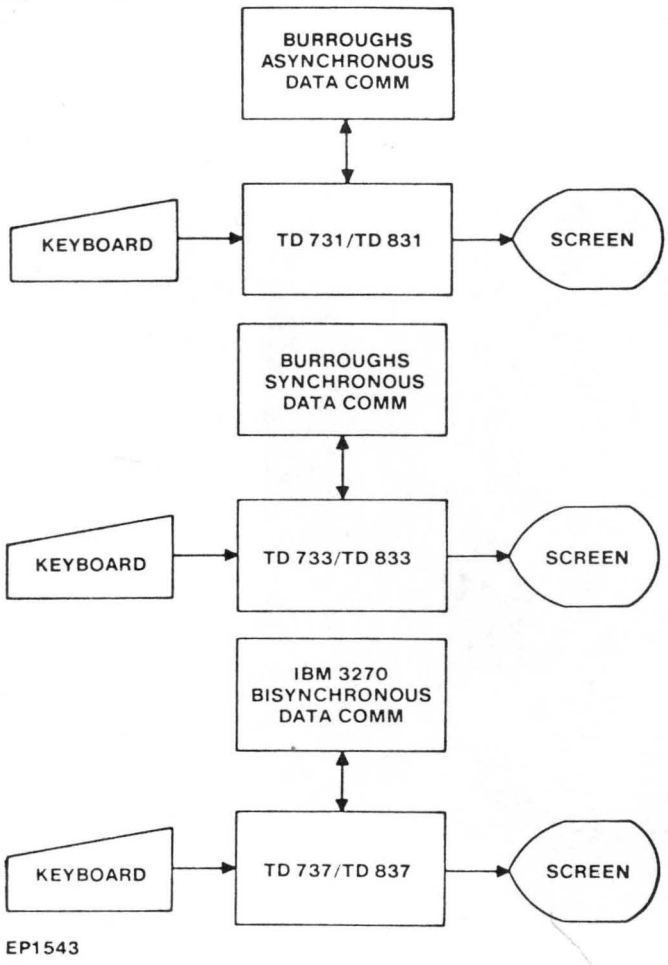

Figure 1-3. TD 830/TD 730 Basic System Configurations

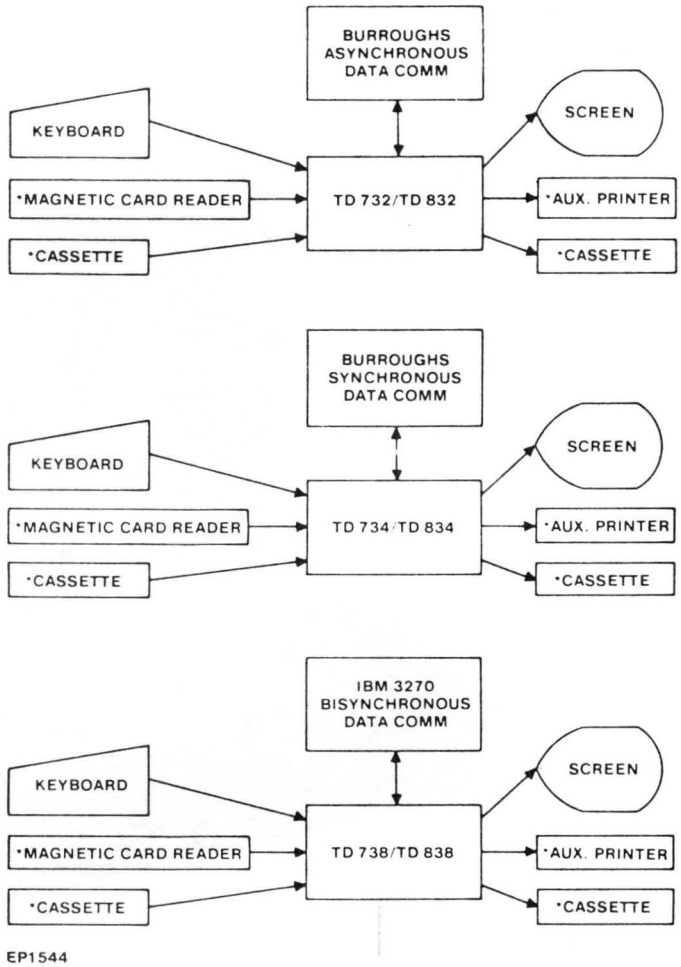

Figure 1-4. TD 830/TD 730 Peripheral-Capable System Configurations

SECTION 2
SYSTEM CHARACTERISTICS

GENERAL DESCRIPTION

The system characteristics include the remote input/output, local input/output, processing characteristics, and system confidence tests. This section describes the system data flow to and from the central system and peripherals (figures 2-1 and 2-2).

REMOTE I/O

The system can communicate with the data comm systems. Data comm capability is further described in the TD Series Burroughs Data Comm Line Control Procedure Reference Manual. Data comm capability includes either Burroughs asynchronous

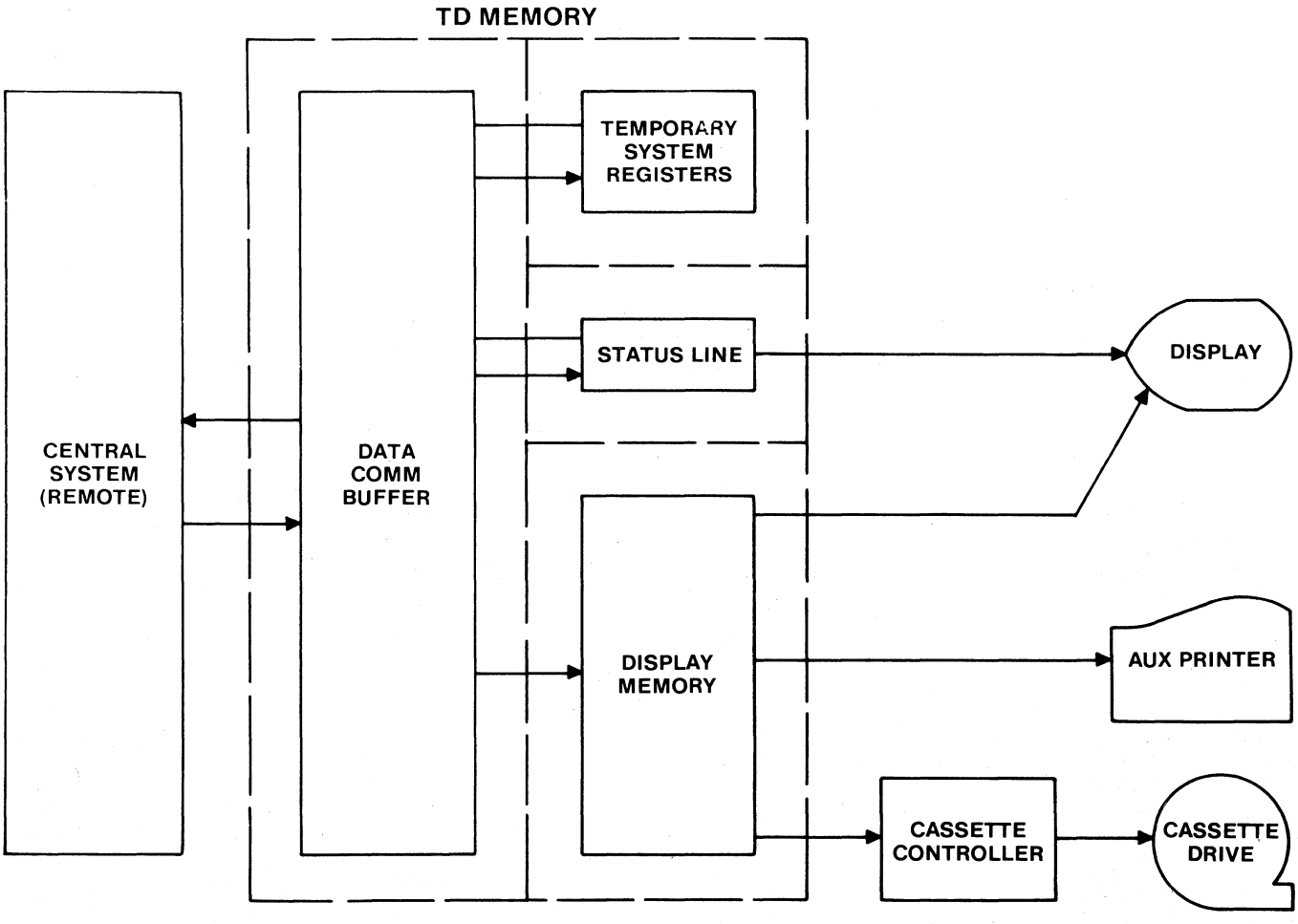

Figure 2-1. Simplified Remote Input/Local Output Flow

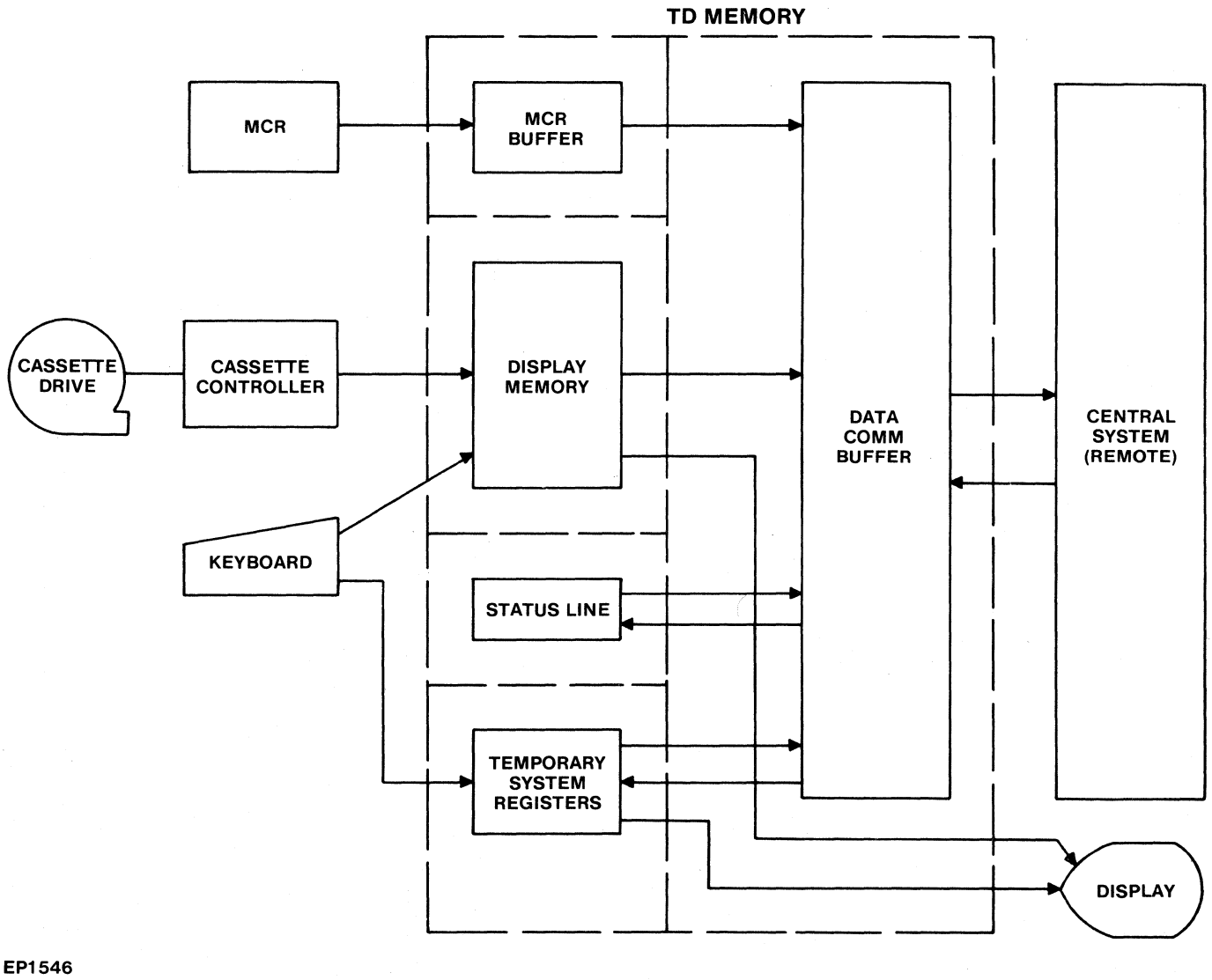

Figure 2-2. Simplified Local Input/Remote Output Flow

(TD 832/TD 831/TD 732/TD 731); Burroughs synchronous (TD 834/TD 833/TD 734/TD 733), or IBM 3270 binary synchronous (TD 838/TD 837/TD 738/TD 737) mode of transmission (table 2-1). With Burroughs asynchronous mode, the data comm line may be TDI (two-wire direct-connect interface); BDI (Burroughs direct-connect interface); or via data sets. Burroughs synchronous and IBM 3270 binary synchronous modes utilize data sets. The line disciplines for the TD data comm configurations available to the user are listed in table 2-1.

LOCAL INPUT

The local input may be from the keyboard, the magnetic card reader, and the magnetic tape cassette. Except for the keyboard, all local input peripherals require the peripheral interface (peripheral-capable systems). Up to two peripheral commands may be stored in each peripheral-capable system. Each peripheral operates independently of any other within each peripheral-capable system.

Keyboard

Several keyboards are available for each system. The keyboard keys function as local input to TD memory. Keyboards are described in more detail in Section 4.

Magnetic Card Reader

The magnetic card reader (MCR) reads magnetic

Table 2-1. TD Data Comm Configurations

Line Disciplines	Direct-Connect BDI	Direct-Connect TDI	Data Sets: Multiple Terminals (Concatenation)	Data Sets: Single Terminal
Burroughs Asynchronous				
TD 731/TD 732/TD 831/TD832				
Multipoint Procedure				
Poll	X	X	X	X
Select	X	X	X	X
Fast Select	X	X	X	X
Contention	X	X	X	X
Broadcast Select	X	X	X	X
Group Select	X	X	X	X
Group Poll (with Concatenation)	X	X	X	X
Point-to-Point Procedure				
Switched (Non-Batch)				X
Leased (Contention)	X	X		X
Operator Display Terminal				
(ODT) B 9348-30				
B 6700 ODT Point-to-Point Procedure		X*		
Burroughs Synchronous				
TD 733/TD 734/TD 833/TD 834				
Multipoint Procedure				
Poll			X	X
Select			X	X
Fast Select			X	X
Contention			X	X
Broadcast Select			X	X
Group Select			X	X
Group Poll			X	X
Point-to-Point Procedure				
Switched (Non-Batch)				X
Leased (Contention)				X
IBM Binary Synchronous				
TD 737/TD 738/TD 837/TD 838				
3270 Procedure				
General Poll			X	X
Specific Poll			X	X
Select			X	X

* B 6700/B 1700 6-wire ODT cable with TD 830 using RS232C asynchronous interface.

stripes on credit cards that conform to ABA (Track II) standards. The magnetic card reader may be attached to peripheral-capable systems. The magnetic card reader is described in Section 5.

Magnetic Tape Cassette

The magnetic tape cassette attaches to peripheral-capable systems. Data transfers from a cassette

drive via a cassette controller to the display terminal. The configurations and cassette operation are described in Section 7.

LOCAL OUTPUT

The local output available on these systems is to the screen, auxiliary printer, or magnetic tape cassette. Every system has screen capability. However, peripheral-capable systems may also interface the auxiliary printer and the magnetic tape cassette.

Screen

Each terminal in the series has a local output to the screen. The screen acts as a window to the display memory. The TD 730 utilizes a 480-character SELF-SCAN II display panel, which displays up to 12 lines of 40 characters each. Data field configuration is set during system initialization and may be changed temporarily through central system program control. Two basic screen display configurations are available: 12 lines of 40 characters per line, and 8 lines of 32 characters per line. The basic configurations are further alterable through use of the variable page length function.

The TD 830 displays 2,000 characters, consisting of 1,920 characters of data and 80 characters of system information (status line). Data field configuration is set during system initialization and may be changed through central system program control. Four basic screen display configurations are available: 12 lines of 40 or 80 characters per line, and 24 lines of 40 or 80 characters per line. The four basic configurations are further alterable through use of the variable page length function.

Auxiliary Printer

Local hard-copy output is available in the peripheral-capable systems. Three Burroughs auxiliary printers are available: A9249, TC4001, and B9354-6. Only one auxiliary printer may be configured by Burroughs with each system. Auxiliary printers are described in Section 6.

Magnetic Tape Cassette

The peripheral-capable systems have the optional capability of writing to cassettes. Cassette operations are described in Section 7.

PROCESSING CHARACTERISTICS

The processing of the terminal is performed by the microprocessor, firmware, character generator, and memory.

Microprocessor, Firmware, and Character Generator

The terminal contains a microprocessor with access to all terminal memory. The microprocessor interprets instructions contained within the firmware memory. The microprocessor and firmware control the features of the terminal internally.

NOTE

References to firmware within this manual refer to all firmware levels unless otherwise identified.

The character generator can generate 128 character symbols (Appendix C). Ninety-six characters may be called out from the U.S. Typewriter ASCII keyboard.

Memory

Memory layout is provided in a simplified form in table 2-2. Memory is laid out in terms of accessibility by firmware, Burroughs, and the user program.

Firmware Memory

Firmware memory is a set of operating instruction sequences. These instruction sequences control system functions (system firmware) and peripherals (device firmware). Device firmware is provided with peripheral-capable systems. The instruction sequences control edit functions, confidence tests, interrupt procedures, initialization procedures, and peripheral control. Firmware memory is internal to the terminal and is protected from being altered either by Burroughs or by the user.

User Program Memory

This memory is of primary concern to the user. It is subdivided into data comm buffer, display memory, magnetic card reader buffer, status line, and temporary registers.

The data comm buffer transfers data to and from the central system. Buffer size is 1,200 characters in the basic system and 3,000 characters with the expanded memory option. A 1,920-character page requires the expanded memory option.

The display memory contents may be viewed on the screen by accessing a selected portion of display memory, (as described in Section 3). Data goes from the display memory to the central system and is received in display memory from the central system

Table 2-2. TD 830/TD 730 Simplified Memory Layout

MEMORY ITEM	ACCESSIBLE BY
DATA COMM BUFFER	USER PROGRAM (CENTRAL SYSTEM)
DISPLAY MEMORY	
MAGNETIC CARD READER BUFFER	
STATUS LINE BUFFER	
TEMPORARY SYSTEM REGISTERS	
SCRATCHPAD, ETC.	BURROUGHS
PERMANENT SYSTEM REGISTERS	
SYSTEM FIRMWARE	FIRMWARE
DEVICE FIRMWARE (PERIPHERAL CAPABLE SYSTEMS)	

via the data comm buffer. The display memory size is 1,920 characters in the basic system and 4,000 characters with expanded memory.

The magnetic card reader buffer size is 40 characters. The MCR data is stored in the buffer before transmission to the central system.

Central system messages may be sent to the 80-character status line buffer. In the TD 830, the message is immediately displayed on the screen status line. To view the central system message on the TD 730, the status line has to be called out.

The user may temporarily change the system registers (Appendix A). The program may call out (read) a temporary system register and change the system register temporarily for a particular application. The system returns to its permanent system registers when a system confidence test is performed or when the terminal is powered-down.

SECTION 3
SYSTEM
CONCEPTS

GENERAL DESCRIPTION

This section describes the concepts that are specific to the basic system. They include system registers, status line, page, format, editing functions, data highlighting, and special data comm features.

SYSTEM REGISTERS

The configuration of the system is defined by 32 bytes of the system register which are set up in the factory and may only be modified by Burroughs. The system register contents are permanently stored (refer to Appendix A for options). System register bytes may be altered temporarily by the central system program. On power-down of the terminal, the temporarily altered bytes are erased. On the next power-up, permanent data is rewritten into memory to configure the system.

The ESC, RH, aaaa, 01, HH ESC RC sequence allows temporary change of one byte at address aaaa, and HH the hexadecimal value. For example, ESC RH 0084 01 03 ESC RC temporarily sets the number of lines per page to four.

STATUS LINE

Status line data is stored in 80 characters of display memory, which is only indirectly accessible. the status line is displayed constantly on the TD 830 in the 25th display line, but must be called on the TD 730 by pressing the CTRL key twice. The TD 730 only allows the first 64 characters access to the status line if it has the 8-by-32 screen format (TD 700 look-alike mode).

The TD 730 status line disappears on the subsequent activation of any keyboard. The TD 730 status line occupies the last two lines of the display in place of the data normally on those lines. Data normally displayed is stored in the display memory and reappears when any keyboard key is activated. The status line format (figure 3-1) includes the error conditions, special messages, and the page number. The status line display is independent of system register options.

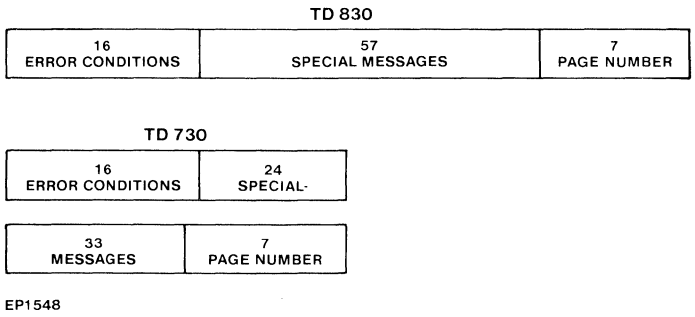

Figure 3-1. Status Line Format

Error Conditions

The terminal displays error messages in the first 16 character-positions of the status line. The terminal contains five error messages which may be personalized by Burroughs as explained in table 3-1. Error messages are cleared by pressing the LOCAL key.

Error Log

The terminal records up to 15 errors for data comm, cassette, A9249 printer, magnetic card reader, and power supply. To retrieve the errors (error log), the central system program sends out the retrieve command (implemented in firmware 2):

ESC RL

Table 3-1. Status Line - Error Messages

Error Message	Error Condition
DATA COMM ERROR	Block check or data comm hardware error
KEYBD DATA LOST	Keyboard buffer overflow
PRINTER ERROR	Printer hardware error Power off or faulty cable connection
CASSETTE ERROR	Cassette read or write error Impomplete tape command or CRC error
POWER FAULT	Momentary power loss

The terminal leaves receive mode and enters transmit mode with the error log information ready for transmission. When polled, the terminal transmits the message identified in figure 3-2. Locally, the error log may be retrieved by the following sequences:

CTRL RWMODE
CTRL RLXXXX

Locally, the display result is:

/DC 00 D1 00 D2 00 D3 00 1E 00

Each error hexadecimal digit shown may vary from 0 to F, indicating from 0 to 15 errors. If the errors exceed 15, the error count still remains at 15. The error log is cleared when the terminal is powered-on (by CTRL space, D, CTRL or ESC, space, D).

For example, if the central system program sends:

ESC RL

The terminal might respond with the following 10 hexadecimal digits:

000B040000

indicating that 11 cassette errors and four printer errors have occurred.

SPECIAL MESSAGES

The special message section of the status line is used to display data comm entered data that cannot be altered by the operator. Special messages of up to 57 characters (FW1), or up to 72 characters (FW2), may be displayed without overwriting other data displayed in the status line. Typical special messages may include computer or system status and operator notification of data entry on non-displayed pages.

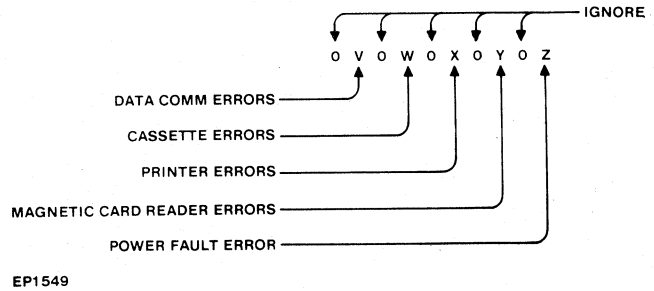

Figure 3-2. Error Log Format

The fast select, group select, and broadcast select procedures are used in conjunction with the ESC, RA sequence (FW1 or FW2) to write special messages of up to 57 characters.

Program control of the status line special message has the following format:

ESC RA031039 (message up to 57 characters)

For example, the message OPERATOR ALERT appears as follows:

ESC RA031039OPERATOR ALERT

Sending a message to the status line automatically erases the previous message in firmware 1.

Fast select, group select, and broadcast select procedures are used in conjunction with the ESC, RS sequences for special messages of up to 72 characters (FW2 only). Program control of the status line special message has the following format:

ESC RSHH (message up to 72 characters)
where HH is the message length in hexadecimal.

For example, the message OPERATOR ALERT appears as follows:

ESC RSOE OPERATOR ALERT

Pressing the LOCAL key clears the status line, except PAGE and the page number. Sending the ESC RS000 sequence also clears the status line (excluding page and page number).

Page Number

The word PAGE and the number of the page on which the cursor is located are displayed automatically in the last seven positions of the status line.

In terminals configured for single page operation, the customer may elect not to display the word PAGE or the page number, by having Burroughs disable this option.

Page

During multiple page operation, this system is able to separate the data communications pointer from the display cursor, thereby allowing keyboard data to be entered on one page and external data (data comm or peripheral) to be entered on, or transmitted

from, another. This capability greatly increases efficiency: it is no longer necessary for the operator to wait for the display to be serviced by the central system. After the XMT key is pressed, the operator may immediately advance to the next page and start entering data.

Data verification messages may also be transmitted back while the operator is entering new information. For example, data is entered on page 1 and transmitted. The operator advances to page 2 and enters data. When the central system completes processing the page 1 information, it responds to page 1 without interrupting local operation on page 2. When the page 2 entry is complete, page 1 and page 2 reverse roles. Thus the operator is able to enter data continually without having to wait for the central system.

Where selective print of messages is required, the operator can initiate a print function and proceed to enter data on the next page while the system is printing the previous page on an auxiliary printer.

This allows the user to divide the terminal display memory into one or more pages. The user selects the page size via program control. Each page consists of a minimum of four lines of display memory and may be extended up to the limits of the display memory in four-line increments (table 3-2).

Table 3-2. Page/Screen/Display Memory Relationship

Page*	Screen			Display Memory: Basic (1920)*		Display Memory: Expanded (4000)*	
Lines per Page	Lines per Screen	Char. per line	Pages Displayed	Pages	Usable Char.	Pages	Usable Char.
8	8	32	1	7	1792	N/A	N/A
32	8	32	1/4	1	1024	N/A	N/A
4	12	40	3	12	1920	25	4000
8	12	40	1-1/2	6	1920	12	3840
12	12	40	1	4	1920	8	3840
24	12	40	1/2	2	1920	4	3840
4	12	80	3	6	1920	12	3840
8	12	80	1-1/2	3	1920	6	3840
12	12	80	1	2	1920	4	3840
24	12	80	1/2	N/A	N/A	2	3840
4	24	40	6	12	1920	25	4000
8	24	40	3	6	1920	12	3840
12	24	40	2	4	1920	8	3840
16	24	40	1-1/2	3	1920	6	3840
20	24	40	1-1/4	2	1600	5	4000
24	24	40	1	2	1920	4	3840
48	24	40	1/2	N/A	N/A	2	3840
72	24	40	1/3	N/A	N/A	1	2880
4	24	80	6	6	1920	12	3840
8	24	80	3	3	1920	6	3840
12	24	80	2	2	1920	4	3840
16	24	80	1-1/2	N/A	N/A	3	3840
20	24	80	1-1/4	N/A	N/A	2	3200
24	24	80	1	N/A	N/A	2	3840
36	24	80	2/3	N/A	N/A	1	2880

*NOTE: Page size cannot exceed data comm buffer size. The Basic and Expanded memory data comm buffers are 1200 and 3000 characters, respectively.

The system performs most edit and format functions on a page basis. The scroll and tabulation functions are on a system basis. Data highlighting operates on a line basis. This allows varied data configurations on different pages.

Page Boundary Crossing

The page boundary may be crossed either by the display cursor or the data comm pointer. The display cursor is moved across the page boundary by five functions: page advance, page back, scroll up, scroll down, and cursor alignment. The data comm pointer is moved by three functions: select page and pressing the XMT or the RCV key. Tab stops are on a system basis. The functions are explained as follows:

Function	Explanation
Page advance	Enabled through keyboard (CTRL →) and advances the display cursor to the home position of the next page.
Page back	Enabled through keyboard control (CTRL ←) and moves the display cursor to home on the preceding page.
Scroll up	Allows the operator to scan downward toward the end of the display memory. Data appears to move upward on the screen (figure 3-3). When the cursor is on the last line of a page, scroll up causes the cursor to appear at the same location in the first line of the next page. CTRL ↑ controls this function.
Scroll down	Allows the operator to scan upward toward the beginning of the display memory. The data appears to move downward on the screen (figure 3-3). When the cursor is in the first line of a page, the scroll down function causes the cursor to appear at the same location in the last line of the preceding page. CTRL ↓ controls this function.
Cursor alignment	Enabled through keyboard control (CTRL >) or program control (ESC &) and moves the display cursor to the location and page on which the data comm pointer is positioned.
Select page	Enabled through program control (ESC & Page), Appendix E, causes the data comm pointer to move to the home position of the selected page. Examples: ESC & ! homes the cursor on page 2. ESC & space homes the cursor on page 1. ESC & & homes the cursor on page 5.
XMT key or RCV key	Pressing either the XMT key or the RCV key aligns the data comm pointer with the display cursor.

During multiple page operation, the terminal may separate the data comm pointer from the display cursor. This allows keyboard data to be entered on one page and external data (central system data or peripheral data) to be entered on another.

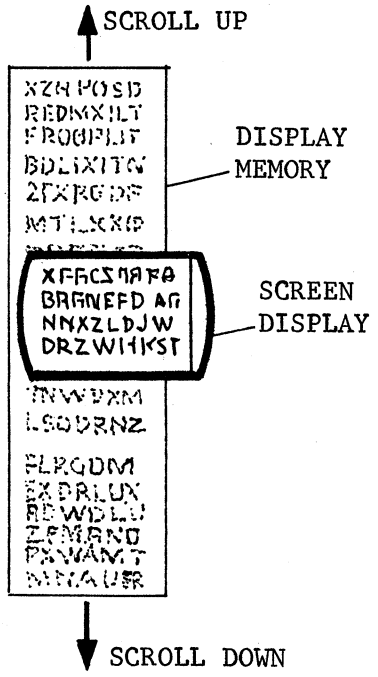

Figure 3-3. Scroll Up/Down

Format and edit functions that are data comm initiated affect data on the data comm pointer page only. Format and edit functions that are keyboard entered affect data on the display cursor page only. Data from the data comm pointer page is transmitted through the use of the proper keyboard or program control (Appendices D and E respectively).

FORMAT FUNCTIONS

The system may display data in various formats, which are controllable by either the central system program or the keyboard operator. The format functions described are forms mode, tabulation, and screen operations. These functions are on a page basis except for the scroll and tabulation operations.

Forms Mode

Forms mode is used to send page information from the central system to assist the operator to input data in the proper format. In forms mode, data is divided into unprotected and protected fields. The unprotected data may either by left-justified (normal unprotected data field) or right-justified (numeric fields). The protected data fields may either be transmittable or not transmittable. The field overflow inhibit and the tab field identifier features may be enabled by Burroughs to be used in forms mode.

The unprotected data field defines an area where data can be acted upon by the operator. An operator is prevented from altering any data within a protected data field. Unprotected data is accessible for data entry and editing. Unprotected data fields and transmittable protected data fields are contained within delimiters and may be transmitted while the page is in forms mode.

When in forms mode, all cursor movements, including carriage return, line feed, reverse line feed, backspace, cursor advance, and programmable cursor, are enabled. Full cursor movement is provided for the entire page. The program must be written to position the cursor in an unprotected area, so that the operator cannot access protected areas. In the forms mode, the RTAB key moves the cursor to the first data character location of the prior unprotected data field, the SKIP/TAB key advances the cursor to the first data character location of the next unprotected data field. Forward and reverse tab movements within an individual unprotected data field occur when multiple US (▷) or GS (△) delimiters are used prior to an RS (◁) delimiter.

During forms mode, activation of the CLEAR key causes the terminal to erase either the unprotected data or the entire page depending on the option enabled by Burroughs. Taking a page out of forms erases all data on that page when the terminal is configured for the CLEAR key to clear page.

One opening and one closing delimiter of an unprotected data field are required for the terminal to enter forms mode. Since forms mode is page specific and takes two characters to identify an unprotected field, the maximum unprotected field is two characters less than one full page.

The central system causes the terminal to operate in forms mode by the transmission of the proper control code: ESC W enables forms mode; ESC X disables it. When the terminal receives the ESC W control code (Appendix E), the FORMS indicator lights to alert the operator of the active forms status. The DC2 character option to control forms mode may be enabled by Burroughs.

The operator may control the status of the terminal relative to the forms mode using keyboard CTRL. If the terminal is in the forms mode, the operator may change its status by initiating the CTRL Q control code, causing the FORMS indicator to go out. Conversely, the terminal may be placed into the forms mode by the operator initiating the CTRL W control code (provided at least one left delimiter is on the page), thereby lighting the FORMS indicator. The coordination of forms status with the central system is an operator function when the CTRL control is used.

Unprotected Data Field (Left-Justified)

The terminal uses the US (▷) and RS (◁) symbols on the screen to identify the opening and trailing delimiters respectively for a left-justified unprotected data field. Through Burroughs adjustment, the terminal may accept any two characters as additional forms delimiters. The terminal converts the additional delimiters to the US (▷) and RS (◁) symbols upon entering forms mode. The US and RS characters have ASCII codes 1,15 and 1,14 respectively (Appendix C). The cursor is put to the right of the first opening delimiter from the home position, which is the forms home position.

When transmitting a message to the central system while in forms mode, the terminal transmits the unprotected data and all protected data contained within the transmittable protected data fields. The qualified data transmitted begins at the cursor location and ends at the stored ETX character. If no ETX character is stored, the transmission of qualified data is from home to the cursor position. A message transmitted by the central system and not containing the EXC sequence for forms is treated as a standard message by the terminal. As a result, the terminal is taken out of the forms mode. A typical forms message from the central system to the terminal has the following sequence:

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

P is a protected data character and U is an unprotected data character. When the terminal is not in the forms mode, the FORMS indicator is out and delimiter characters are not recognized as delimiters for data fields. In the event that the central system transmits a message with the ESC W to the terminal without an opening delimiter, the terminal does not enter the forms mode, the FORMS indicator stays out, and the cursor is stopped at the first position of the display. The terminal is returned to the receive mode while in forms when the receive key is pressed.

Right-Justified Field

The right-justified unprotected data field is limited by the opening delimiter GS (△) and the trailing delimiter RS (◁). The GS character has the ASCII code 1,13 (Appendix C). The right-justified field is a standard feature. The trailing delimiter must be in-

serted in order for the right-justified field to be operational. When the cursor enters the right-justified field, it automatically moves to the right-most position of the field. As new data enters at the cursor position, existing data shifts to the left in the unprotected data field as follows:

Keyboard Entry	Display Result
1	Δ 1 ▷
2	Δ 1 2 ▷
3	Δ 1 2 3 ▷
4	Δ 1 2 3 4 ▷
5	Δ 1 2 3 4 5 ▷
6	Δ 2 3 4 5 6 ▷

If the field is filled with data, additional information entered causes the data to be shifted out of the left side of the field and lost. A TAB, SKIP, or RTAB operation is required for the cursor to enter the next/previous unprotected data field. This feature prevents the operator from unknowingly advancing to another unprotected field.

A right-justified field may not be the first unprotected data field if all unprotected data must be transmitted (HOME and XMT). If it is used in the first position on a HOME and XMT operation, only the first right-justified field is transmitted. HOME position not defined for this condition.

Transmittable Protected Data Field

The field is enclosed by the opening delimiter FS (◘ in TD 730, ◇ in TD 730) and the trailing delimiter RS (◁). The FS has ASCII code 1,12 (Appendix C).

The ability to transmit selected protected data fields provides the advantage of being able to include identifiers such as account number or patient number with each message while ensuring that the operator does not accidently alter these fields.

The transmittable protected data field is not accessible by the operator. However, this field is transmitted together with the unprotected data to the central system.

Field Overflow Inhibit

The field overflow inhibit feature may be enabled or disabled by Burroughs. This feature operates in forms mode only. If this option is disabled, a data character entered into the last position of an unprotected data field automatically causes the cursor to be advanced to the first position of the next unprotected data field. If this feature is enabled, the cursor does not skip to the next unprotected data field, but remains in the last data position and overwrites data characters as they are entered. The field overflow inhibit feature allows only the shifted or unshifted SKIP/TAB or RTAB keys to move the cursor between unprotected data fields. The field overflow inhibit feature is built into the right-justified field.

Tab Field Identifier

The tab identifier is enabled or disabled by Burroughs. The enabled tab field identifier operates with either fixed or variable tabulation in either forms or non-forms mode. In forms mode, the unshifted SKIP/TAB key causes a field identifier (→) to be written into memory at the cursor location in a left-justified field. The cursor then automatically advances to the next field. In a right-justified field, a field identifier (→) is automatically written into the first position following a left delimiter and the cursor stops in the position before the closing delimiter.

During transmission, the character spaces between the tab field identifier and the beginning of the next field are not transmitted, except in the right-justified field. The right-justified field is completely transmitted if any entry is made in this field, otherwise none of the field is transmitted.

For tab field identifier operation in non-forms mode, refer to the tabulation subparagraph in this section.

Tabulation

Tabulation is a system-specific (not page-specific) feature. This system may operate with either fixed or variable tabulation. However, only one type may be configured within the terminal. In forms mode, all tab stops are ignored. The SKIP/TAB key or HT character causes the cursor to move to the next tab stop, or to the next field when in forms mode.

Fixed

The fixed tab stops are located every eighth position starting with the first position of each line of the display, such as the first, ninth, seventeenth, etc. If the following tab stop is beyond the end of the display line, pressing the TAB key (or program HT character) causes the cursor to stop at the first position of the next line.

Variable

The variable tab-stop option allows each tab stop along the display line to be set or reset through key-

board or program controls (non-forms only). The shifted TAB key sets/resets, through alternate key depressions, the cursor column position into tab-stop storage. Entering the ESC . or CTRL P control code also causes the cursor column position to be stored in tab-stop storage. The tab-stop storage may be cleared by the program ESC # or keyboard CTRL 0 control code, removing all variable tab stops.

Reverse Tabulation

The RTAB key on the keyboard causes the cursor to move from field to prior field or from tab stop to prior tab stop. Reverse tabulation has the capability of operating with either fixed or variable tab stops. In forms mode, reverse tabulation causes the cursor to be positioned at the first data entry position of the prior unprotected field. The function is controlled from the keyboard only.

Tab Field Identifier

In non-forms mode, the unshifted TAB key causes a field identifier to be written into memory at the cursor location. The cursor then automatically advances to the next tab stop. During transmission, the character spaces between the field identifier and the next tab stop are not transmitted.

For additional information about the tab field identifier, refer to the forms mode paragraph in this section.

Screen Operations

The screen operations include programmable cursor, page roll up/down, display scroll up/down (keyboard only function), variable end-of-page alarm, and wrap-around inhibit. These operations may be controlled remotely by the central system program control (Appendix E) and locally by terminal keyboard control (Appendix D).

Programmable Cursor Position

The cursor may be programmed to any position on the page by program or keyboard control (Appendix E). The program (central system) control is ESC " COLM ROW and the keyboard control is CTRL < COLUMN ROW. In both four-character control codes, the COLM character represents the column position, and the ROW character represents the row position. In a multi-page terminal, the page on which the cursor is to be positioned must also be selected via the Select Page command (Appendix E).

For example:

ESC " G $ (or CTRL < G $) puts the cursor in column 40, row 5.

ESC " 8 + (or CTRL < 8 +) puts the cursor in column 25, row 12.

ESC $ $ ESC " # % puts the cursor on page 5, column 4, row 6.

The SPCFY control key allows transmission of the cursor position to the central system. The specify operation is described in the Keyboard section.

Pages Roll Up/Down

The terminal has the capability through keyboard control (Appendix D) or central system program control (Appendix E) of causing the data on the page to roll up or down while the cursor remains stationary. During a scroll up function, all the data on the display simultaneously moves line-for-line up the page. The data transferred from the top line appear on the bottom line, causing a wrap-around effect. The scroll down function is the converse. Where more than one page is displayed on the terminal display, data roll up or down is within the page, and the wrap-around effect causes data to be transferred between the top and bottom of the page. The page roll function is inhibited during forms mode.

Display Scroll Up/Down

The display scroll up/down is a keyboard function only. The terminal has the capability of causing the data of the display to scroll up or down by pressing CTRL ↑ or CTRL ↓. The cursor remains in a fixed position in relation to the display. During the scroll up function, all the data on the display is simultaneously transferred line-for-line up the display. Data on the top line of the display shifts off the display and new data appears on the bottom line of the display. Successive scroll up functions continue data shifting up through the last line of the terminal memory. When the last line of memory is displayed, succeeding scroll up functions are ignored. The scroll down is the converse of a scroll up function except that when the first line of memory is displayed, succeeding scroll functions are ignored (figure 3-3).

Variable End-of-Page Alarm

The terminal sounds an alarm when the cursor reaches a predetermined character position on the page. The alarm position is selectable through reconfiguration of system registers via the central system program (Appendix A).

With firmware level 3 or higher, the audible alarm sounds under the following conditions:

1. Upon reaching the pre-set alarm position on the page.
2. Upon tabbing, skipping, or line feeding through the pre-set alarm position.
3. Upon attempting a page wrap-around when the page wrap-around inhibit bit was set in the configuration register.
4. Upon attempting keyboard data entry into a protected data field in forms mode.

Page Wrap-Around Inhibit

If the wrap-around inhibit bit is set in the configuration register, the user is unable to advance the cursor beyond the last position on the page, causing character overwriting in the last character position on the page. The feature prevents the operator from unknowingly advancing to the beginning of the same page. The wrap-around inhibit function only operates in non-forms mode with firmware levels 1 and 2.

With firmware level 3, wrap-around inhibit operates in forms and non-forms mode. Cursor advance beyond the last position on the page is inhibited for the functions:

1. Data entry
2. Tab key function
3. Skip key function

NOTE

Wrap-around inhibit does not work for data comm.

EDIT FUNCTIONS

Edit functions include the character insert by line/page, character delete by line/page, line insert/delete, line movement up/down, clear to end-of-line/page, lower case enable/disable, and search mode. All these edit functions may be controlled remotely (Appendix E) or locally (Appendix D).

Character Insert by Line or Page

The terminal has the capability of a character insert function.

Pressing the CHAR INS key places the terminal in the character insert mode and automatically inserts a single space at the cursor position. Subsequent pressing of an alphanumeric key (including space) causes the alphanumeric character to be inserted at the cursor location. The succeeding characters within the line are moved one space to the right. Surplus characters, if any, are shifted off the end of the line and lost.

If the CTRL key is activated prior to pressing 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 by line. A second pressing of the CHAR INS key disables the character insert mode.

When in forms mode, the character insert function causes data shifting within the single unprotected data field in which the cursor is located.

The terminal can also perform the character insert function through program control (Appendix E). However, the program character insert function differs from the keyboard control function. The character insert mode is not entered by program control. Instead, each character to be inserted requires a new character insert program control code.

Character Delete

The CHAR DEL key causes the erasure of the displayed character at the cursor location. The succeeding characters within the line move one space to the left. If the CTRL key is activated prior to pressing 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 by line.

In forms mode, the character delete function causes data shifting within the unprotected data field in which the cursor is located.

The terminal also performs the character delete functions through central system program control (Appendix E).

Line Insert/Delete

The terminal performs the page-specific line insert and delete function. The line insert function moves all data in the lines below (including the line with the cursor) down one line.

The line delete causes the erasure of the line in which the cursor is positioned and all data in the lines below moves up one line.

The line insert/delete functions are initiated by the LINE DEL/INS key (shifted and unshifted respectively) or by program control (Appendix F). This function is inhibited in forms mode.

Line Movement Up/Down

The terminal may, through keyboard control (Ap-

pendix D) or program control (Appendix E), cause a line of display data to be interchanged with the line above or below, depending on the function selected. The line of data to be moved is selected by placing the cursor in that line. When line movement causes data to be displaced, the displaced data reappears in the original position of the line moved. The cursor follows the line moved in all cases. An upward movement of the top line of a page causes the bottom line of the page to be exchanged with the top line of the page. The same exchange occurs if a downward movement is requested for the bottom line of a page. This function is inhibited during forms mode.

Clear to End-of-Line/Page

The terminal may clear data from the cursor position to the end of a line or page. In non-forms, the CLR EOP/EOL key (unshifted) clears all data from the cursor position to the end of a line. In forms, the CLR EOP/EOL key (unshifted) clears all data from the cursor position to the trailing delimiter.

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

The terminal is also capable of initiating the clear to end-of-line/page function through program control (Appendix E).

Lower Case Enable/Disable

The terminal may, through keyboard or program control (Appendices D and E), enable/disable the display of lower case letters, which includes all characters in ASCII columns 6 and 7. When the lower case is disabled, all letters are displayed in upper case. Note that keyboard control disables only keyboard-entered lower case. Program control disables only data comm entered lower case.

Search Mode (Item Correction)

The search mode is enabled/disabled through the keyboard CTRL A/S or the central system program ESC E/F control codes. If search mode is enabled, placing the terminal in forms mode causes an immediate search for either the error character (¦), column 7, row 12 of Appendix C) or an opening delimiter. If the cursor stops on an error character (¦) in a protected field, data may be written into that one location. Either entering data or pressing the SKIP key causes a skip to the next error character or the next unprotected field.

In the search mode, entering either the three-character control code ESC – CHAR or CTRL E CHAR assigns a selected search character. CHAR is any selected search character and functionally replaces the error character. Disabling the search feature cancels the selected search character.

After correction of data, with the terminal still in forms mode and search-enabled, pushing XMT transmits the total form (protected and unprotected data).

In non-forms, the search feature does not recognize forms delimiters.

DATA HIGHLIGHTING FUNCTIONS

The data highlighting functions provide for visual accenting of all or part of the data on which the operator is working. Both TD 730 and TD 830 lines have the capability for two modes of data highlighting specific fields: blink and secure. In addition, the TD 830 line has the underline, bright video, and reverse video capability.

Negative Page Video

The TD 830 screen displays white characters on a black background (normal video) or black characters on a white background (negative video). At the time of powering-on the TD 830 terminal, the mode is normal video. Upon receipt of an ESC followed by N from the data comm line during text, or the pressing of the CTRL key and then the shifted U key, the system enters the negative video mode on a page basis. Upon receipt of an ESC followed by 0 from the data communications network during the text or upon pressing the keyboard CTRL key followed by the shifted I key, the system returns the page to the normal video mode.

When both forms mode and negative video are active, the unprotected data areas are displayed as normal video as follows: The GS, US, or left forms delimiter are the start of a reverse video mode and the RS or right forms delimiter ends the reverse video mode. A reverse video field on a negative video background appears as normal.

Any unprotected data field continuing from the last column to column 1 of the next line does not continue the reverse video.

Field Video

The display screen can highlight selected fields of data on the screen. Five modes of data highlighting are available to the central system program for use

on either the normal or negative video background modes, with or without forms mode.

Highlighting is accomplished through use of six control codes: SO, SI, EM, SUB, CAN, and RS, which are entered into memory from the central system via data comm line during text to start their respective fields of highlighting.

The RS code (ASCII 1,14) ends all the highlights preceding it. If the operator chooses, highlight codes may be overwritten in memory via the keyboard or by the central system during selection. The operator is not able to overwrite data in the protected data field during forms mode. Highlight codes are displayed as a space character (ASCII 2,0). Highlight codes are effective in their position.

Data highlight modes are independent, thus allowing nesting and giving a cumulative action upon the video data to the extent that no highlight extends beyond either an end highlight code (RS) or beyond the end of a display line.

The RS code is also used as the right forms delimiter.

Blink Video (CAN)

Either the TD 730 or TD 830 screen, upon reading a CAN code (ASCII 1,8) from memory, commences a blinking video display at a 1.5 Hertz rate, and maintains this highlight until an end highlight code is read, thereby ending all selective highlights. The blink video highlight causes video data to alternate with solid background. This solid background mode is dependent upon negative video or normal video mode of display.

The blinking highlight field is able to highlight any area without regard to in-process highlighting of other types or to forms mode. This blinking highlight, when initiated, continues to the last column of that line or until an end highlight code is reached.

Secure Video (EM)

Upon reading an EM code (ASCII 1,9) from memory, either the TD 730 or TD 830 screen begins placing blanks on the display and maintains this highlight until an end highlight character is read. These blanks consist of a solid display matrix for each secured character.

The secure highlighting field is able to highlight any area without regard to in-process highlighting of other types or to forms mode. The secure highlight, when initiated, continues to the last column of that line or until an end highlight code is reached.

Reverse Video (SO)

Upon reading an SO code (ASCII 0,14) from memory, the TD 830 screen starts a reverse video display and maintains this highlight until an end highlight code is read, thereby ending all selective highlight fields. The reverse video highlight causes negative video to be displayed from the initial SO code to the end highlight code, provided the display is in the normal video mode. Activation of the reverse video highlight when the display is in a negative video mode causes normal video to be displayed from the initial SO code to the end highlight code.

A GS, US, or left delimiter in forms mode and negative video mode causes the reverse video to show normal video in the unprotected area. The RS or right delimiter during forms mode and negative video mode ends the reverse video field and any other highlight fields that may be in process.

If the reverse video highlight field is not ended via RS or FORMS right delimiter by the last column of the line, the reverse video highlight ends automatically.

Positioning the negative character cursor within this reverse field reverses the video at that position one more time to indicate the position. The 1.5 Hertz blink rate of the cursor, if used, aids in visually locating the cursor at negative/normal video boundaries.

Bright Video (SUB)

The TD 830, upon reading a SUB code (ASCII 1,10) from memory, intensifies a line on the screen and maintains this highlight until an end highlight code is read. The bright video highlight can highlight any area without regard to in-process highlighting or forms mode. The bright video highlight, when initiated, continues to the last column of the display line or an end highlight code.

The bright video highlight causes brighter characters to appear when the display is in the normal video mode. Its activation in the negative page video mode causes brighter background to appear.

Underline Video (SI)

Upon reading an SI code (ASCII 0,15) from memory, the TD 830 screen begins an underline data

highlight and maintains it until an end highlight code is read. The underline highlight appears on the ninth scan line and consists of solid video in contrast with the opposite mode background video.

The underline highlight may highlight any area regardless of in-process highlighting or forms mode. The underline highlight, when initiated, continues to the last column of that display line or until an end highlight code is reached.

SPECIAL DATA COMM FEATURES

The special data comm features are the numerical control message, cursor position transmission, variable data transmission, and programmatic mode control.

Numerical Control Message

This terminal can transmit a numerical control message. The significance of this message is defined at the central system. For example, it may call out a pre-assigned form, routine, or central system program. The numerical control message is initiated by pressing CTRL, followed by a numeric code from 00 to 99, followed by pressing the XMT key. Then, when the terminal is polled, it responds with its normal heading, followed by STX, ESC, CHAR, CHAR, ETX. BCC. The two CHARs are the numeric code. The numerical control message is not displayed on the screen. No other control or data may be transmitted with this message.

Cursor Position Transmission

The terminal transmits its cursor position when the SPCFY (specify) key is pressed. Pressing SPCFY when the terminal is polled automatically transmits the message: SOH, AD1, AD2, [XMN], STX, ESC, '', COLM, ROW, ETX, BCC.

The terminal may also receive a message to position the cursor, the programmable cursor position function described with the screen format functions.

Variable Data Transmission

The system permits, through keyboard or program control selection of start and stop positions, the transmission of data on a page basis (FW1), or from a pre-selected position within a page (FW2).

Data Transmission by Page

When transmitting data on a page basis, the following start and stop position options are available:

Forms Mode

1. Cursor to ETX.
2. All unprotected data.
3. Beginning of form to cursor position.
4. Entire form (search mode).

Non-Forms Mode

1. Cursor to ETX, or home to cursor if there is no ETX.
2. Home to end-of-page (cursor home, no ETX).

Variable Start-of-Transmission Position (FW2 only)

In firmware level 2, any position on a page may be defined as the start-of-transmission point. Configuration register address 00A0, bit 7, when set to 0, enables the feature called "mobile home."

This feature allows data comm transmission from the start-of-transmission point up to, but not including, the cursor position. If the cursor is positioned in a right-justified field, the entire right-justified field is transmitted.

If an ETX is written into memory, transmission is from cursor to ETX, independent of start-of-transmission point. If the ETX is written into a right-justified field, transmission is from cursor to ETX, including all right-justified field positions left of the ETX.

The start-of-transmission point is determined by:

1. Setting configuration register address 00A0, bit 7, to the ZERO state.
2. Placing the cursor to the desired new start-of-transmission point.
3. Using keyboard CTRL HOME sequence or program ESC D sequence.

Performing the system confidence test automatically resets the start-of-transmission point to 0,0.

When configuration register address 00A0, bit 7, is set to 1, the feature called "line-at-a-time transmission" is enabled.

Line-at-a-time transmission is a special case of the start-of-transmission point, in which the transmission starting point is the first position of the line on which the cursor is located.

XMT Page in Forms Mode (FW2 Only)

This feature transmits all unprotected data and transmittable protected data on the page from the start-of-transmission point, independently of cursor position, if no ETX is written into memory. If an ETX is written into memory, transmission of unprotected data and transmittable protected data on the page is from the start-of-transmission point to the ETX. If an EXT is written into a right-justified field, the unprotected data in the right-justified field is included in the transmission.

This feature is implemented in firmware 2 and is enabled by the field engineer. The field engineer sets configuration register address 0080, bit 4, to the ONE state to enable this feature. If firmware 2 configuration register address 0080, bit 4, is set to the ZERO state, standard forms transmission occurs. Standard forms transmission of unprotected data and transmittable protected data is from the start-of-transmission point to the cursor position if no ETX is written into memory. If an ETX is written into memory, transmission of unprotected data is from the cursor position to the ETX.

NOTE

Firmware 2 allows keyboard data entry within an unprotected data field after any cursor movement into that data field.

CR Character Control (FW2 Only)

1. Write CR from data comm into TD memory (00A0/4/1).
2. Not to write CR from data comm into TD memory (00A0/4/0).
3. Write CR from keyboard into TD memory (00A0/6/1).
4. Not to write CR from keyboard into TD memory (00A0/6/0).
5. No line feed with CR from data comm (00A0/3/1).
6. Line feed function with CR from data comm (00A0/3/0).
7. No line feed with CR from keyboard (00A0/5/1).
8. Line feed function with CR from keyboard (00A0/5/0).

EXT Character Control (FW2 Only)

1. Write ETX from data comm into TD memory (0096/4/1).
2. Not to write ETX from data comm into TD memory (0096/4/0).
3. Cursor advance on ETX from data comm (00A0/2/1).
4. No cursor advance on ETX from data comm (00A0/2/0).
5. Write ETX from keyboard into TD memory (Press ETX key).
6. Not to write ETX from keyboard into TD memory (do not press ETX key).

HT Character control (FW2 Only)

1. Write HT from data comm into TD memory (00A0/0/1).
2. Not to write HT from data comm into TD memory (00A0/0/0).
3. Write HT from keyboard (Tab field identifier) into TD memory (0096/6/1).
4. Not to write HT from keyboard into TD memory (0096/6/0).

MCR Code Translation (FW2 Only)

The magnetic card reader (MCR) code translation option allows the terminal to translate magnetic card data from ASCII 3A through 3E to ASCII 1A through 1E respectively.

This option is enabled by setting address 009B, bit 1, to state ONE. It is disabled by setting address 009B, bit 1, to state ZERO.

TTY Printer CR Delay (FW2 Only)

The Terminet ® TTY printer requires a 256-msec CR delay, enabled by setting address 009B, bit 2, to state ONE. The CR delay is disabled by setting address 009B, bit 2, to state ZERO.

Lower Case Lockout (FW2 Only)

This feature may be used with a keyboard having lower case capability. It causes translation of ASCII columns 6 and 7 to columns 4 and 5 respectively. Firmware 2 implements control of this configuration address 0092, bit 6, set to the ONE state. The configuration bit overrides the data comm and the keyboard control sequences.

If in firmware 2 the configuration address 0092, bit 6, is set to the ZERO state, both keyboard and program control are active. CTRL Y enables lower case keyboard lockout and affects keyboard-entered data. CTRL T disables the feature from the keyboard.

Keyboard lower case lockout is enabled from data comm by ESC Y. The ESC Z sequence disables the feature.

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Programmatic Mode Control

The terminal has programmatic mode control, allowing the central system to select the operating mode of the terminal following a successful transmission from the central system. Normally, in receive mode, the terminal switches to local mode at the successful completion of transmission. Programmatic mode control consists of the insertion by the central system of the DC1 character (column 1, row 1, of figure C-1) into the message between STX and ETX. DC1 requires no memory space. The receipt of the DC1 character causes the terminal to remain in the receive mode for the receipt of successive messages from the central system.

The terminal also has the capability of a hold-in-receive mode (or continuous programmatic mode). It does not require the DC1 character. Upon successful completion of a message transfer from the central system, the terminal remains in the receive mode. Hold-in-receive (continuous programmatic) mode control is selected by Burroughs, for terminals without a keyboard.

SECTION 4
KEYBOARDS

GENERAL DESCRIPTION

Unless a receive-only terminal is desired, a keyboard is included with the basic system. The keyboard allows operator access to the terminal. Keyboard data is simultaneously stored in the display memory and displayed on the screen.

Figure 4-1 shows the U.S. typewriter keyboard for this terminal. Keyboard configurations are identified. The keyboards are subdivided into control keys, indicators, and function keys. The alphanumeric keys are available on either typewriter or data preparation keyboard.

KEYBOARD CONFIGURATIONS

Three basic keyboard configurations are available: the typewriter keyboard, the data preparation keyboard, and the auxiliary numeric keyboard in conjunction with either of the other two. The keyboard is connected to the basic system via a cable. Keyboards are available for nationalistic requirements.

U.S. Typewriter Keyboard

The keyboard resembles a typewriter keyboard. It is designed for ease in entering alphanumeric data. Figure 4-1 shows the layout. The function keys, control keys, and indicators are described later in this section.

Data Preparation Keyboard

The keyboard resembles a keypunch keyboard in the placement of numerals. Figure 4-2 shows the layout. It is designed for ease in entering both alphanumeric and numeric data. Numeric data may be entered in both shifted and unshifted condition. The function keys, control keys, and indicators on this keyboard are described later in this section. The data preparation keyboard is recommended for a data entry installation.

Programmability/Expanded Alphanumeric Keyboard

The TD 830/TD 730 system, with firmware level 3 or higher, can operate with an expanded alphanumeric keyboard (TD019), and permits programming of certain keyboard keys. The programmable keys for the TD018, TD016, TD015 are shown in table 4-1. Programmable keys for the TD019 are identified in table 4-2.

When the TD019 expanded keyboard is used with

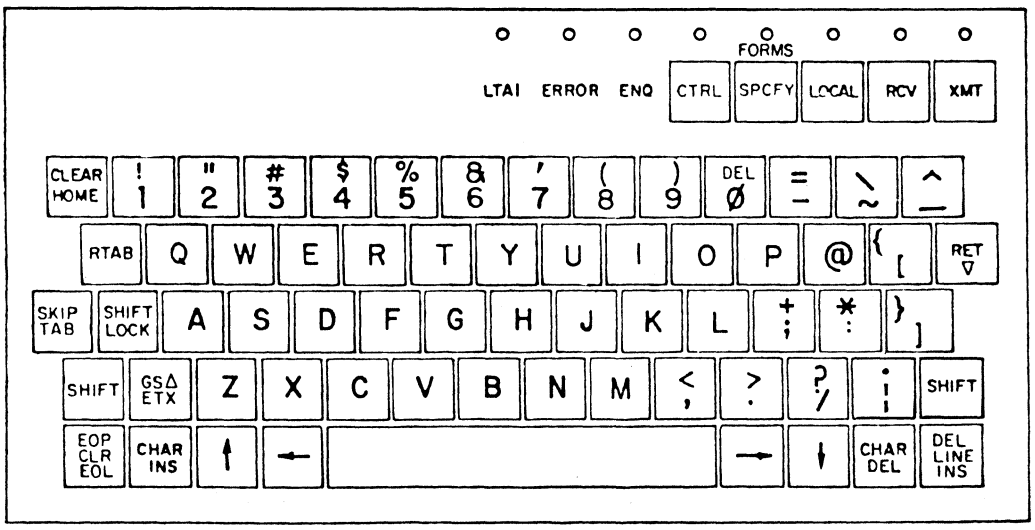

Figure 4-1. U.S. Typewriter Keyboard, ASCII

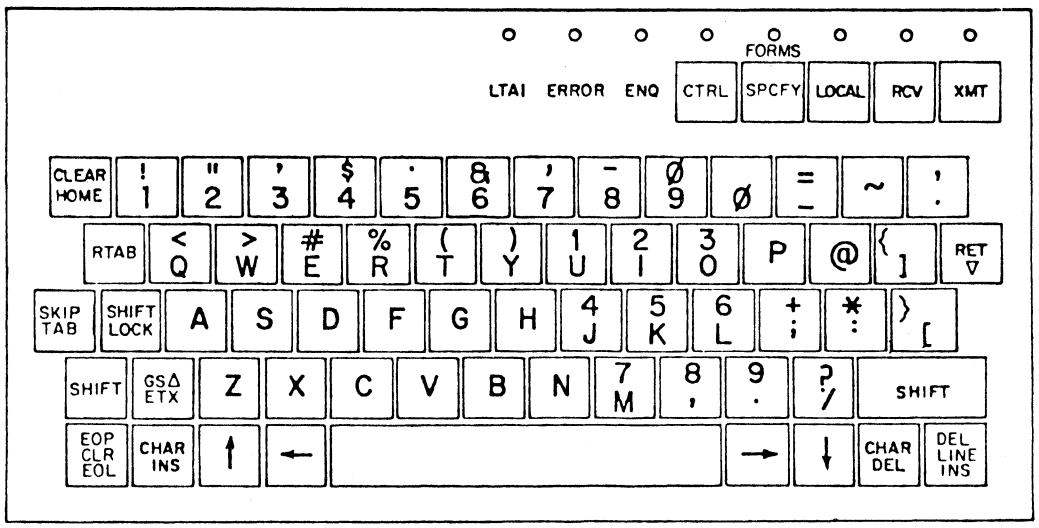

Figure 4-2. Data Preparation Keyboard

the TD 830/TD 730 terminals, the following features are provided:

Full alphanumeric typewriter-style keyboard
Thirteen-key numeric keypad
Dedicated function keys
User programmable function keys
Keylock switch
Twenty-four LED indicators (16 accessible from central processor)

Table 4-1. Programmable Keys on TD015, TD016, and TD018 Keyboards (Firmware 3.0 or Higher)

CLEAR
HOME
REVERSE TAB
RETURN
SKIP
TAB
ETX
CLEAR, END-OF-PAGE
CLEAR, END-OF-LINE
CHARACTER INSERT
CHARACTER DELETE
LINE DELETE
LINE INSERT
SPECIFY
RECEIVE
↑ RECEIVE LINE FEED
← BACKSPACE
↓ LINE FEED
→ FORWARD SPACE

10-Key Auxiliary Keyboard

The 10-key auxiliary keyboard (figure 4-3) is available for connection to any of the typewriter or data preparation keyboards. It provides a 10-key format for convenient numeric inputs. The auxiliary keypad cannot stand alone (without typewriter or data preparation keyboard).

No Keyboard (Receive-Only Terminal)

The terminal is available with the optional configuration which contains no keyboard. This configuration is also called a receive-only terminal. It accepts data only from the central system via data communication lines and displays the data on the screen. Receive-only operation is enabled by Burroughs (hold-in-receive mode option).

CONTROL KEYS

The terminal has five control keys: XMT, RCV, LOCAL, SPCFY, and CTRL (figure 4-1). These allow the operator to control the mode of operation of the terminal. These control keys and the CHAR INS key are nonrepeating. They are the only nonrepeating keys on the keyboard.

XMT - Transmit Key

The XMT key places the terminal in the transmit mode of operation and lights the XMT indicator. Transmission of data from the terminal in forms mode begins with the first unprotected character and

Table 4-2. Programmable Keys on TD019 Keyboard (Firmware 3.0 or Higher)

Key Function	Key Location	Key Function	Key Location
CLEAR	A1	000 TRIPLE ZERO	F8
LINE INSERT	A2 Shifted	FORMS	A17
CHARACTER INSERT	A2 Unshifted	ALIGN	A18
LINE DELETE	A3 Shifted	ETX	A19
CHARACTER DELETE	A3 Unshifted	SPECIFY	A21
CLEAR, END-OF-PAGE	A4 Shifted	RECEIVE	A23
CLEAR, END-OF-LINE	A4 Unshifted	ROLL UP	A6 Shifted
SCROLL UP	A5 Shifted	ROLL DOWN	A6 Unshifted
SCROLL DOWN	A5 Unshifted	TAB SET	E15
MOVE UP	A7 Shifted	PRINT ALL	A16 Shifted
MOVE DOWN	A7 Unshifted	PRINT UNPROTECTED	A16 Unshifted
↖ HOME	B1, C23	TAPE TWO	A14
→ SKIP	B15/16, C21/D21	TAPE ONE	A13
|← REVERSE TAB	C1, D22/23	BACKSPACE TAPE	A8 Shifted
→| TAB	C15, E21/F10	SEARCH TAPE	A8 Unshifted
CAP LOCK	D1	WRITE TAPE MARK	A9 Shifted
←┘ RETURN	D14/15	READ RECORD	A9 Unshifted
↑ REVERSE LINE FEED	F1	READ PAGE	A10 Unshifted
← BACKSPACE	F2	READ PAGE, TRANS.	A10 Shifted
→ FORWARE SPACE	F4		
↓ LINE FEED	F5	READ FILE, TRANS.	A11
CLEAR FIELD	C22	CARD READER ENABLE	A15 Unshifted
BACK PAGE	E22/23	PIN ENABLE	A15 Shifted
NEXT PAGE	F11/12	WRITE ALL	A12 Shifted
00 DOUBLE ZERO	F7	WRITE UNPROTECTED	A12 Unshifted

continues through all unprotected and transmittable protected data up to, but not including, the cursor position. Pressing XMT aligns the data comm pointer to the display cursor position of the terminal and initiates the transmit operation. After a successful transmission, the XMT indicator goes out and the RCV indicator lights.

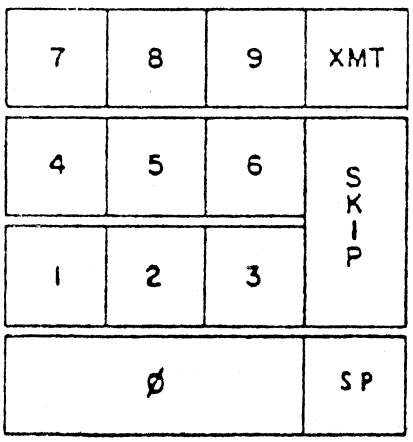

Figure 4-3. 10-Key Auxiliary Keyboard

RCV - Receive Key

The RCV key puts the terminal in the RCV mode and lights the RCV indicator. Use of the RCV key is only possible in local mode. The lighted RCV indicator signifies that the terminal is prepared to receive data. Pressing the RCV key aligns the data comm pointer with the display cursor position.

LOCAL Key

The LOCAL key puts the terminal in local mode and lights the LOCAL indicator.

SPCFY - Specify Key

The SPCFY (specify) key puts the terminal in transmit mode and lights the XMT indicator. It causes the location of the cursor to be transmitted to the central system during the next polling sequence.

When the terminal is polled, it responds with its normal heading followed by STX, ESC, '' , COL, ROW, ETX, BCC. COL represents the cursor column position and ROW represents the cursor line position. Refer to the programmable cursor position description in Section 3 for more detailed character description and examples.

CTRL - Control Key

Pressing the CTRL key puts the terminal in control mode. The CTRL key functions in either the shifted or unshifted mode. The CTRL indicator lights when the CTRL key is pressed. Pressing the unshifted CTRL key prior to pressing one or more keyboard keys causes the entry to be interpreted as a single control code (Appendix D). Pressing the shifted CTRL key locks the system in the control mode until the CTRL key is pressed again, which causes the CTRL indicator to go out and takes the terminal out of control mode.

INDICATORS

Indicators show the status (or operating mode) of the terminal to the operator. Figure 4-2 identifies the location of the indicators.

XMT - Transmit Mode Indicator

When the terminal is in the XMT mode the XMT indicator lights when XMT or SPCFY keys are pressed. XMT goes out when a transmission from the terminal has been positively acknowledged by the central system or when the terminal is switched to local mode.

RCV - Receive Mode Indicator

RCV lights either when the RCV key is pressed from local mode or when data transmission from the terminal has been successfully completed. The light shows that the terminal is ready to receive data. The RCV indicator goes out when either the LOCAL, XMT, or SPCFY key is pressed or, by keyboard entry, when the display cursor and data comm pointer are on the same page.

LOCAL - Local Mode Indicator

The LOCAL indicator lights when the local mode is activated. This may occur by pressing the LOCAL key or by using the keyboard when the terminal is in receive mode with no data being transmitted to the terminal. It lights following successful completion of data transmission to the terminal unless the programmatic mode control is in effect. The indicator goes out when the terminal is switched to the receive or transmit mode.

FORMS - Forms Mode Indicator

The FORMS indicator lights whenever the displayed page of the terminal is in forms mode. There is no single FORMS key to activate the FORMS indicator; instead, there are control codes (Appendices D and E) which may be originated either from the keyboard or the central processor. This terminal switches to forms mode whenever it receive either a CTRL W or an ESC W. CTRL Q and ESC X cause the FORMS indicator to go out.

CTRL - Control Mode Indicator

The lighted CTRL indicator shows that the terminal is in control mode. The indicator lights when the CTRL key is pressed and remains lit as long as the terminal is in the control mode. It goes out upon completion of the control sequence for unshifted CTRL key operation. However, when the terminal is locked (shifted CTRL) in the control mode, the CTRL key must be pressed by the operator to cause the CTRL indicator to go out.

ENQ - Enquiry Indicator

The ENQ indicator lights when the terminal detects that the central system is attempting to transmit a message to the terminal while the terminal is not in receive mode. The ENQ indicator goes out when the terminal is placed in the receive mode or when the operator presses the LOCAL key. To alert the operator, the audible alarm sounds when the ENQ indicator lights.

ERROR Indicator

The ERROR indicator lights when any error is detected by the terminal, and goes out on the successful retransmission of the message, the receipt of the new message, or the pressing of the LOCAL key.

LTAI - Line Terminal Activity Indicator

The LTAI indicator is lit whenever the central processor is transmitting to any terminal on the line. The LTAI indicator goes out on any given terminal when that terminal is transmitting to the central processor. The indicator flashes with normal data communications line activity, for example when the terminal is polled/selected. The time that the light re-

mains on or off depends upon the message on the line. An LTAI indicator which remains off indicates that the terminal has not detected any transmission on that line, while an LTAI indicator which remains lit indicates that the terminal is not responding.

FUNCTION KEYS (KEYBOARD SYMBOL)

Function keys are designed to perform several specialized tasks.

Automatic Key Repeat

All noncontrol keys except the CHAR INS key are repeating. Noncontrol keys are all keys except the control keys identified earlier in this section. Each repeating key, when pressed for a period exceeding 1/2 second, initiates an automatic 12-Hertz repeat of that key. Automatic repeat of a key causes the repetition of that character or function in successive screen and memory locations. Releasing the key terminates the repeat operations.

Line Feed (↓)

Line feed moves the cursor to the same relative position one line down. When the cursor is in the bottom line of the page, line feed causes it to be moved to the same relative position in the top line of the page. This key has the same function as the central system program LF control character.

Reverse Line Feed (↑)

Reverse line feed moves the cursor to the same relative position one line up. When the cursor is in the top line of the page, reverse line feed causes it to be moved to the same relative position in the bottom line of the page. This key is duplicated by the central system program DC3 control character.

Backspace (←)

Backspace moves the cursor backward one position. When the cursor is to the left edge of a line, backspace causes it to be moved to the right edge of the next higher line of the page. If the cursor is in home position, backspace causes it to be moved to the last position of the last line. The central system program BS control character duplicates this function.

Forward Space (→)

Forward space moves the cursor one space to the right. If the cursor is at the right edge of a line, forward space moves it to the first position on the next line. If the cursor is on the last line, forward space causes the cursor to be moved to the home position of the page. The central system program ESC C control code duplicates this function.

CLEAR/HOME

The unshifted CLEAR/HOME key activates the home function. Pressing the CLEAR/HOME key causes the cursor to be moved to the left-most position on the top line of the page (home position). In forms mode, HOME moves the cursor to the first position of the first unprotected data field. The central system program DC4 control character also performs the home function.

The shifted CLEAR/HOME key activates the clear function. CLEAR erases all data on the page and also moves the cursor to the home position. In forms mode, CLEAR erases the unprotected data only, and moves the cursor to the first position of the first unprotected data field on the page. The central system program FF control character activates both home and clear. If Burroughs enables the CLEAR key option, the CLEAR key clears the entire page in forms mode.

Return (RET)

Return moves the cursor from any position in a line to the first position of the next line. If the cursor is in the last line, return moves it to home position. This terminal may write the CR character symbol (▽) into memory and on the screen. The system option of not writing the CR symbol into memory may be installed. The central system program CR control character duplicates the return function.

SKIP/TAB

The TAB key moves the cursor forward to the next fixed or variable tab stop location. If the fixed tab option is installed, fixed tab stops are located at positions 1, 9, 17, 25, 33, 41, 49, 57, 65, and 73 of each line. If the variable stop option is installed, the variable tab stop may be set at any position on the display line.

In forms mode, tab stops (fixed or variable) are ignored, and TAB causes the cursor to move forward to the first character location of the next unprotected field. If the field identifier option is installed by Burroughs, the TAB key causes a field identifier character (→) to be written into memory and on the screen.

SKIP is the shifted TAB key. With the variable tab feature enabled, pressing SKIP alternately sets or resets the tab stop at the cursor location. With search mode enabled, the SKIP key causes a skip to the next unprotected data field, error or assigned search character. SKIP is not duplicated by program control.

Reverse Tabulation (RTAB)

When forms mode is disabled, the RTAB key causes the cursor to move back to the preceding tab stop. In forms mode, the RTAB key moves the cursor back to the preceding unprotected data field. The RTAB function is not duplicated by program control.

End-of-Line/End-of-Page Clear (EOL/EOP CLR)

The unshifted key clears data from the cursor to the end of the line. When forms is disabled, the EOL key clears all data from the cursor position to the end of that line. In forms mode, the EOL key clears all data from the cursor position to the trailing delimiter (◁) in an unprotected field without right justification and from the cursor to the left to the group separator(△)in an unprotected field with right justification.

The shifted EOl/EOP CLEAR key clears all data (or all unprotected data in forms) from the cursor to the end of the page.

Line Insert/Delete (LINE INS/DEL)

The unshifted LINE INS key causes all data in the lines below and including the line in which the cursor is positioned to be moved down one line. All data on the bottom line of the page is lost. This function is inhibited in forms mode.

The shifted LINE INS/DEL key erases the line in which the cursor is positioned and all data in the lines below is moved up one line. This function is inhibited in forms mode.

End-of-Text/Group Separator (ETX/GS△)

Unshifted ETX/GS△causes the ⧖ symbol to be written into memory and on to the screen if enabled by Burroughs. The ⧖ symbol (ASCII 0,3) is interpreted as the end-of-text character. pressing ETX automatically moves the cursor to home.

Shifted ETX/GS△ enters the △ symbol into memory and onto the screen. With forms mode enabled, this △ symbol is interpreted as the leading delimiter of a right-justified field. With forms mode disabled, this symbol is ignored.

Leading Forms Delimiter Key

In the terminal, the leading forms delimiter is usually the left brace { key, unless a different character key has been enabled by Burroughs to do this function. The leading forms delimiter character US (▷) is derived from the enabled leading character and is written into memory and displayed on the screen in non-forms mode. It has no special function in non-forms.

In forms mode, this character is displayed on the screen as the symbol ▷ . This symbol is interpreted as the leading delimiter of an unprotected data field without right justification.

Trailing Forms Delimiter Key

The trailing forms delimiter character is usually the closing brace } key, unless a different character key has been enabled by Burroughs to do this function. The trailing delimiter character is written into memory and is displayed on the screen in non-forms. However, it has no function in non-forms.

In forms mode, this character is displayed on the screen as the symbol ▷. This symbol is interpreted as the trailing delimiter of an unprotected data field with or without right justification. Disabling forms mode does not convert the RS character back to the trailing delimiter. The RS character also terminates the highlighting fields and the transmittable protected data field.

Character Insert (CHAR INS)

Pressing the CHAR INS key puts the terminal in character insert mode and inserts a space at the cursor position. Subsequent pressing of an alphanumeric key (including space) causes the alphanumeric character to be inserted at the cursor location. The succeeding characters within the line are moved one space to the right. Surplus characters, if any, are shifted off the end of the line and lost. If the CTRL key is pressed prior to pressing the CHAR INS key, the function is performed on a page basis. The succeeding characters are moved down one space to the right and down line by line. A second pressing of the CHAR INS key causes the terminal to exit the character insert mode.

When in the forms mode, the character insert function causes data shifting within a single unprotected data field in which the cursor is located.

Character Delete (CHAR DEL)

The CHAR DEL key causes the removal of the displayed character at the cursor location. The succeeding characters are moved one space to the left within the display line or the unprotected data field (forms mode). Spaces are moved into the line from the right edge of the line or the next trailing delimiter (forms mode).

For the right-justified field (forms mode), a character is removed at the cursor location but the data moves from left to right. Spaces are inserted at the opening delimiter of the right-justified field.

In non-forms mode only, pressing CTRL prior to pressing CHAR DEL causes the succeeding characters on the page to be shifted to the left and up, line by line.

KEYBOARD SECURITY LOCK

(See figures 1-1 and 1-2.)

A security lock is optionally provided with each keyboard. The security lock electrically inhibits unauthorized use of the keyboard by disabling the keyboard encoder outputs. The security lock consists of a tumbler lock with a removable key and is located on the right side of the keyboard assembly. The keyboard can only be locked in receive or local modes.

ALPHANUMERIC TYPEWRITER

The TD019 keyboard (figure 4-4) provides an alphanumeric typewriter-style section which allows entry of both alphanumeric characters and symbols. The key characteristics (including spacing, pressure, and throw) are similar to those of an electric typewriter.

The alphanumeric typewriter section of the keyboard may be configured with various character sets to meet the domestic and international markets. Figures 4-4 through 4-6 show the codes used by the terminal to represent the U.S. and international characters. The character sets provided for the U.S. and international markets are shown in figures 4-7 through 4-17.

13-KEY NUMERIC KEYPAD SECTION

The TD019 keyboard has a numeric keypad for rapid entry of numeric data. The numeric keypad features 12 numeric keys and a decimal point clustered together.

The 12 numeric keys consist of 0 through 9 plus double zero and triple zero.

The double zero key puts two zeros (ASCII 3,0) into display memory.

The triple zero key puts three zero characters (ASCII 3,0) into display memory.

The decimal point key puts the period symbol (ASCII 2,E) into display memory.

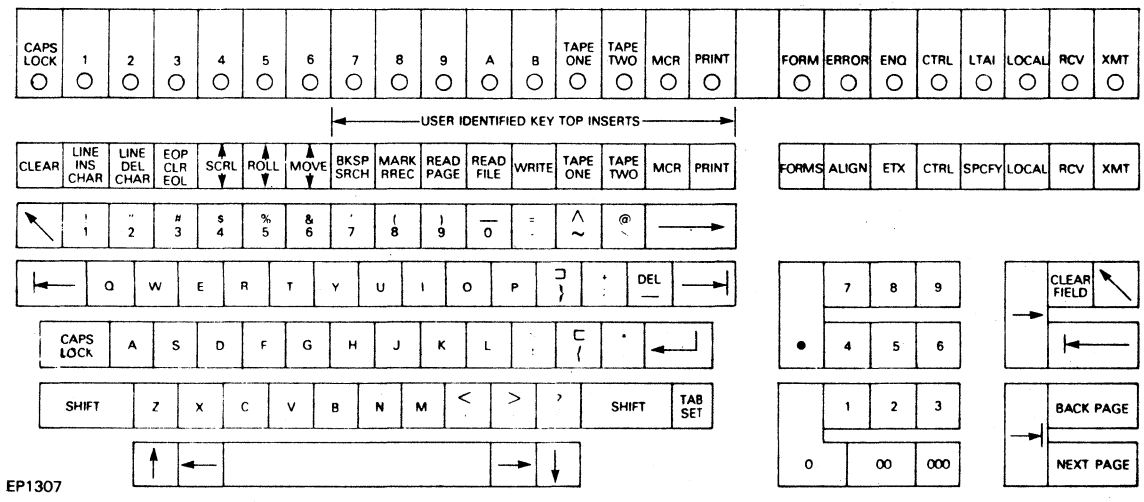

Figure 4-4. TD019 Keyboard, U.S. (Version 1)

Version	Col 2 Row 3	Col 4 Row 0	Col 5 Row 13	Col 5 Row 14	Col 5 Row 15	Col 6 Row 0	Col 7 Row 13	Col 7 Row 14	Col 5 Row 11	Col 7 Row 11	Col 5 Row 12	Col 7 Row 12
2	£							—				
3	£							—				
4	£							—				
5	£	§	Ü				ü	ß	Ä	ä	Ö	ö
6			Ã				a	—	Õ	õ	Ç	ç
7								—			Ñ	ñ
8	£	Ö	Å	Ü	Ä	Ö	å	ü	Æ	œ	ø	ø
9	£	§	Š	Ž			š	ž	Ć	ć	Č	č
10	£		Å	Ü			å	ü	Ä	ä	Ö	ö

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Figure 4-5. International Character Modifications to ASCII Code Chart

KEYBOARD FUNCTION KEYS

The terminal keyboard unit contains control keys which relate to the mode of operation and operational status of the terminal. These keys are used by the operator to select terminal functions. Keyboard control keys are listed in table 4-3 along with their respective functions. All positions are referenced to table 4-2. Keyboard control keys are also described in this section under the Standard Keyboard heading.

LED Indicators

The TD019 keyboard has 24 light emitting diode (LED) indicators for use by the terminal. These indicators are located across the top of the keyboard and are labeled A through X in left to right order. Table 4-4 defines the function of each LED indicator.

Automatic Key Repeat Function

If a key on the TD019 keyboard is pressed for more than 0.5 seconds, automatic 12-character-per-second repetition occurs.

Releasing the key ends the repeat action. Keyboard key positions exempt from the repeat are:

CTRL
SPCFY
RCV
XMT
LOCAL
SHIFT

The repeat function is non-operable whenever more than one keyswitch is pressed.

Security Lock

A security keylock switch is standard on all TD019-type keyboards. When locked, data output is inhibited. The LED indicators on the keyboard, however, are not affected by the position (lock/unlocked) of the security keylock switch.

KEY PROGRAMMABILITY

The TD 830/TD 730 terminal provides the capability for users to program certain keyboard function

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	ス	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	ー	=	M	シ	フ	ワ
14	･	)	N	ヌ	ヘ	ン
15	／	ク	O	セ	ホ	DEL

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Figure 4-6. Japanese (KAWASE) Character Set

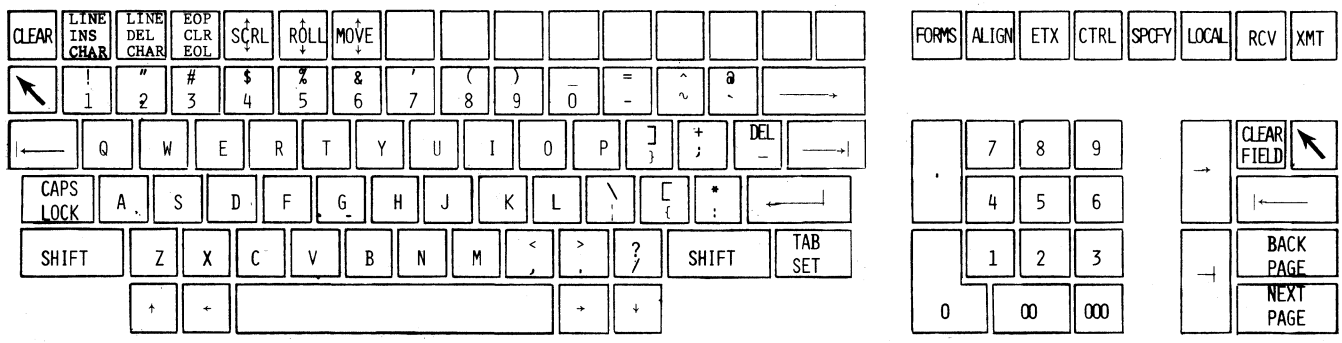


Figure 4-7. Version 1 Keyboard

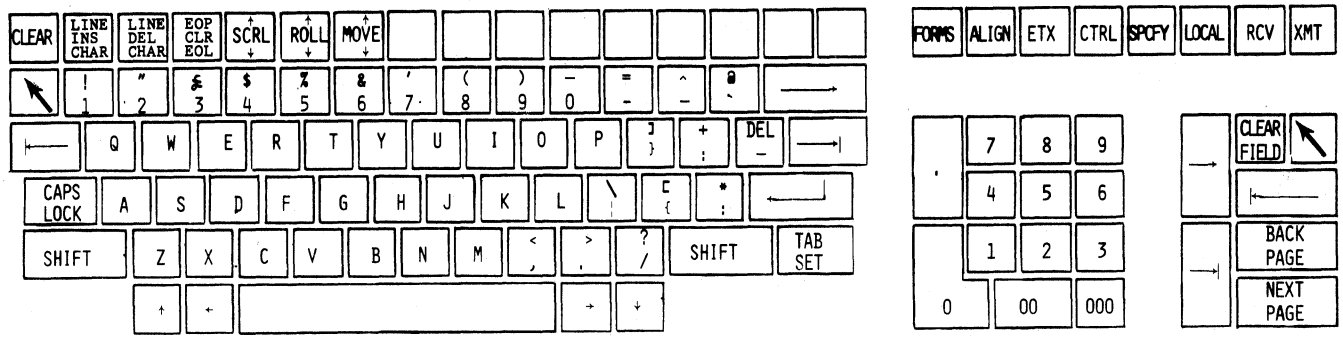


Figure 4-8. Version 2, Keyboard

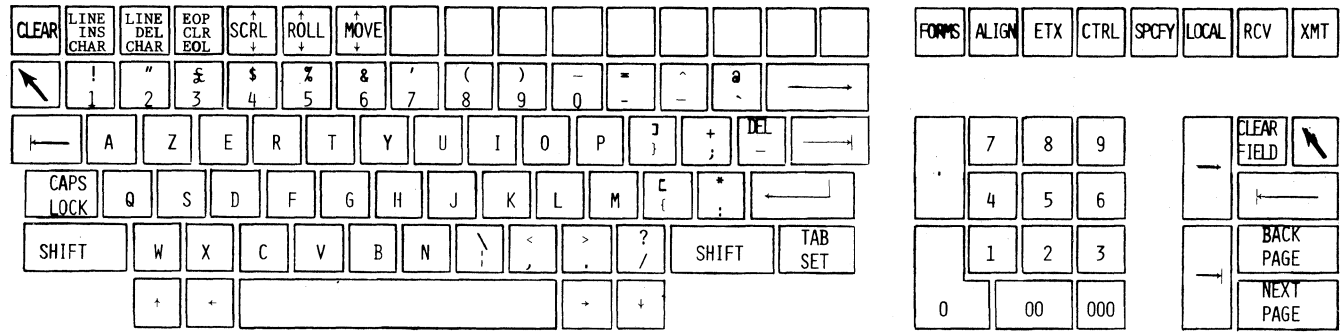


Figure 4-9. Version 3 Keyboard

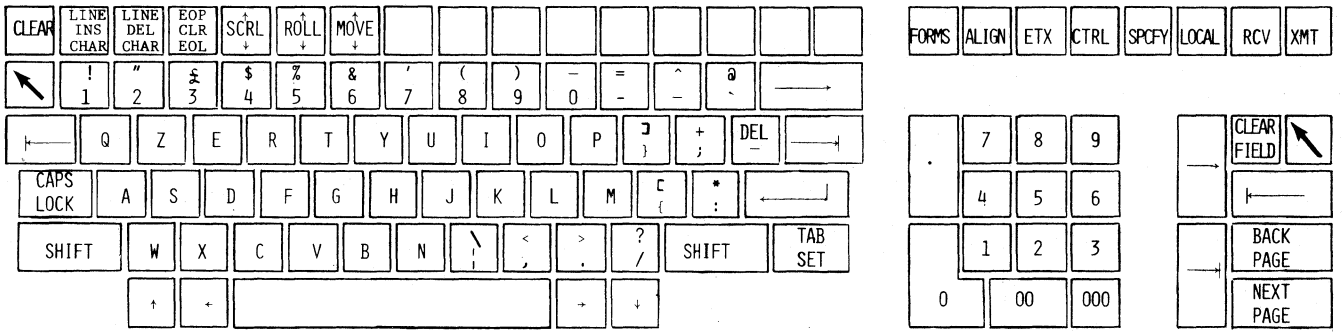


Figure 4-10. Version 4 Keyboard

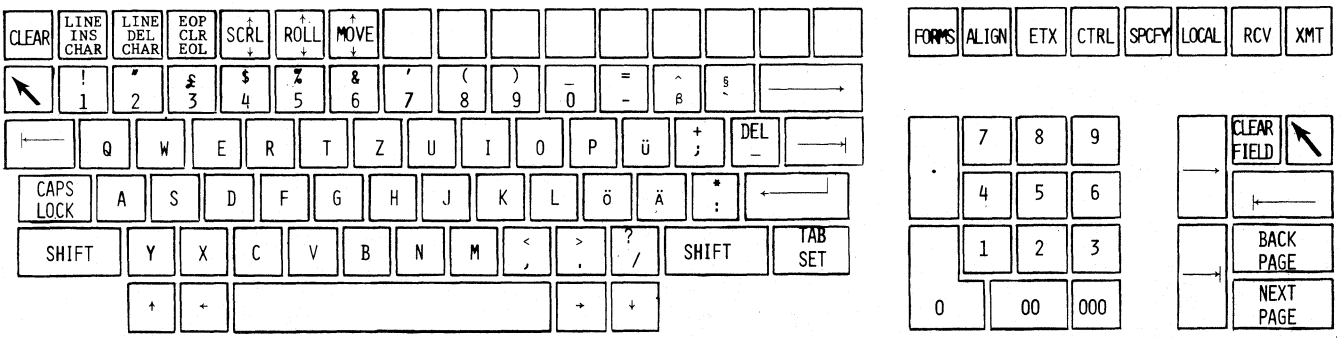


Figure 4-11. Version 5 Keyboard

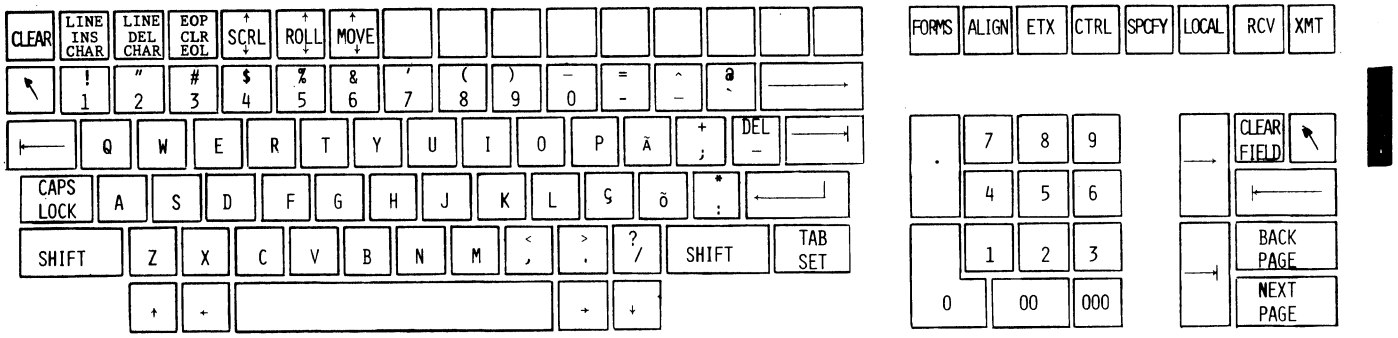


Figure 4-12. Version 6 Keyboard

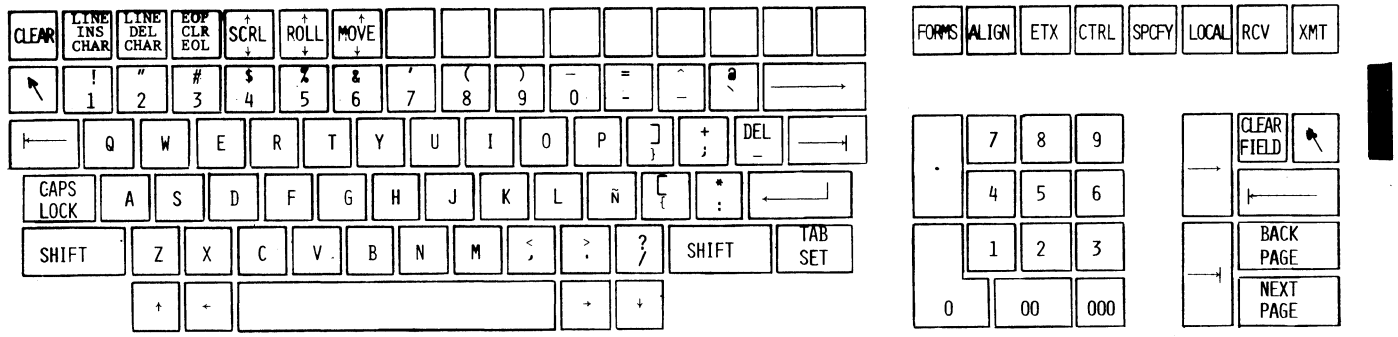


Figure 4-13. Version 7 Keyboard

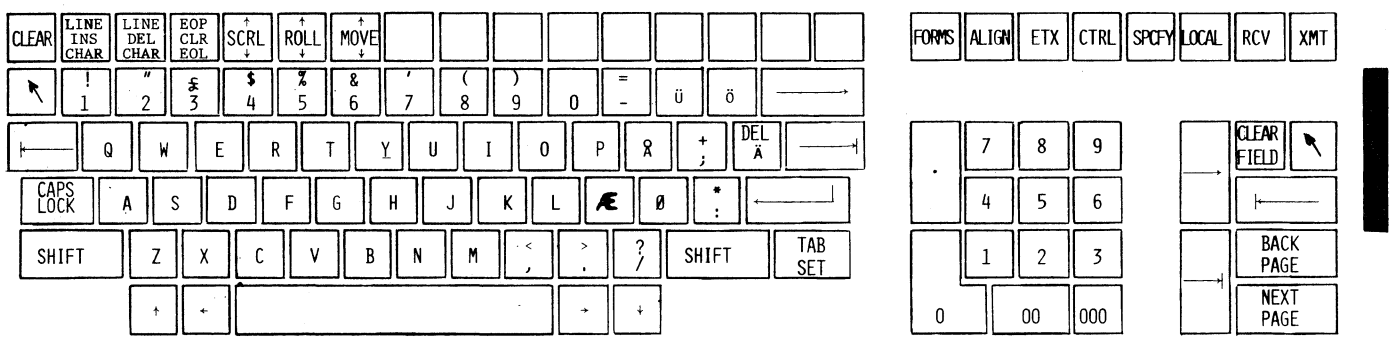


Figure 4-14. Version 8 Keyboard

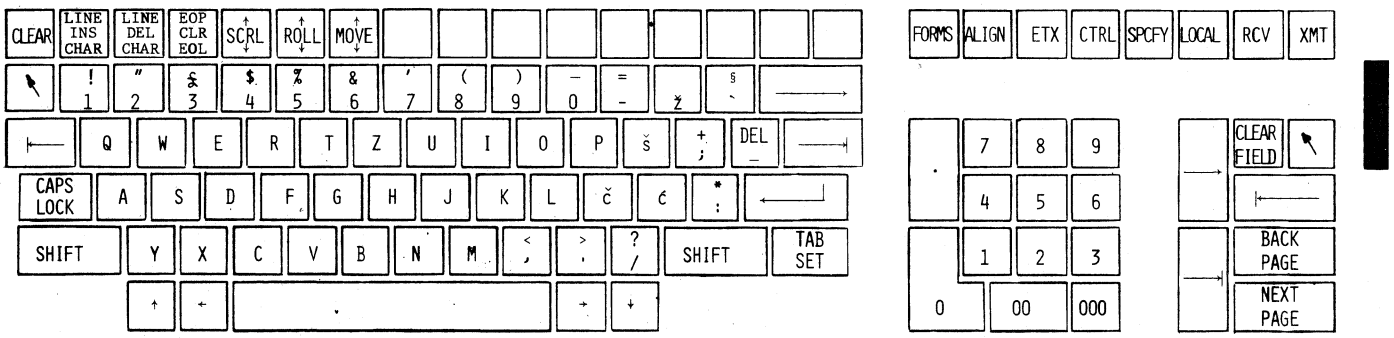


Figure 4-15. Version 9 Keyboard

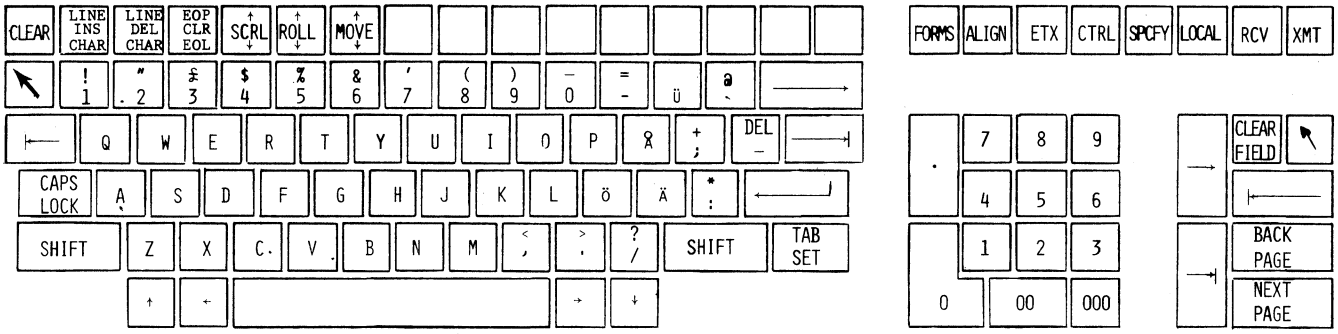


Figure 4-16. Version 10 Keyboard

keys to either change the function or to cause the key to request a set of predefined functions or characters.

Key programmability allows the user to establish a character or function sequence, or form, within the terminal and to then reaccess that sequence or form by pressing a single key. A key program may be established from either the keyboard or the CPU through data comm.

KEY PROGRAMMING FROM KEYBOARD

A function key is programmed from the keyboard as follows:

1. Enter keyboard program mode by entering CTRL, space, L, CTRL sequence.
2. Press function key to be programmed.
3. Enter the desired key program characters, functions, or other information. (Note that the CTRL H sequence may be used to enter characters from ASCII columns 0 and 1.)
4. Press LOCAL key to exit the keyboard program mode.

Example 1

Press the following keys to enable the ETX key to transmit 123456 as secure data. This is an example of secure data being transmitted by pressing a single key (ETX).

CTRL space L CTRL
ETX
CTRL H 9 (secure data)
123456 (code)
CTRL H > (end highlight)
XMIT
LOCAL

Example 2

Group separator (△) is not a TD019 keyboard character. If the △ character is required, this example puts △ on the same key (ETX) in the shifted position as it is on the TD015 keyboard.

CTRL space L CTRL
Shifted ETX
CTRL H = △
LOCAL

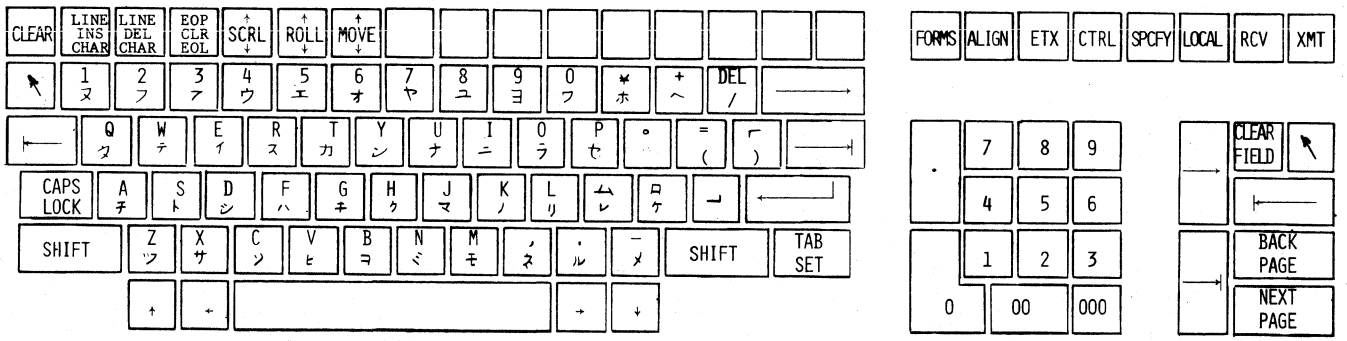


Figure 4-17. KAWASE Keyboard

Table 4-3. Keyboard Control Keys

Key	Function
XMT key (key position A24)	Transmit key. Pressing the XMT key places the Terminal in the Transmit mode of operation, lights the XMT indicator, and initiates a transmit operation.
RCV key (key position A23)	Receive key. Pressing the RCV key places the Terminal in the Receive mode of operation and lights the RCV indicator.
LOCAL key (key position A22)	Pressing the LOCAL key places the Terminal in the Local mode of operation and lights the LOCAL indicator. The LOCAL key is also used to initiate a general Terminal reset function, which includes cancelling the reconfiguration mode, control (CTRL) mode and character insert mode.
SPCFY key (key position A21)	Specify key. Pressing the SPCFY key causes the location of the cursor to be transmitted to the central processor during the next interrogation sequence.
CTRL key (key position A20)	Control key. In the unshifted mode, activation of the CTRL key prior to striking single or multiple alpha or numeric key(s) causes the alpha or numeric key(s) to be interpreted as a control code. In shifted mode, activation of the CTRL key will lock the system in the control mode until the CTRL key is activated in the unshifted mode.
↓ (Line Feed, key position F5)	Line feed moves the cursor down one line. When the cursor is in the bottom line, line feed causes it to reappear in the top line.
↑ (Reverse Line Feed, key position F1)	Reverse line feed causes the cursor to be moved up one line. When the cursor is in the top line, reverse line feed causes it to reappear in the bottom line.
← (Backspace, key position F2)	Backspace the cursor one character. When the cursor is at the left edge of the viewing area, backspace causes it to reappear at the right edge of the 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, key position F4)	Forward space moves the cursor one space to the right. If the 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, key positions B1 and C23)	HOME causes the cursor to be moved to the Home (upper left) position.
EOP CLEAR	Clear to End of Page. Pressing of the EOP CLEAR key (key position A4 shifted) clears 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, pressing the EOL CLEAR key (key position A4 unshifted) clears all data from the cursor position to the end of that line. In Forms, the EOL CLEAR key will clear all data from the cursor to the next delimiter.
CLEAR (key position A1)	CLEAR erases all data on the page and homes the cursor, however, when in the Forms mode, only unprotected data is erased, unless the Forms erase configuration has been selected. The CLEAR key operates in shifted mode.

Table 4-3. Keyboard Control Keys (Cont.)

Key	Function
↵ (RETURN) (key position D14/15)	Pressing the return key causes the Terminal to execute a combined CR-LF (carriage return/line feed) function by moving the cursor to the first column of the following line. In normal operation, the Terminal writes the CR character (▽) into memory. The Terminal has the capabilities of not writing the CR character, and/or interpreting the return key as carriage return request without line feed. When the Terminal is in Forms mode, pressing the return key shall cause the cursor to perform the CR or CR-LF function followed by a tab to the next unprotected data field. Terminal interpretation of the return key and writing of the CR character (▽) are controlled through configuration change.
→ (TAB, key positions C15 and E21/F10)	The TAB key causes the cursor to move forward to the next fixed or variable tab stop location. 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. If the tab field identifier feature is enabled, the TAB key causes a field identifier (⟶) character to be written into memory.
ETX (key position A19)	End-of-Text. Pressing the ETX key causes the symbol (⧖) to be written into memory and the movement of the cursor to the Home position. This symbol is interpreted as the end-of-text character.
INS CHAR	Character insert. The INS CHAR key (key position A2, unshifted) places the Terminal into the character insert mode.
INS LINE	Insert line. Pressing the INS LINE key (key position A2 shifted) causes 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 is lost. This function is inhibited in Forms mode.
DEL CHAR	Character delete. Pressing the DEL CHAR key (key position A3, unshifted) 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 mode). Pressing the CTRL key prior to pressing the DEL CHAR key causes the succeeding characters on the page to be shifted one space to the left and up line to line.
DEL LINE	Delete line. Pressing the DEL LINE key (key position A3 shifted) causes the erasure of the line in which the cursor is positioned and all data in the lines below to be moved up one line. This function is inhibited in Forms mode.
⟶ (SKIP)	With search mode enabled, the SKIP key (key positions B15/16 and C21/D21) causes the cursor to skip to the next field or error character.
← (RTAB)	Reverse tab. When Forms is disabled, pressing the RTAB key (key positions C1 and D22/23) will cause the cursor to move to the prior tab stop. In Forms, the RTAB key causes a tab from an unprotected data field to the prior unprotected data field. The RTAB key will operate in either fixed or variable tab mode.

Table 4-3. Keyboard Control Keys (Cont.)

Key	Function
BACK PAGE	Pressing the BACK PAGE key (key position E22/23) causes the Terminal to display the last entered or preceding page.
NEXT PAGE	Pressing the NEXT PAGE key (key position F11/12) causes the Terminal to display a new page (the next page in order).
CLEAR FIELD	Pressing the CLEAR FIELD key (key position C22) will cause the Terminal to perform a clear to end-of-line, or, in Forms mode, a clear to end-of-field. The CLEAR FIELD key clears all data in a right justified field.
TAB SET (key position E15)	Pressing the unshifted TAB SET key sets and resets variable tab stops at the cursor position. Pressing the shifted TAB SET key clears all variable tab stops.
FORMS (key position A17)	Pressing the unshifted FORMS key will place the Terminal into Forms mode and illuminate the Forms indicator. Pressing the shifted FORMS key will take the Terminal out of Forms mode and cause the Forms indicator to be extinguished.
ALIGN (key position A18)	Pressing the ALIGN key causes the Terminal to align the display cursor to the data comm pointer.
CAPS LOCK (key position D1)	Pressing the shifted CAPS LOCK key illuminates the Caps Lock indicator and causes the Terminal to lock out all keyboard characters from ASCII columns 6 and 7. Pressing the unshifted CAPS LOCK key extinguishes the Caps Lock indicator and causes the Terminal to accept keyboard entered characters from ASCII columns 6 and 7. When in Caps Lock, the Terminal converts keyboard entered characters from columns 6 and 7 to their column 4 and 5 counterparts.
SCRL ↑	Scroll up. Pressing the scroll up key (key position A5 shifted) causes the Terminal to scroll up to the next line.
SCRL ↓	Scroll down. Pressing the scroll down key (key position A5 unshifted) causes the Terminal to scroll down to the next line.
ROLL ↑ (up)	Roll up. Pressing the roll up key (key position A6 shifted) causes the Terminal to move the page data up one line.
ROLL ↓ (down)	Roll down. Pressing the roll down key (key position A6 unshifted) causes the Terminal to move page data down one line.
MOVE ↑ (up)	Move up. Pressing the move up key (key position A7 shifted) causes the Terminal to interchange data within the cursor display line with the data above the cursor display line.
MOVE ↓ (down)	Move down. Pressing the move down key (key position A7 unshifted) causes the Terminal to interchange data within the cursor display line with the data below the cursor display line.
PRINT (key position A16)	Pressing the shifted PRINT key will cause the Terminal to request a print page function. Pressing the unshifted print key will cause the Terminal to request a print unprotected data function.

Table 4-3. Keyboard Control Keys (Cont.)

Key	Function
	The print key provides a capped keytop for user defined label inserts.
CARD READER (key position A15)	Pressing the unshifted card reader key will cause the Terminal to illuminate the MCR indicator and to activate the manual Magnetic Card Reader (TD019-1 only). Pressing the shifted card reader key will cause the Terminal to activate the MCR indicator and activate the PIN keyboard (TD019-1 only). (MCR and PIN keyboard operations are described later in this section).
	The card reader key provides a capped keytop for user defined label inserts.
TAPE TWO (key position A14)	Pressing the unshifted tape two key causes the Terminal to illuminate the tape two indicator, extinguish the tape one indicator, and request a tape two select function for Terminal tape commands. Pressing the shifted tape two key will cause the Terminal to request a tape rewind in addition to the above.
	The tape two key provides a capped keytop for user defined label inserts.
TAPE ONE (key position A13)	Pressing the unshifted tape one key causes the Terminal to illuminate the tape one indicator, extinguish the tape two indicator, and request a tape one select function for Terminal tape commands. Pressing the shifted tape one key causes the Terminal to request a tape rewind in addition to the above.
	The tape one key provides a capped keytop for user defined label inserts.
WRITE (key position A12)	Pressing the shifted write key will cause the Terminal to request a write page function from the cassette controller in accordance with the previously selected tape drive. Pressing the unshifted write key will cause the Terminal to request a write unprotected function from the cassette controller, again in accordance with the previously selected tape drive.
	The write key provides a capped keytop for user defined label inserts.
READ FILE (key position A11)	Pressing the read file key causes the Terminal to request a read file and transmit function from the cassette controller in accordance with the previously selected tape drive.
	The read file key provides a capped keytop for user defined label inserts.
READ PAGE (key position A10)	Pressing the unshifted read page key will cause the Terminal to request a read page function from the cassette controller in accordance with the previously selected tape drive. Pressing the shifted read page key will cause the Terminal to request a read page function then transmit the resulting data page.
	The read page key provides a capped keytop for user defined label inserts.
TAPE MARK	Pressing the tape mark key (key position A9 shifted) will cause the Terminal to request a tape mark write by the cassette controller in accordance with the previously selected tape drive.

Table 4-3. Keyboard Control Keys (Cont.)

Key	Function
READ RECORD	Pressing the read record key (key position A9 unshifted) will cause the Terminal to request a read record function from the cassette controller in accordance with the previously selected tape drive. The tape mark/read record key provides a capped keytop for user defined label inserts.
BACKSPACE	Pressing the backspace key (key position A8 shifted) will cause the Terminal to request a backspace function from the cassette controller in accordance with the previously selected tape drive.
SEARCH	Pressing the search key (key position A8 unshifted) followed by the entry of a 3-digit numeric sequence will cause the Terminal to request a search by the cassette controller for the identified tape mark. The controller will search the previously selected tape drive. The Backspace/Search key provides a capped keytop for user defined label inserts.

Example 3

If the CLEAR key (TD019) in location A1 is confusing to an operator because the same key on a TD015 is home in the unshifted mode, perform the following steps to make it (unshifted) a home operation. Shifted CLEAR performs a clear operation.

CTRL space L CTRL
Unshifted CLEAR key
HOME (↖)
LOCAL

Example 4

In the "print all" mode, the terminal sends data from home to the cursor position. If all data must be sent to the printer, even if it is protected data before or after the forms on the screen, it is possible to program a key to position the cursor before printing to either first screen position or last screen position. The sequence is:

CTRL space L CTRL
Any key desired
CTRL < space space or CTRL < 0 7 (lower case 0, 7)
Shifted PRINT
LOCAL

Each additional key to be programmed requires a repetition of the preceding sequence. Up to 26 key functions may be stored. Each key for which a program is established is included in the 26-key function total. (The total is the sum of the number of keys programmed plus the programming for each key. This sum must be ≤26 functions total.)

The programmable keys for the TD019/TD019-1 keyboards are identified in table 4-2.

The programmable keys for the TD015, TD016, and TD018 keyboards are identified in table 4-1. The TD 830/TD 730 must contain level 3.0 (or higher) firmware for these keys to be programmable.

The standard function assigned to each of these keys is listed in table 4-3. Key locations are referenced in table 4-2.

The standard function assigned to each of these keys is listed at the beginning of this section.

KEY PROGRAMMING FROM DATA COMM

The TD 830/TD 730 terminals provide the capability for temporary (program loss with power-down) key program storage for key programs entered from the CPU through data comm.

Table 4-4. LED Indicator Functions

Indicator Position	Keyboard Label	Function
A	CAPS LOCK	LED indicator A is lit by the Terminal when the shifted CAPS LOCK key is pressed and indicates that the Terminal is in the Caps Lock mode. LED indicator A may also be accessed by the central processor through data comm. The ESC SP sequence will light the indicator and ESC RQ will extinguish the indicator. Indicator A is also lit/extinguished by enabling/disabling the Caps Lock feature from data comm (ESC Y/ESC Z). Power up with Caps Lock enabled will also light indicator A.
LED indicators B through L are controlled from the central processor only.		
B	1	ESC Λ S1 lights indicator. ESC Λ R1 extinguishes indicator.
C	2	ESC Λ S2 lights indicator. ESC Λ R2 extinguishes indicator.
D	3	ESC Λ S 3 lights indicator. ESC Λ R3 extinguishes indicator.
E	4	ESC Λ S4 lights indicator. ESC Λ R4 extinguishes indicator.
F	5	ESC Λ S5 lights indicator. ESC Λ R5 extinguishes indicator.
G	6	ESC Λ S6 lights indictor. ESC Λ R6 extinguishes indicator.
H	7	ESC Λ S7 lights indicator. ESC Λ R7 extinguishes indicator.
I	8	ESC Λ S8 lights indicator. ESC Λ R8 extinguishes indicator.
J	9	ESC Λ S9 lights indicator. ESC Λ R9 extinguishes indicator.
K	A	ESC Λ SA lights indicator. ESC Λ RA extinguishes indicator.
L	B	ESC Λ SB lights the indicator. ESC Λ RB extinguishes the indicator.
M	TAPE ONE	LED indicator M is lit by the Terminal when the Tape One key (key position A13) is pressed. LED indicator M is extinguished through lighting the LED indicator N (Tape Two). LED indicator M may also be accessed by the central processor through data comm. The ESC Λ SC sequence lights the indicator and the ESC ΛRC sequence extinguishes the indicator. Indicator M is not affected by data comm tape select.
N	TAPE TWO	LED indicator N is lit when the Tape Two key (key position A14) is pressed. LED indicator N is extinguished through lighting LED indicator M (Tape One). LED indicator N may also be accessed by the central processor data comm. The ESC Λ SD sequence lights the indicator and the ESC ΛRD sequence extinguishes the indicator. Indicator N is not affected by data comm tape select.
O	MCR	LED indicator O is lit when the Card Reader key (key position A15) is pressed. LED indicator O is extinguished upon completion of the card read or PIN entry function selected. LED indicator O may also be accessed by the central processor through data comm. The ESC Λ SE sequence lights the indicator and the ESC ΛRE sequence extinguishes the indicator.

Table 4-4. LED Indicator Functions (Cont.)

Indicator Position	Keyboard Label	Function
P	PRINT	LED indicator P is lit when the Print key (key position A16) is pressed. LED indicator P is extinguished upon completion of the data transfer from the Terminal to the printer. LED indicator P may also be accessed by the central processor through data comm. The ESC ^SF sequence is used to light the indicator and the ESC ^ RF sequence extinguishes the indicator.
Q	FORMS	The Forms indicator is lit when the unshifted FORMS key is pressed or when the Terminal enters Forms mode from data comm. Forms indicator is extinguished upo pressing of the shifted FORMS key or whenever the Terminal leaves Forms mode.
R	ERROR	The Error indicator is lit 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 buffer capacity. The Error indicator is turned off by the successful receipt of a new message, or the activation of the LOCAL key.
S	ENQ	Central Processor inquiry indicator is lit 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.
T	CTRL	The control indicator is lit upon activation of the CTRL key. The control indicator remains lit until one of the following conditions is met: 1. Enter sequence is completed. 2. Illegal control sequence is detected. 3. LOCAL key is pressed.
U	LTAI	Line-Terminal activity indicator is lit 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 extinguishes its LTAI indicator. In normal operation, the LTAI indicator blinks due to the data line activity. An LTAI indicator which remains lit indicates that the terminal is not responding. The LTAI indicator may be extinguished by pressing the LOCAL key.
V	LOCAL	The Local mode indicator is lit 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 lit 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.
W	RCV	The Receive mode indicator is lit 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.
X	XMT	The Transmit mode indicator is lit by the activation of the XMT key and 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.

NOTE

When programming the host system to send keyboard programming sequences to the terminal, the hexadecimal code requirements are represented by an ASCII character of the same description. For example, in the ESCRB program sequence (figure 4-18), the hexadecimal key location 9C for the PRINT key is loaded as ASCII 9 (3/9) and ASCII C (4/3) in the data comm buffer.

The following sequences allow key program storage within the terminal:

Sequence	Function
ESC RB	The ESC RB (a) (b) (c) sequence enables the terminal to allocate memory for the use of data comm, display, and key programs. The (a), (b), and (c) are interpreted as follows:
(a)	The three-character hexadecimal size of the total data comm buffer required.
(b)	The four-character hexadecimal size of the total display memory required.
(c)	The three-character hexadecimal size of the total key program memory required. After receiving the ESC RB sequence, the terminal uses the parameters to calculate the total memory requirements, then displays six asterisks if the total requirements do not exceed the available memory. If the memory requirements exceed available memory, the terminal displays an error message. In either case, the terminal enters transmit mode and sends the six asterisks or the error message to the CPU. Once memory parameters are set in the terminal, key programming sequences may be entered from data comm as long as the allocated key program memory is not exceeded. ESC RB is not required for a total key programming of less than, or equal to, 26 functions plus programmed keys (figure 4-18).
ESC RK	The ESC RK (a) (b) (c) sequence is used to load key programs into the terminal. The (a), (b), and (c) are interpreted as follows:

Hex Address	Digit 4				Digit 3				Digit 2				Digit 1			
Binary Addr. Wt.	8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1
M. Bit Weight	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1

Note: With an 8K terminal the memory is divided as follows:

Data Comm = CAF, Display memory = 0FFF, Key Program = 000.

ESCRBCAF0800800

This message will allocate one half of the display memory for the key program which will be 2048 characters.

EXAMPLE I of Memory Allocated for Key Program					8				Ø				Ø			
					1	0	0	0	0	0	0	0	0	0	0	0

ESCRBBB80FFF0F8

This message will allocate 248 characters for the key program.
The data comm buffer will be 3,000 characters.

EXAMPLE II of Memory Allocated for Key Program					Ø				F				8			
					0	0	0	0	1	1	1	1	1	0	0	0

EP1309

Figure 4-18. Example of ESC RB Sequence

Sequence	Function
(a)	The three-character hexadecimal byte count used to identify the number of bytes of data contained in parts (b) and (c).
(b)	The hexadecimal program defining each key to be programmed, the key program, and the key program end flags. Table 4-6 shows the hexadecimal codes for each keyboard function key or character.
(c)	The hexadecimal code A9 (LOCAL key) used to indicate the end of the ESC RK program sequence.

Figures 4-18 and 4-19 show examples of ESC RB and ESC RK sequences, respectively.

PROGRAMMING LIMITATIONS AND NOTES

When establishing a key program, any key on the keyboard may be used (except LOCAL). Recursive programming does not occur; that is, any preprogrammed key used in a key program sequence adds only its standard function to the program sequence.

The function keys, LOCAL, XMT (transmit), and CTRL (control), cannot be programmed. LOCAL cannot be used as part of a key program sequence, only as a sequence end.

Any function causing a transmit operation should only be used as the last function in a key program sequence. Programming a transmit function causes the terminal to go into the transmit mode. Programming may continue (without character display), or the LOCAL key may be used to end the program.

All temporary programs are erased through the CTRL space D CTRL sequence (confidence test request).

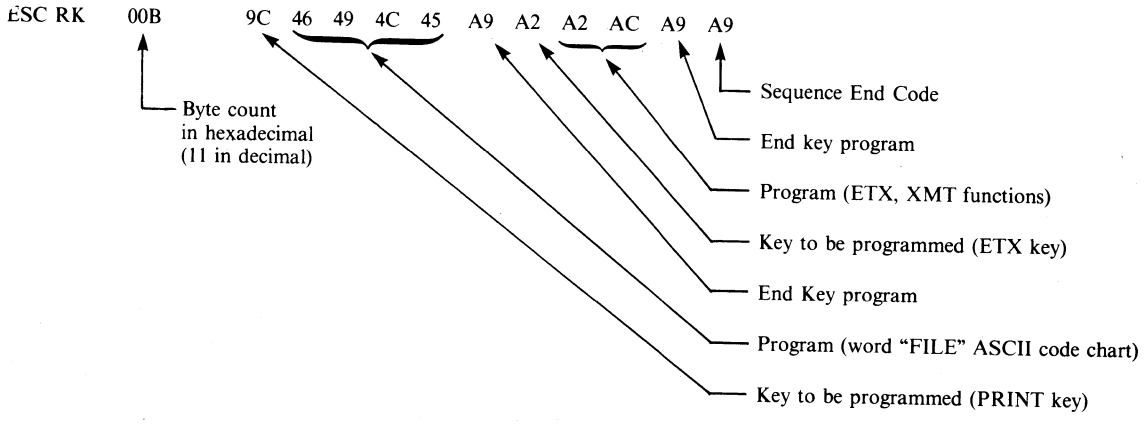
Overflow of the keyboard program area during manual programming is indicated by an error message (KEYBOARD DATA LOST), and the last key program entered is lost. Overflow during data comm programming is indicated by an error message (DATA COMM OVERFLOW), and loss of all key programs occurs.

Table 4-5 identifies the Hex code associated with function keys on the TD015/016, TD018, TD019, and TD019-1 keyboards. These codes identify the key to be programmed and the program code for each function. To program ASCII characters (U.S. or international), refer to the appropriate charts.

EAROM Configuration

All terminals using firmware 3 must have the keyboard program area limits programmed into the EAROM. The address limits of the keyboard program area are permanently stored in the EAROM as follows:

0102 0103	Starting address of keyboard program area.
0104 0105	End address of keyboard program area.
0170	Enter A9 for initial installation to allow any keys to be programmed.



NOTE

All keys to be programmed must be entered in one message. The next ESC RK sequence resets the previous ESC RK sequence.

Figure 4-19. Example of ESC RK Program Sequence

If the permanent EAROM locations are used for storage of the keyboard programs:

Address	Content
0102	01
0103	70
0104	01
0105	8A

If a temporary storage area is used as the keyboard program area, its starting and ending address must change accordingly.

Table 4-5. Hexadecimal Codes for Programmable Keys

TD019 Keys/Functions	HEX Code Required	TD019 Keys/Function	HEX Code Required
Clear (Unshifted)	80	Card Reader	9A
Clear (Shifted)	81	PIN Keyboard	9B
Line Insert	83	Print Unprotected	9C
Character Insert	82	Print All	9D
Line Delete	85	Forms Enable	9E
Character Delete	84	Forms Disable	9F
Clear, End-of-Page	87	Align (Unshifted)	A0
Clear, End-of-Line	86	Align (Shifted)	A1
Scroll Up	FB	ETX (Unshifted)	A2
Scroll Down	FA	ETX (Shifted)	A3
Roll Up	89	Specify (Unshifted)	A6
Roll Down	88	Specify (Shifted)	A7
Move Up	8B	Receive (Unshifted)	AA
Move Down	8A	Receive (Shifted)	AB
Backspace Tape	8D	Home (Typewriter Section) (Unshifted)	AE
Search Tape	8C	Home (Typewriter Section) (Shifted)	AF
Write Tape Mark	8F	Skip (Typewriter Section) (Unshifted)	B2
Read Record	8E	Skip (Typewriter Section) (Shifted)	B3
Read Page	90	RTAB (Typewriter Section) (Unshifted)	C4
Read Page, Transmit	91	RTAB (Typewriter Section) (Shifted)	C5
Read File, Transmit (Unshifted)	92	TAB (Typewriter Section) (Unshifted)	C6
Read File, Transmit (Shifted)	93	TAB (Typewriter Section) (Shifted)	C7
Write Unprotected	94	Caps Lock Enable (Unshifted)	D2
Write All	95	Cape Lock Disable (Shifted)	D3
Tape One (Unshifted)	96	Return (Unshifted)	D6
Tape One (Shifted)	97	Return (Shifted)	D7
Tape Two (Unshifted)	98	Tab Set (Set/Reset) (Unshifted)	E0
Tape Two (Shifted)	99	Tab Set (Clear Tab) (Shifted)	E1
Reverse Line Feed (Unshifted)	F6	SKIP (Function Pad) (Shifted)	DB
Reverse Line Feed (Shifted)	F6	Home (Function Pad) (Unshifted)	D0
Backspace (Unshifted)	F7	Home (Function Pad) (Shifted)	D1
Backspace (Shifted)	F7	RTAB (Function Pad) (Unshifted)	DE
Forward Space (Unshifted)	F8	RTAB (Function Pad) (Shifted)	DF
Forward Space (Shifted)	F8	TAB (Function Pad) (Unshifted)	F0
Line Feed (Unshifted)	F9	TAB (Function Pad) (Shifted)	F1
Line Feed (Shifted)	F9	Back Page (Function Pad) (Unshifted)	FC
Double Zero (Unshifted)	EA	Back Page (Function Pad) (Shifted)	FD
Double Zero (Shifted)	EB	Next Page (Function Pad) (Unshifted)	FE
Triple Zero (Unshifted)	EC	Next Page (Function Pad) (Shifted)	FF

Table 4-5. Hexadecimal Codes for Programmable Keys (Cont.)

TD019 Keys/Functions	HEX Code Required	TD019 Keys/Function	HEX Code Required
Triple Zero (Shifted)	ED	Transmit (Not Programmable)	AC or AD
Clear Field (Unshifted)	CE	Control (Unshifted) (Not Programmable)	A4
Clear Field (Shifted)	CF	Control (Shifted) (Not Programmable)	A5
Skip (Function Pad) (Unshifted)	DA		

TD015/TD016/TD018 Keys/Functions	HEX Code Required	TD015/TD016/TD018 Keys/Functions	HEX Code Required
Forward Space	F8	Home	AE
Backspace	F7	Specify	A6
Reverse Line Feed	E6	Tab	C6
Line Feed	F9	Line Delete	85
Return	D6	Line Insert	83
Character Delete	84	Reverse Tab	C4
Clear, End-of-Line	86	Skip	B2
ETX	A2	Character Insert	82
Clear, End-of-Page	87	Transmit (Not Programmable)	AC
Receive	AA	Control (Unshifted) (Not Programmable)	A4
Clear	80	Control (Shifted) (Not Programmable)	A5

NOTE

Terminals using Firmware Level 3.0 and above designs are exempt from ODT requirements, and qualification criteria for these terminals do not include parameters which are exclusive to ODT.

SECTION 5
MAGNETIC CARD READER

GENERAL DESCRIPTION

The peripheral-capable terminal has an I/O interface for connecting the TD078-1 magnetic card reader. The card reader is a separately contained unit which accepts magnetic cards conforming to American Banking Association (ABA) standards.

The card reader may be interfaced to any peripheral-capable system utilizing either the TD015-A, TD016, or TD019 keyboard. This reader has its own cable and may be up to 10 feet away from the TD (figure 5-1).

MCR function, MCR operation, and ABA magnetic card data format are described in this section.

MCR FUNCTION

The MCR function is to read the ABA stripe of a magnetic card, to detect read errors, and to forward MCR data to terminal memory. When the card is inserted into the reader and the READ key is pressed, the data encoded on the magnetic stripe is read into the terminal memory. The data is not displayed; the terminal is automatically placed in the transmit mode and the magnetic card data in the terminal memory is transmitted.

The MCR secure data option allows multiple transmissions from one card. When the card is inserted into the reader and the READ key is pressed, the data encoded on the magnetic stripe is read into the terminal memory and automatically transmitted to the central system. Each subsequent transmission from the terminal is preceded by the magnetic card data contained in the terminal memory. Removal of the card from the reader causes an automatic erasure of the magnetic card data contained in the terminal memory.

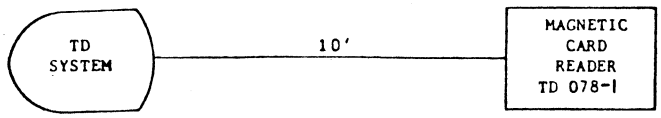


Figure 5-1. TD/MCR Configuration

The operating mode of the magnetic card reader interface is selected through configuration control by Burroughs (MCR secure data option).

MCR Operations

To read the magnetic card:

1. The terminal must be in either local or receive mode.
2. A magnetic card must be inserted, lighting the READ key on the MCR.
3. The READ key is then pressed, causing the card to be read and the READ key indicator to go out.

The MCR card slot accepts magnetic stripe cards which conform to ABA standards. The card positioning assembly provides proper alignment of the magnetic stripe card for the read head, which moves along the magnetic stripe of the stationary card. When the reading pass is completed, the read head returns to the start position.

An unsuccessful data transfer causes the READ key indicator to flash. The reading of an improperly positioned magnetic card is treated as an unsuccessful data transfer. This condition requires inserting and reading the card again. Pressing the READ key causes the card to be read a second time and the flashing READ key indicator goes out.

Correct transfer of data causes the terminal to enter the transmit mode automatically and to forward the data to the central system on its next poll. Upon successful completion of the transmission, the terminal enters receive mode. If no message is received by the terminal, pressing the LOCAL key returns the control of the terminal to the operator.

If the READ key is pressed in error, pressing the LOCAL key on the TD keyboard releases the terminal from MCR interface control.

ABA MAGNETIC STRIPE DATA FORMAT

Figure 5-2 shows the ABA data format as read from the magnetic card. The ABA format is also referred to as track 2.

The start sentinel precedes the stripe data; the stop sentinel and the longitudinal redundancy check (LRC) character follow.

The LRC character provides a check of the transfer of stripe data to the terminal. Before data is transferred to terminal memory, the ASCII codes are generated (table 5-1). The start sentinel and the LRC character are not transferred to memory (table 5-2). The stop sentinel is replaced by the ETX character (ASCII 0,3) which is transmitted to the central system with the standard MCR operation. With the MCR secure data option the ETX is overwritten by the screen data following the MCR (stripe) data.

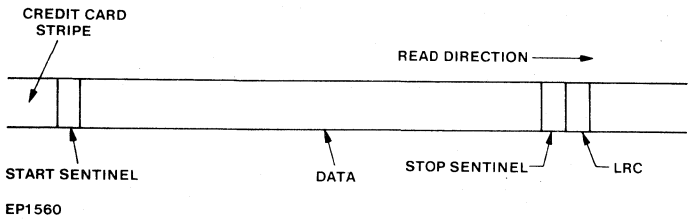


Figure 5-2. ABA Magnetic Stripe Data Format

MCR Code Translation

The magnetic card reader (MCR) code translation option allows the terminal to translate magnetic card data from ASCII 3A through 3E to ASCII 1A through 1E respectively.

This option is enabled by setting address 009B, bit 1, to state ONE. It is disabled by setting address 009B, bit 1, to state ZERO.

Table 5-1. MCR Character Conversion

Character	ASCII Code Generated
0	30
1	31
2	32
3	33
4	34
5	35
6	36
7	37
8	38
9	39
*	3A
Start Sentinel	3B
Start Read Code	3C
Field Separator	3D
*	3E
Stop Sentinel	03(ETX)

* Available for future definition.

Table 5-2. Sample Stripe Data

Stripe Data	Characters Encoded
Start sentinel	1 (not transferred)
Account number (credit card)	19 maximum
Field separator	1
Expiration date (MMYY)	4
Start read code	1
Account number (computer)	12 maximum, if 19 maximum used above
Stop sentinel	1 (transferred as ETX character)
LRC	1 (not transferred)

40, however, 38 is the maximum number of transferrable characters

SECTION 6
AUXILIARY PRINTERS

GENERAL DESCRIPTION

The peripheral-capable system has, as standard, the I/O interface for connection to one of three types of printers, A9249, TC4001, and B9354-6. The first two printers may be shared by several TD terminals. The B9354-6 is a dedicated printer. All three printers use the same print commands. Burroughs configures the system for the type of printer, print speed, and extended line option. Print commands, A9249 line printer, TC4001 serial printer, and B9354-6 printer are described in this section.

PRINT COMMANDS

Any of the printers may use one of two types of print operation.

The first print operation prints the whole page from home to cursor position. This operation is performed in either forms or non-forms mode.

The second operation prints the unprotected data from home to cursor position. The second operation applies only to a terminal in forms mode. In non-forms mode the second operation is treated as the first print operation.

The print operations are controlled by print commands (table 6-1) for either attended (keyboard) or unattended (program) terminals. The print control codes (CTRL ; and CTRL :) shown in Appendix D allow keyboard (local) control of the respective print operations. The respective program control codes (ESC ; and ESC :) shown in Appendix E allow print operation control of terminals from a central system program (remote) via the data comm line.

Table 6-1. Print Commands

Print Operation	Control Codes: Program (Remote)	Control Codes: Keyboard (Local)
Print Whole Page Home To Cursor	ESC ;	CTRL ;
Print Unprotected Data, Home To Cursor	ESC :	CTRL :

The critical point in the print operation is the cursor position at the time the terminal receives the print command from either the keyboard or the program. Printing starts (or a position in the queue is established) following transmission of the ACK character by the terminal, confirming that a valid message has been received.

In the shared printer configuration, requests for print service during periods of printer activity are stored in a queue in the terminal peripheral interface. The queue allows print service to be supplied in the order of request. Furthermore, a terminal operator requesting printer service is able to cancel a request without disrupting other queued requests by pressing the LOCAL key. Each terminal peripheral interface can store up to two print commands. Each print command is active until either the print operation is completed or the print request is cancelled.

The new print command (ESC] and CTRL]) available with firmware 3 and higher is included for A9249 (ODEC) printer systems. This command causes the terminal to initiate a print of total screen contents without the automatic generation of the FF (top of form) and DC4 (print motor off) printer control characters.

External control of paper movement, line feed, and printer start/stop functions is provided through use of a new control sequence, ESC ' CHAR, where CHAR may be any character from columns 2 and 3 of the terminal's code table. This sequence causes the terminal to translate the character CHAR from column 2 or 3 to the corresponding character in column 0 or 1 (table 6-2). The character translation is then placed into the terminal's memory for use as a printer control character. The ESC ' CHAR sequence causes the ASCII characters to be written into TD memory without the TD taking any other action on the control characters.

Additional printer control has been provided in the extended line mode of printer operation. The terminal now automatically appends a CR/LF to the data stream at the 133rd location if the CR/LF function is not included as part of the printer data.

Table 6-2. ODEC Control Through Character Translations

ODEC Printer Function	Data Comm Command	ASCII Char	TD Memory Display Symbol	Code to ODEC
Line Feed/Carriage Return	ESC ' *	LF	≡	0,A
Line Feed	ESC ' +	VT	↓	0,B
Top of Form	ESC ' ,	FF	↓	0,C
Carriage Return (Line Feed)	ESC ' -	CR	▽	0,D
Print Motor Off	ESC ' 4	DC4	⏲	1,4
Vertical TAB on Channel 2	ESC ' + ESC ' "	VT STX	↓⊥	0,B 0,2
*Vertical Tab on Channel 3	ESC ' + ESC ' #	VT ETX	↓⧖	0,B 0,3
*Vertical Tab on Channel 4	ESC ' + ESC ' $	VT EOT	↓	0,B 0,4
*Vertical Tab on Channel 5	ESC ' + ESC ' %	VT ENQ	↓	0,B 0,5
*Vertical Tab on Channel 6	ESC ' + ESC ' &	VT ACK	↓	0,B 0,6
*Vertical Tab on Channel 7	ESC ' + ESC ' '	VT BEL	↓	0,B 0,7
*Vertical Tab on Channel 8	ESC ' + ESC ' (	VT BS	↓	0,B 0,8
*Vertical Tab on Channel 9	ESC ' + ESC ')	VT HT	↓→	0,B 0,9
*Vertical Tab on Channel 10	ESC ' + ESC ' *	VT LF	↓≡	0,B 0,A
*Vertical Tab on Channel 11	ESC ' + ESC ' +	VT VT	↓↓	0,B 0,B

*Requires 12 channel ODEC Printer

A9249 LINE PRINTER

The peripheral-capable system may interface one of three styles of A9249 Line Printers. The three styles, A9249-1, A9249-2, and A9249-3 print at 85, 160, and 250 lines per minute (LPM) respectively. Each line printer style prints up to 132 characters per line, if the printer extended line option is set by Burroughs. However, A9249 does not perform the LF function unless a CR (▽) is placed in TD memory.

The peripheral interface in each terminal permits operation of an A9249 auxiliary printer, which is either dedicated to a single terminal or shared by up to three terminals (figure 6-1). In the shared printer configuration, each of the terminals has random,

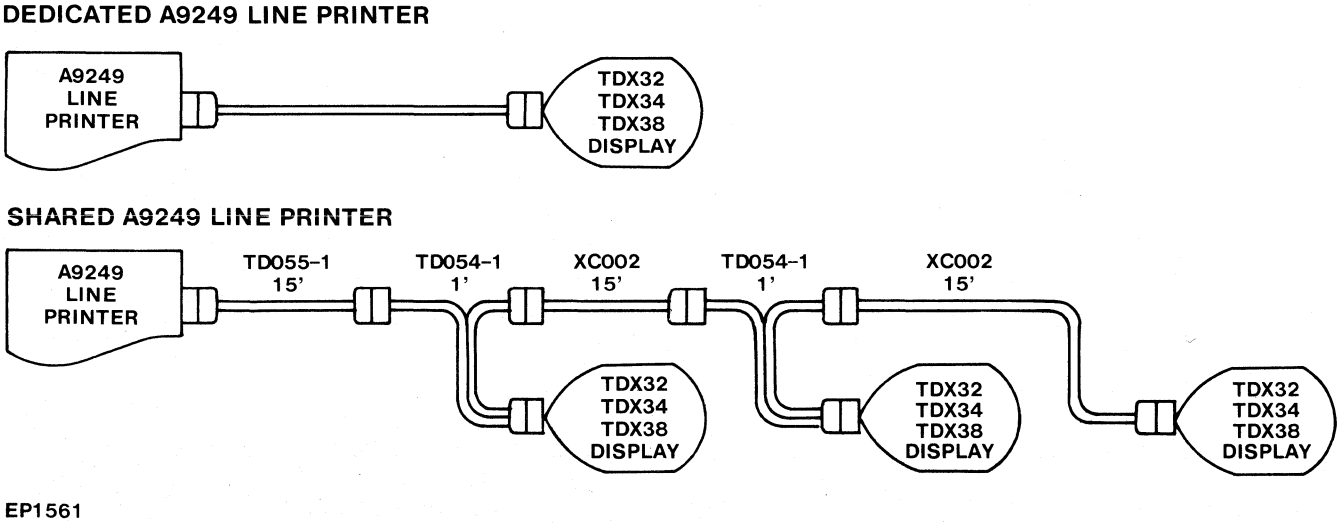


Figure 6-1. TD/A249 Configurations

non-priority access to the printer. During printer activity, both keyboard and program print commands are queued in the peripheral interface in the received order. Pressing the LOCAL key of a terminal cancels its active print request. Maximum distance from the A9249 to the last TD is 50 feet.

Shared Operation

Up to three TD terminals may be concatenated to share one printer. A queue is established among the terminals, regardless of the status of the printer. If the printer has been made ready prior to the first print request, printing begins immediately. If some condition exists that forces the printer into a not-ready status, PRINTER ERROR is displayed on the screen.

The FORM FEED and LINE FEED buttons on the printer are active either if the STOP button on A9249 has been pressed or if the PRINT has not been pressed.

If the STOP button is pressed during a print cycle, the buffer within the printer continues to be loaded until a format control character is received. Once this is received, the contents of the buffer are printed. The format control is activated, and the printer enters a not-ready condition, allowing the use of the other panel controls. PRINTER ERROR is displayed on the screen status line.

The not-ready condition of the A9249 printer displays PRINTER ERROR on all terminals and cancels all print requests automatically.

Each terminal may cancel a request to print at any time by pressing the LOCAL key. The next print request from this terminal then becomes the last in the queue. A terminal may cancel a request to print during its own printing.

Data Message

The data message is transmitted to the A9249 printer either by the central system program to the terminal or through keyboard control. Two print commands (table 6-1) are available. Printing of data stored in the terminal memory is from the home position up to the position of the cursor at the time the printer is activated. All characters (except CR) from columns 0 to 1 of the ASCII chart (Appendix C) are converted by the interface and sent to the printer as spaces. The interface also transmits spaces for all protected data when the print unprotected area data request is used. An automatic forms feed occurs with each print command.

When a CR (▽) character is read from the terminal memory, the terminal sends a CR-LF to the printer causing the printer to perform a carriage return/line feed operation. The interface also sends a CR-LF to the printer whenever the last column of a display line is read. Automatic sending of the CR-LF to the printer at the end of a display line may be disabled by Burroughs. When the automatic CR-LF is disabled, the printer prints up to 132 characters per line, but a CR character must be inserted following the last print character in each line (for example, at each 133rd position).

A Print Unprotected Data request is valid only if the terminal has been placed in the forms mode prior to the initiation of the request. If the terminal is not in forms mode when the print unprotected data request is initiated, the Print All (whole page) command is executed. The HT character is functionally the same as a right delimiter during this printing mode.

TC4001 SERIAL PRINTER

The peripheral-capable system provides an I/O interface for connection to the TC4001 Serial Printer. The interface permits either the operation of a single terminal to a dedicated TC4001 printer, or the shared operations of up to 15 terminals to a printer on a first-in/first-out basis. Typical dedicated and shared configurations are shown in figure 6-2. Burroughs enables the TC4001 at the 300 bps per second printer rate.

The TC4001 requires:

XA 177 TD interface kit.
6400-1 transmission speed of 300 bits per second.
6410-1 teletype async firmware.
6411-1 forms compose option.
6420-1 data comm controller.

The TC4001 prints up to 30 characters per second in this system. The interface is a modified Burroughs direct interface (BDI). The TC4001 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.

Configuration

In a shared configuration, the distance from the TC4001 printer to the last terminal is up to 765 feet when 15 terminals are shared.

The TC4001 requires printer functions, such as

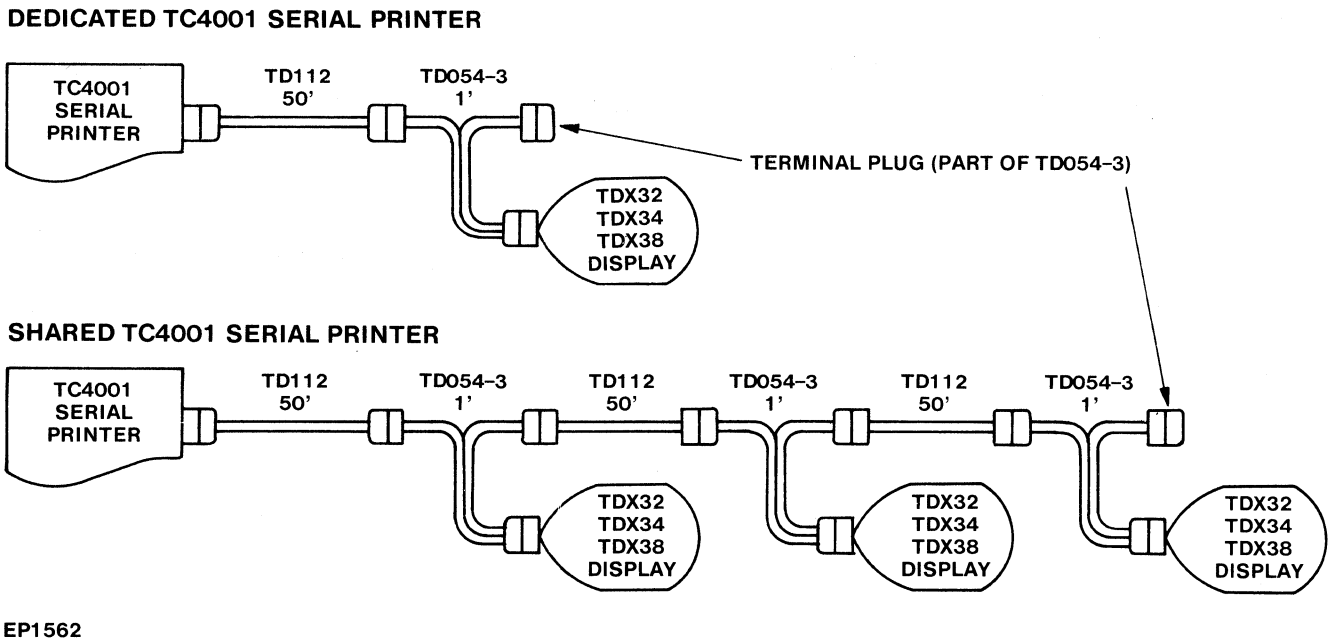


Figure 6-2. TD/TC4001 Configurations

margins and tab stops, to be set by either keyboard or program control. Therefore, the terminal I/O interface provides two classes of messages: control and data. These messages are separate and unique. Control messages cannot be mixed with data messages.

Control Messages (Forms Compose Option)

The control sequences from either control system program (ESC =) or keyboard (CTRL =), condition the printer interface to accept and translate the displayed characters as control codes which set printer functions. A list of the displayed characters and TC4001 functions performed is provided (table 6-3).

Each terminal may queue printer messages up to two levels. Queuing allows the terminal to set up a new printer format and have data printed in this new format with only one access of the printer by the terminal. Bilevel queuing is accomplished, prior to printer access, by placing the format sequence on one page of the terminal memory while the data to be printed is placed on another page of memory. The pages are programmatically connected through the terminal paging function.

For example, the central system program sends to the terminal:

2 ESC =

which causes the TC4001 to clear all horizontal tab stops and set up tab stops in increments of eight print positions.

Entering a 2 on the screen from the keyboard, followed by CTRL =, results in the same function as the 2 ESC sequence does.

Multiple TC4001 functions may be performed with only a single program ESC = sequence or keyboard CTRL = sequence. For example,

280 ESC =
or
280 CTRL =

causes the TC4001 to perform the preceeding function: changing line feed mode to single-line or double-line paper feed, depending on the previous setting, and to canceling the right margin stop.

Data Messages

The data message goes to the TC4001 printer either by central system program control to the terminal or through keyboard control. Two print commands (table 6-4 are available.

The data message to the printer may contain cer tain positional/format control characters. The terminal translates these characters into codes which cause the printer to perform the required

Table 6-3. TC4001 Control Codes

Keyboard Control	Program Control	TC 4001 Function
1 CTRL =	1 ESC =	Set horizontal tab stop at present carrier position, clear all previously set tab stops to the right. Maximum number of tab stops is 16.
2 CTRL =	2 ESC =	Clear all horizontal tab stops and enable standard tab stops in increments of eight print positions.
3 CTRL =	3 ESC =	Set left margin stop, the carrier having been moved to correct position by space codes.
4 CTRL =	4 ESC =	Set vertical tab stops, the paper having been brought to correct position by successive paper advances using LF code.
5 CTRL =	5 ESC =	Clear all vertical tab stops.
6 CTRL =	6 ESC =	Set top of form. Also clears all vertical tab stops.
7 CTRL =	7 ESC =	Record in memory the length of the form, since the paper is 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 codes.
8 CTRL =	8 ESC =	Command the line feed mode to change between single and double line paper feed.
9 CTRL =	9 ESC =	Set right margin at present carrier position.
0 CTRL =	0 ESC =	Cancel right margin stop.
: CTRL =	: ESC =	Initiate 1/2 line (1/12 inch) forward paper movement.
; CTRL =	; ESC =	Initiate 1/2 line (1/12 inch) teverse paper movement.
= CTRL =	= ESC =	Initiate carrier return to print position zero.

Table 6-4. TC4001 Print Functions

Print Command	Forms	Non-forms
Print Whole Page CTRL ; or ESC ;	Print Whole Page, independent of cursor position. For Forms, Print Whole Page condition, each HT, RS, or CR character sends out a space to TC 4001.	Print home to cursor. If cursor is home, Print Whole Page.
Print Unprotected Data CTRL : or ESC :	Print from Forms Home to cursor. If cursor is at Forms Home, print all unprotected data on page.	Default to Print Whole Page command.

positional/format action. Table 6-5 provides a list of these characters, and the function performed.

The positional/format control characters given in the table 6-5 cause the printer to react to the respective characters when the terminal is either in the non-forms mode, or under program command (ESC ;) to print all displayed data in the forms mode.

When the terminal has been instructed to print only unprotected data in the forms mode (ESC ;) the control characters cause the printer to react only when characters are detected in an unprotected field.

Also, while under instructions to print only unprotected data, the I/O interface scans all characters before a US (▷) or GS (△) character without sending them to the printer. Data following US or GS prints until an RS (◁) or HT (→) character occurs, at which time the interface returns to the search for US or GS. The ETX character in an unprotected field is obeyed in all cases through its FF translation for advancing the printer to the top of the next form. If, in transmitting data to the printer, no CR/LF is included, a CR is automatically inserted following the end of the display line.

An extended line function, when enabled by Burroughs, overrides the automatic sending of the CR control after the end of the display line. The printer, in response to the extended line function, continues printing data until the 150-character limit is reached, when the printer does an automatic carriage return-line feed and continues printing data.

In the shared printer connection, each terminal has access to the printer on a random-access, non-priority basis. As each terminal requests printer service, the commands are queued and ultimately completed. Pressing the LOCAL key cancels a printer command in that terminal without disrupting the other terminals in the queue.

Table 6-5. **TC4001 Positional/Format Control Characters**

Terminal Character	Function
RS (◁)	Horizontal tab (SPACE)
CR (▽)	Carriage return and line feed
HT (⟶)	Horizontal tab
ETX (⧖)	Form feed carriage returns to start of next form
&	Vertical tab

B9354-6 PRINTER

This printer is dedicated to one terminal, as shown in figure 6-3. The B9354-6 printer operates at 10 characters per second (110 bps). Burroughs adjusts the terminal for either 20 mA or 60 mA current loop operation, depending on the printer requirements.

A description of the print commands is at the beginning of this section.

Printing of data stored in the terminal memory is from home to the position on the cursor at the time the printer is activated. A CR, NUL, LF sequence is sent to the printer by the terminal at the end of each display line. The CR, NUL-LF sequence is sent to the printer when a CR character is written into the display of the page written to the printer.

TTY Printer CR Delay

The Terminet TTY printer requires a 256-msec CR delay. The optional delay is enabled by setting address 009B, bit 2, to state ONE. It is disabled by setting address 009B bit 2, to state ZERO.

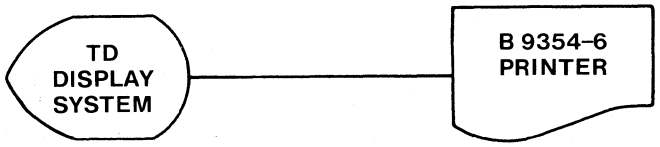


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Figure 6-3. TD/B9354-6 Printer Configuration

SECTION 7
MAGNETIC TAPE CASSETTE

GENERAL DESCRIPTION

The peripheral-capable system has, as standard, the I/O interface for connection of the TD 076 magnetic tape cassette controller. The I/O interface and the TD 076 cassette controller allow the display terminal to operate with single or dual cassette devices. The cassette controller allows up to four display terminals and up to four A9490-5 cassette drives. This section describes cassette controller configurations and operational considerations.

Three cassette configurations are available. One configuration uses a cassette controller dedicated to one terminal. The terminal uses the cassette controller to control one or two cassette drives (figure 7-1).

The second TD/cassette configuration uses one TD 076 cassette controller with two TD terminals. Each of the two terminals may access one or two dedicated cassette drives (figure 7-2). However, the drive/drives dedicated to one terminal cannot be accessed by the second terminal.

The third configuration uses the cassette controller with up to four TD terminals. This allows up to four cassette drives. Each drive in this configuration is dedicated to one particular TD terminal (figure 7-3).

The cassette controller (TD 076) is a separate unit from the TD terminal. The controller unit may be located up to 10 feet from the TD terminal, and up to 12 feet from the cassette drives. The cassette controller contains its own power supply which also powers the cassette drives.

It is not possible for terminals to share a cassette drive. Only one cassette drive may operate at a time through one cassette controller. However, two cassette commands may be queued in each TD terminal.

In a shared environment, the cassette controller is shared on a poll basis. In order to access the cassette controller, a terminal issues a tape command either from a central system or from an operator via the keyboard. When the controller polls the terminal, it receives the tape command and executes it, and then polls the next terminal in the string.

OPERATIONAL CONSIDERATIONS

The following subparagraphs describe the operation of the magnetic tape cassette with the peripheral-capable terminal. Figure 7-4 identifies cassette tape formats.

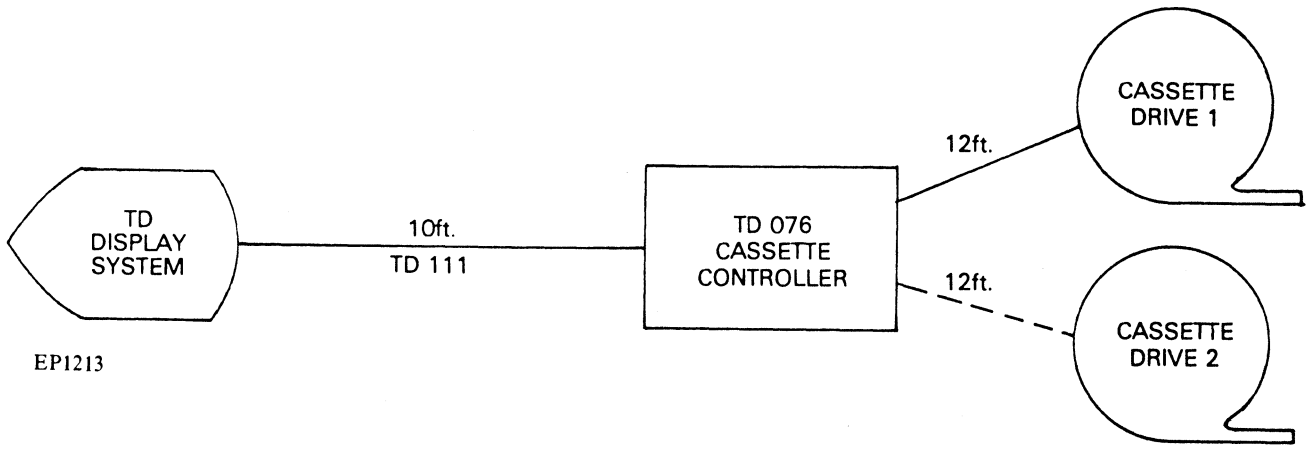


Figure 7-1. Single TD/Cassette Controller Configuration

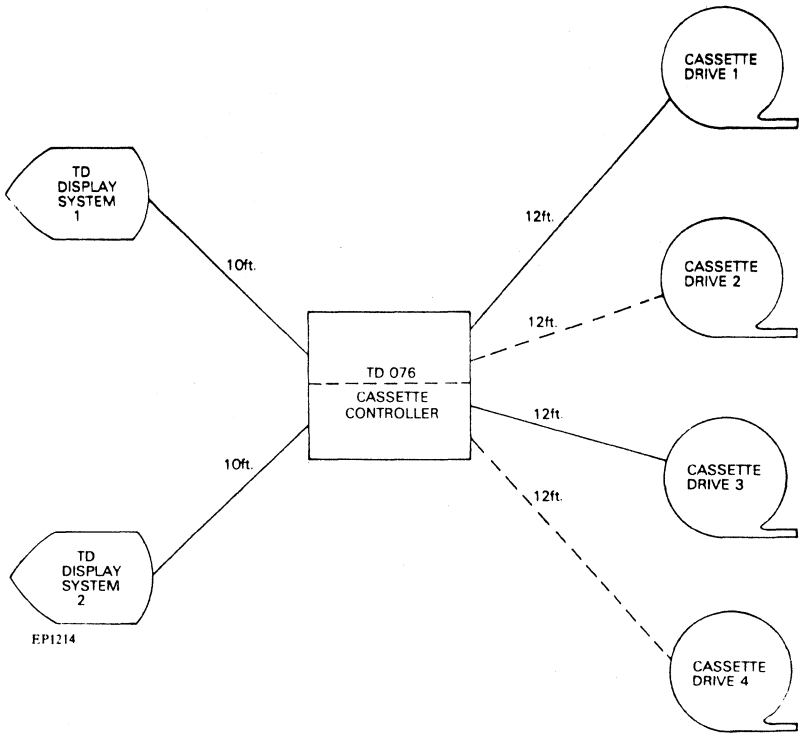


Figure 7-2. Two TD/Cassette Configuration

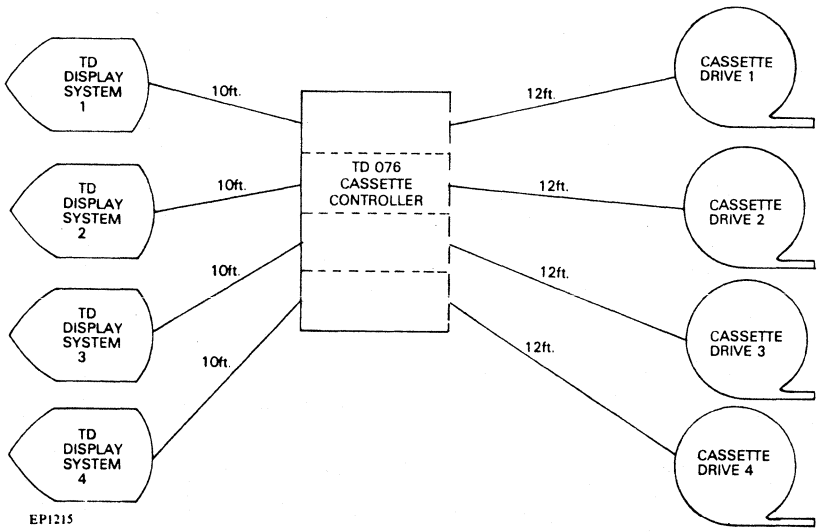


Figure 7-3. Four TD/Cassette Configuration

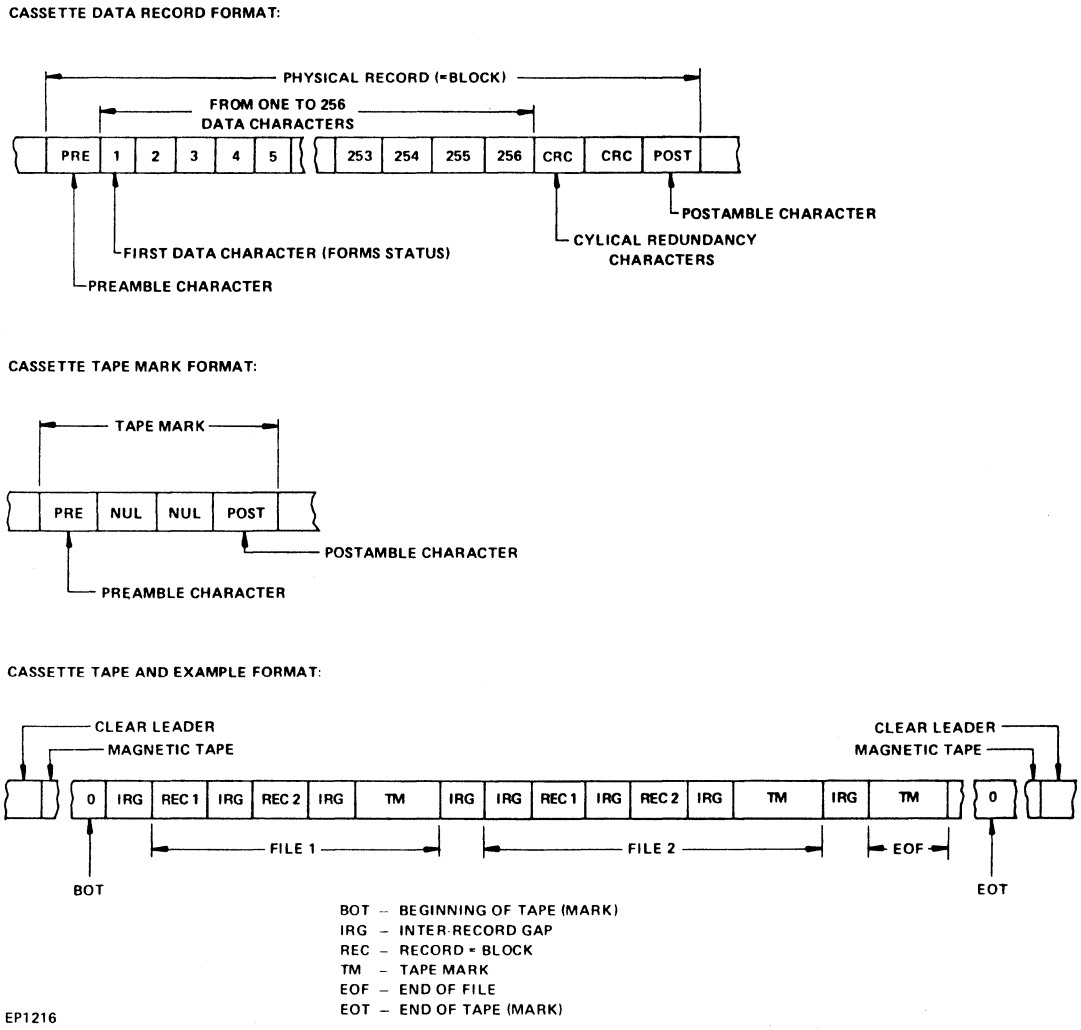


Figure 7-4. Cassette Tape Formats

Modes of Operation

The cassette controller may be operated either locally by an operator through the terminal keyboard, or remotely by a central system. It operates in the following basic modes:

1. Read - 10 inches per second.
2. Write - 10 inches per second.
3. Backspace - 10 inches per second.
4. Search Forward/Reverse - 30 inches per second.
5. Rewind - 60 inches per second.

Commands

A central system program issues a tape command by sending an ESC sequence. A keyboard operator uses the CTRL key to issue a tape command (table 7-1).

Write Modes

The following subparagraphs describe the write modes (figure 7-5).

Write Data to Tape

The central system or the operator displays the desired message on the screen and, unless the terminal is in the forms mode, must position the cursor to the right of the last character to be written to tape. If the terminal is in forms mode, the entire page is written to tape regardless of the cursor position. After positioning the cursor, the central

Table 7-1. Cassette Control Codes

Command (Function)	Program (Remote)	Keyboard (Local)
Write data to tape	ESC G M	CTRL ' M
Write unprotected data to tape	ESC Q M	CTRL (M
Write tape mark	ESC A M	CTRL \ M
Read block from tape	ESC H M	CTRL & M
Read page from tape	ESC * M	CTRL # M
Read page and transmit	ESC ' M	CTRL % M
Read file and transmit	ESC + M	CTRL & M
Rewind	ESC I M	CTRL ^ M
Backspace	ESC B M	CTRL) M
Search tape drive 1 to selected file	ESC U NNN	CTRL ! NNN
Search tape drive 2 to selected file	ESC V NNN	CTRL " NNN

In configurations in which one terminal can control up to two tape drives, M defines the cassette drive being accessed: 1 for drive 1 and 2 for drive 2.

NNN defines a three-digit numeric value (000 to 999) specifying the desired file in the event of a search.

In configurations in which one terminal may control only one dedicated drive, M may be either 1 or 2, and either U or V may be used for selected tape mark search. The controller automatically addresses the correct drive.

system/operator issues the Write Data To Tape command. The cursor does not move during a Write Data To Tape command.

For every block, a forms status character (space for non-forms and W for forms) is written to tape, followed by the entire page from home to the stored cursor address. If the terminal is in forms mode, the entire page (both protected and unprotected) is written to tape regardless of the stored cursor address. After writing the last character to tape, the cassette controller writes the end-of-text block (ETB) character. If ETB is not the last character in a 256-character data block, the remainder of the record is filled with space characters. All writing to tape is done in accordance with the Burroughs Information Recording Format (NRZI).

Before writing a 256-character block, the controller checks for end-of-tape (EOT). If the EOT mark has been passed, the controller writes a tape mark, executes an automatic rewind, and sounds the terminal alarm. The controller then resumes polling. The last 256-character block and all characters after it are not written to tape. The operator may write the entire page onto another cassette.

As each 256-character data record is written to tape, a read-after-write check is made for errors. If an error is found, the controller backspaces to the beginning of the bad block and attempts to rewrite over it. A maximum of three retries may be attempted. If, after three retries, the block is still bad, the controller erases it. If the erase is complete, the controller writes the record on the next location. Up to three locations may be tried before the error is considered fatal. If the error is fatal or an erase is incomplete, the controller sounds the terminal alarm and lights the ERROR indicator, then resumes polling. Pressing the LOCAL key causes the ERROR light to go out.

Write Unprotected Data to Tape

This command differs from the above in that only unprotected data is transferred in 256-character blocks.

Write Tape Mark

Tape marks are used to delineate multiple blocks of data which constitute a file. A file is defined by one tape mark at its beginning and another at its end.

Tape marks are written in accordance with NRZI.

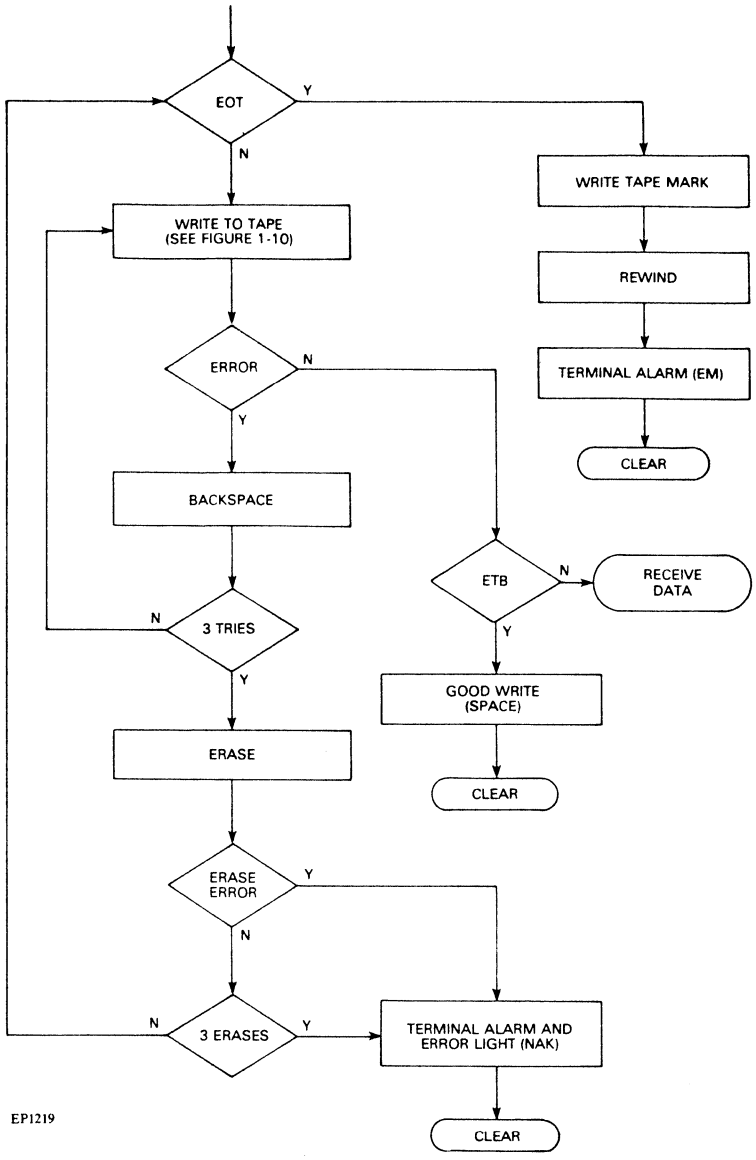


Figure 7-5. Write Flow

All tape marks are checked for errors and a maximum of two retries attempted.

Read Modes

The following subparagraphs describe the read modes (figure 7-6).

Read Block from Tape

the central system or the operator positions the cursor at the desired starting point and then issues the Read Block command.

The controller reads the next data record (one forms status character followed by 255 display characters) and displays it. The terminal is placed in the forms mode if the status character indicates to do so and the ETB is received.

If a tape mark is encountered before a data block, the controller performs an end-of-tape (EOT) check. If the tape is at EOT, the controller executes an automatic rewind and sounds the terminal alarm. It then resumes polling. If the tape is not at EOT, the tape mark is ignored and not displayed because it does not contain meaningful data.

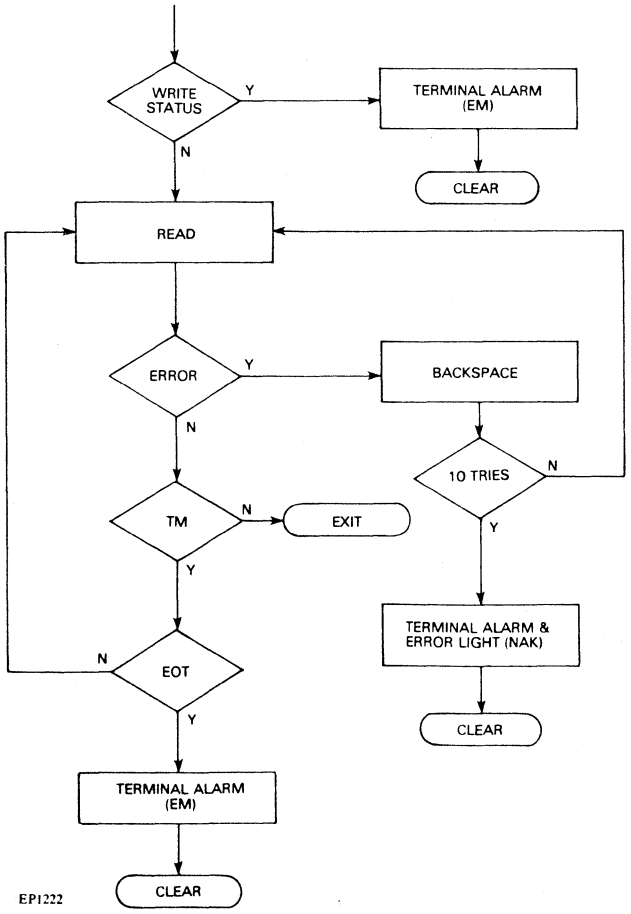


Figure 7-6. Read Flow

While a data block is read, the controller performs a read error check. If an error is found, the controller attempts to reread the blocks. A maximum of 10 tries may be attempted. If, after 10 tries, an error is still found, the bad block is displayed, the terminal alarm sounds, the ERROR indicator lights, and CASSETTE ERROR is displayed on the screen. The controller resumes polling. Pressing the LOCAL key causes the ERROR indicator to go out.

Read Page Fom Tape

The Read Page From Tape command always starts from home, independent of cursor position.

The controller reads and displays data blocks until it reads the end-of-text block (ETB) character. If the ETB is not the last character of a block, the controller reads but does not display the remainder of the block. The terminal is placed in the forms status as dictated by the forms status character on the tape.

Read errors are handled on an individual block basis as in Read Block from Tape.

Read Page and Transmit

The ESC , M or CTRL % M sequence is functionally the same as read page, with one addition: upon completion of read page, the terminal transmits the entire page to the central system. If the terminal is in forms mode, only unprotected data is transmitted. Read errors force cancellation of the transmit function.

Read File and Transmit

The ESC + M or CTRL & M sequence causes the terminal to issue a series of Read Page and Transmit commands. After each page of data is transmitted to the central system, the terminal requests a new page of data from the controller by sending the space character (2,0). The controller continues to respond to data requests until a tape mark is detected, causing the controller to send the ETB character. The terminal does not erase previously written data.

Rewind

The controller initiates a rewind cycle upon receiving either an ESC I M or CTRL ∧ M sequence, then resumes polling. The actual rewinding takes place off-line. Rewinding is at 60 inches-per-second until the beginning of the clear leader is reached.

A rewind occurs if:

1. The central system or the operator issues the command.
2. EOT is sensed.
3. Power is turned on.
4. A cassette is inserted into the drive unit.

Backspace

the controller initiates backspace (tape drive reverse) and holds it until an inter-record gap (IRG) is reached. Tape marks encountered are ignored. If beginning-of-tape (BOT) is encountered, the operation is considered complete.

Selected File Search

The controller determines the location of the desired file on the tape. It then executes high speed (30 ips) drive in the proper direction (forward or reverse) and stops in the IRG immediately preceding the desired file.

If the central system or the operator desires the next file on tape without knowing its number, file 000 may be requested. The controller automatically advances to the next file on tape.

General Operation

The general requirements are given in the following subparagraphs.

End-of-Tape (EOT)

Except as noted elsewhere, whenever the EOT mark is sensed, the controller finishes the tape command, initiates an automatic rewind, and sounds the terminal alarm. It then resumes polling. If the tape command cannot be completed before the clear leader at the end of the cassette is reached (for example, a Read Block when there is no data block present), the controller sounds the terminal alarm, signifying that operator intervention is needed. The operator must then remove the cassette, rewind manually beyond the clear leader, and reinsert the cassette. The cassette then rewinds automatically, and the controller resumes polling.

Updating

Replacement of previously written blocks by writing inside previously formatted tape is not advisable and should not be attempted.

Error Detection

The following error checking is provided:

1. **CRC Check** - As the 256-character data stream is written to tape, a 16-bit CRC (cyclic redundancy check) character is generated and appended to the data stream. When the record is read (either during a read-after-write or during a read command), this CRC character is checked for accuracy.
2. **Preamble/Postamble Check** - Since neither the preamble nor the postamble is included in the CRC check, each is checked individually for accuracy.
3. **Tape Mark Check** - The tape mark character (16 consecutive zeros) is checked for accuracy.
4. **Dropped Data Bit** - If an all-zero character is read from a data record, the controller sends a question mark for the terminal to display.
5. **Inter-Record Gap (IRG) Identification** - Lack of clock pulses for 3 milliseconds.
6. **Tape Mark Identification** - Preamble, 16 consecutive zeros, and postamble.

OPERATOR ALERTS

The following operator alerts are provided:

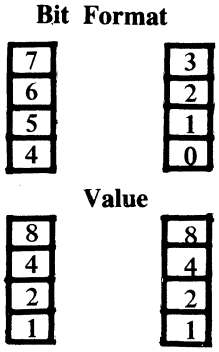
1. Two indicators with each cassette drive:
   a. Write Status (WS) - Lights when a cassette with write enable plugs is properly inserted.
   b. Ready Light (RL) - Goes out when at end leader.
2. Read/Write errors signalled by an audible alarm, the lighting of the terminal ERROR indicator on the keyboard, and the display of CASSETTE ERROR on the screen status line.
3. End-of-Tape (EOT) or an attempt to read while in a write mode indicated by the audible alarm of the terminal.

APPENDIX A
SYSTEM REGISTER AND CONFIGURATION OPTIONS

BIT FORMAT AND VALUES

Table A-1 gives bit locations and values for Hex characters.

Table A-1. Bit Format and Value



As indicated in table A-1, setting bits 1, 2, 3, 5, 6 to the ONE state results in the hexadecimal value of 6E.

MEASUREMENT INFORMATION

Lines per page are (refer to table A-2):

Lines Per Page	0084 Register Content
4	03
8	07
12	0B
16	0F
20	13
24	17
28	1B
32	1F

Characters per line are (refer to table A-2):

Characters Per Line	0085 Register Content	Address 0092 Bit 2	Remarks
32	1F	0	TD 730
40	27	1	TD 730
40	27	0	TD 830
80	4F	1	TD 830

Table A-2. Display Memory Characters and Page Combinations

Characters per Line	Maximum Displayable Characters	Maximum Pages at Lines per Page of: 4	8	12	16	20	24	28	32	36	40	44	48	52 thru 100
80	1920 (Standard)	6	3	2	1	1	1	–	–	–	–	–	–	--------
80	4000 (Optional)	12	6	4	3	2	2	1	1	1	1	1	1	--------
40	1920 (Standard)	12	6	4	3	2	2	1	1	1	1	1	1	--------
40	4000 (Optional)	25	12	8	6	5	4	3	3	2	2	2	2	1

Characters per Line	Maximum Displayable Characters	Maximum Pages at Lines per Page of: 4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64 thru 125
32	1920 (Standard)	15	7	5	3	3	2	2	1	1	1	1	1	1	1	1	--------
32	4000 (Optional)	3	15	10	7	6	5	4	3	3	3	2	2	2	2	2	1

Note 1: The number of displayable characters does not include the status line which contains 80 characters.

Note 2: A page must consist of a minimum of four lines of refresh memory and can be increased to the limits of refresh memory in increments of four lines. All pages in the terminal must contain an equal number of lines.

Lines per display are (refer to table A-2):

Lines Per Display	0093 Register Content	Address 0092 Bit 3	Remarks
8	07	NOP	TD 730
12	0B	NOP	TD 730
12	0B	0	TD 830
24	17	1	TD 830

Table A-3. Position End-of-Page Alarm

0097 or 0098 Register Content	Alarm Row/ Column	0097 or 0098 Register Content	Alarm Row/ Column	0097 or 0098 Register Content	Alarm Row/ Column	0097 or 0098 Register Content	Alarm Row/ Column
00	1	18	25	30	49	48	73
01	2	19	26	31	50	49	74
02	3	1A	27	32	51	4A	75
03	4	1B	28	33	52	4B	76
04	5	1C	29	34	53	4C	77
05	6	1D	30	35	54	4D	78
06	7	1E	31	36	55	4E	79
07	8	1F	32	37	56	4F	80
08	9	20	33	38	57	50	81
09	10	21	34	39	58	51	82
0A	11	22	35	3A	59	52	83
0B	12	23	36	3B	60	53	84
0C	13	24	37	3C	61	54	85
0D	14	25	38	3D	62	55	86
0E	15	26	39	3E	63	56	87
0F	16	27	40	3F	64	57	88
10	17	28	41	40	65	58	89
11	18	29	42	41	66	59	90
12	19	2A	43	42	67	5A	91
13	20	2B	44	43	68	5B	92
14	21	2C	45	44	69	5C	93
15	22	2D	46	45	70	5D	94
16	23	2E	47	46	71	5E	95
17	24	2F	48	47	72	5F	96

Table A-4. Terminal Configuration Firmware 1

Address	Bit	State	Function	Remarks
0080	0	1	Inhibit parity check	Maintenance aid.
		0	Check parity	Standard Operation.
	1	1	TD 830 Series terminal	
		0	TD 730 series terminal	
	2	1	ODT Environment enabled	
		0	ODT Environment disabled	
	3	1	DC1=Programmatic mode control	
		0	DC1=NOP (No operation)	
	4	1	Spare	
		0	Spare	
	5	1	SOH=clear Page	
		0	SOH=NOP	
	6	1	Point-to-point network	
		0	Multipoint network	
	7	1	Synchronous data comm	
		0	Asynchronous data comm	
0081	-	-	Baud rate	(Refer to Table A-9)
0082	-	-	Clear-to-send delay	(Refer to Table A-10)
0083	-	-	Transmit-to-receiver delay	(Refer to Table A-7)
0084	-	-	Lines per page	Enter the number of lines per page in hexadecimal code (Appendix A).
0085	-	-	Characters per line	Enter the number of characters per line in hexadecimal code. (Refer to Appendix A.)
0086	-	-	Left delimiter	
0087	-	-	Right delimiter	
0088	0	1	Optional Poll/Select character	7B/7C
		0	Standard Poll/Select character	70/71
	1	1	@ and A Data Transmission Numbers	Address 0088 bit 6
		0	1 and 0 Data Transmission Numbers	must be enabled to use Transmission Numbers.
	2	1	Circuit 111/126 enabled	Required for certain
		0	Circuit 111/126 disabled	CCITT data sets
	3	1	Circuit 116 enabled	
		0	Circuit 116 disabled	
	4	1	Internal clear-to-send enabled	Refer to Table A-10.
		0	Internal clear-to-send disabled	
	5	1	Trnasmit-to-receive delay enabled	
		0	Transmit-to-receive delay disabled	
	6	1	Enable Transmit number }	Option in point-to-point and
		0	Disable transmit number }	multipoint data comm procedures.

Table A-4. Terminal Configuration Firmware 1 (Cont.)

Address	Bit	State	Function	Remarks
	7	1	Point-to-point switched	
		0	Point-to-point non-switched	
0089	-	-	AD1 (Burroughs)/Select address (3270)	Use any address between ASCII 0,0 and 7,F except 0,4.
008A	-	-	AD2 (Burroughs)/Poll address (3270)	
008B	-	-	Group Select (GSL) address (Burroughs/Device address (3270)	Insert 04, if not used.
008C	-	-	Data comm ACIA control	(Refer to Table A-9.)
008D	-	-	Baud time delay	(Refer to table A-8.)
008E	-	-	Group Poll GPL-AD1 (Burroughs/Dummy Byte 1 (3270)	Insert 04, if not used.
008F	-	-	Group Poll CPL-AD2 (Burroughs/Dummy Byte 2 (3270)	Insert 04, if not used.
0090	-	-	Dummy Byte 3 (3270)	
0091	-	-	Total lines per system	Enter in hexadecimal, number of lines per system excluding status line (Appendix A).
0092	0	1	Interpret LF as line feed with automatic carriage return	
		0	Interpret LF as line feed without carriage return	
	1	1	Blink cursor }	Address 0092 bit 5 must be enabled for cursor display.
		0	Solid cursor }	
	2	1	80 char/line display (TD830)	
		0	40 char/line display (TD830)	
	3	1	24 line display (TD830)	
		0	12 line display (TD830)	
	4	1	Field overflow inhibit	
		0	Field overflow allow	
	5	1	Cursor display inhibited	
		0	Cursor display enabled	
	6	1	Write carriage return into memory	
		0	Do not write carriage return into memory	
	7	1	Interpret CR as carriage return without line feed	
		0	Interpret CR as carriage with line feed	
0093	-	-	Lines per display	Enter in hexadecimal, 24, 12 or 8 line display.
0094	-	-	End address of display memory	Enter most significant byte. (Refer to Table A-12).

Table A-4. Terminal Configuration Firmware 1 (Cont.)

Address	Bit	State	Function	Remarks
0095	-	-	End address of display memory	Enter least significant byte. (Refer to Table A-12.)
0096	0	1	Interpret DC2 as cursor advance	
		0	Interpret DC2 as Forms enable/disable	TD700/TD800 compatibility
	1	1	Interpret FF as Form Feed/Clear Variable Tab Stops	
		0	Interpret FF as Form Feed only	
	2	1	TD700 Extended Memory VT Look-Alike	Keyboard & Data Comm TD700. Page Advance Function.
		0	Standard VT interpretation	Set Variable Horizontal Tab Stop.
	3	1	Interpret CLEAR key to erase entire form	Forms Mode
		0	Interpret CLEAR key to erase only unprotected data	
	4	1	Write Data Comm ETX into memory	
		0	Do not write data comm ETX into memory	
	5	1	Variable Tab enabled	
		0	Fixed Tab enabled	
	6	1	Tab-field-identifier option enabled	
		0	Tab-field-identifier option disabled	
	7	1	Cursor wrap-around inhibit (operates in non-forms only)	Inhibits Keyboard Data Entry beyond last position on page.
		0	Cursor wrap-around enabled	
0097	-	-	End-of-page alarm column detector	Enter in hexadecimal, column in which alarm is to sound (Refer to Table A-13.)
0098	-	-	End-of-page alarm row detector	Enter in hexadecimal, row in which alarm is to sound.
0099	-	-	Starting address of display memory	Enter most significant byte. (Refer to Table A-12.)
009A	-	-	Starting address of display memory	Enter least significant byte. (Refer to Table A-12.)
009B	0	1	High Printer data rate	TC4000 (300 bps).
		0	Low Printer data rate	B9354-6 (110 bps).
	1	1	Spare	
		0	Spare	
	2	1	Spare	
		0	Spare	
	3	1	Hold in Receive mode enabled	For operation without keyboard.
		0	Hold in Receive mode disabled	
	4	1	Security data option enabled	For magnetic card reader.
		0	Security data option disabled	
	5	1	Printer in extended-line mode	Used for TC4000 printer (150 character per line mode).

Table A-4. Terminal Configuration Firmware 1 (Cont.)

Address	Bit	State	Function	Remarks
				Inhibits automatic carriage return to printer that occurs at end of each display line.
		0	Printer in non-extended-line mode	Allows automatic carriage return to printer.
	6	1	Enable A 9249 (ODEC) printer interface	Set Bits 6 and 7 to zero (0) for B9354-6 printer.
	7	1	Enable TC4000 printer interface	
		0	Disable TC4000 printer interface	
009C	-	-	Starting address of data comm buffer	Enter most significant byte.
009D	-	-	Starting address of data comm buffer	Enter least significant byte. (Refer to table A-12.)
009E	-	-	End address of data comm buffer	Enter most significant byte. (Refer to table A-12).
009F	-	-	End address of data comm buffer	Enter least significant byte. (Refer to table A-12.)

Table A-5. Terminal Configuration Firmware 2

Address	Bit	State	Function	Remarks
0080	0	1	Inhibit parity check	Maintenance aid.
		0	Check parity	Standard Operation.
	1	1	TD830 Series terminal	
		0	TD730 series terminal	
	2	1	Large system ODT point-to-point procedure enabled	
		0	Large system ODT point-to-point disabled	
	3	1	DC1=Programmatic mode control	
		0	DC1=Line Erase	
	4	1	Transmit Page in Forms	Home to ETX/Home to end-of-page.
		0	Standard Forms transmit	Cursor to ETX/Home to cursor.
	5	1	SOH=clear page	Up to max of 2400 bps.
		0	SOH=NOP	
	6	1	Point-to-point network	Also medium system ODT
		0	Multipoint network	
	7	1	Synchronous data comm	Also, 3270 operation.
		0	Asynchronous data comm	
0081	-	-	Baud rate	(Refer to Table A-9.)
0082	-	-	Clear-to-send delay	(Refer to Table A-10.)
0083	-	-	Spare	
0084	-	-	Lines per page	Enter the number of lines per page in hexadecimal code (Appendix A).
0085	-	-	Characters per line	Enter the number of characters per line in hexadecimal code. (Refer to Appendix A.)
0086	-	-	Left delimiter	
0087	-	-	Right delimiter	
0088	0	1	Optional Poll/Select character	7B/7C
		0	Standard Poll/Select character	70/71
	1	1	@ and A Data Transmission Numbers	Address 0088 bit 6
		0	1 and 0 Data Transmission Numbers	must be enabled to use Transmission Numbers.
	2	1	Circuit 111/126 enabled	Required for certain
		0	Circuit 111/126 enabled	CCITT data sets
	3	1	Circuit 116 enabled	
		0	Circuit 116 disabled	
	4	1	Internal clear-to-send enabled	Refer to Table A-10.
		0	Internal clear-to-send disabled	
	5	1	Transmit-to-receive delay enabled	128 msec, if enabled.
		0	Transmit-to-receive delay disabled	
	6	1	Enable transmit number	Option in point-to-point and multipoint data comm procedures.
		0	Disable transmit number	
	7	1	Point-to-point switched	Medium system ODT.
		0	Point-to-point non-switched	

Table A-5. Terminal Configuration Firmware 2 (Cont.)

Address	Bit	State	Function	Remarks
0089	-	-	AD1 (Burroughs)/Select address (3270)	Use any address between ASCII 0,0 and 7,F except 0,4.
008A	-	-	AD2 (Burroughs)/Poll address (3270)	
008B	-	-	Group Select (GSL) address (Burroughs)/Device address *3270)	Insert 04, if not used.
008C	-	-	Data comm ACIA control	(Refer to Table A-9.)
008D	-	-	Spare	
008E	-	-	Group Poll GPL-AD1 (Burroughs/Dummy Byte 1 (3270)	Insert 04, if not used.
008F	-	-	Group Poll GPL-AD2 (Burroughs/Dummy Byte 2 (3270)	Insert 04, if not used.
0090	-	-	Dummy Byte 3 (3270)	
0091	-	-	Total lines per system	Enter in hexadecimal, number of lines per system excluding status line (Appendix A).
0092	0	1	Interpret LF as line feed with automatic carriage return	
		0	Interpret LF as line feed without carriage return	
	1	1	Blink cursor }	Address 0092 bit 5 must be enabled for cursor display.
		0	Solid cursor }	
	2	1	80 char/line display (TD830)	40x12 Screen format (TD730)
		0	40 char/line display (TD830)	32x8 Screen format (TD730)
	3	1	24 line display (TD830)	NOP (TD730)
		0	12 line display (TD830)	NOP (TD730)
	4	1	Field overflow inhibit	
		0	Field overflow allow	
	5	1	Cursor display inhibited	
		0	Cursor display enabled	
	6	1	Keyboard upper case only	Prevents keyboard entry of characters from ASCII Col. 6 and 7.
		0	Lower case enabled	For keyboards with lower case 3 bit.
	7	1	RTS Hold Enabled	Time Delay (Refer to Table A-11.)
		0	No RTS Hold	No Delay.
0093	-	-	Lines per display	Enter in hexadecimal, 24, 12 or 8 lines display.
0094	-	-	End address of display memory	Enter most significant byte. (Refer to Table A-12.)
0095	-	-	End address of display memory	Enter least significant byte. (Refer to Table A-12.)
0096	0	1	Interpret DC2 as cursor advance	
		0	Interpret DC2 Forms enable/disable	TD700/TD800 compatibility

Table A-5. Terminal Configuration Firmware 2 (Cont.)

Address	Bit	State	Function	Remarks
	1	1	Interpret FF as Form Feed/Clear Variable Tab Stops	
		0	Interpret FF as Form Feed only	
	2	1	TD700 Extended Memory VT Look-alike	Keyboard & Data Comm TD700. Page Advance Function.
		0	Standard VT interpretation	Set Variable Horizontal Tab Stop.
	3	1	Interpret CLEAR key to erase entire form	Forms Mode
		0	Interpret CLEAR key to erase only unprotected data	
	4	1	Write Data Comm TEX into memory	
		0	Do not write Data Comm ETX into memory	
	5	1	Variable Tab enabled	
		0	Fixed Tab enabled	
	6	1	Tab-field-identifier option enabled	HT (→) character is written into memory from keyboard.
		0	Tab-field-identifier option disabled	
	7	1	Cursor wrap-around inhibit	Inhibits Keyboard Data Entry beyond last position on page.
		0	Cursor wrap-around enabled	
0097	-	-	End-of-page alarm column detector	Enter in hexadecimal, column in which alarm is to sound (Refer to Table A-13.)
0098	-	-	End-of-page alarm row detector	Enter in hexadecimal, row in which alarm is to sound.
0099	-	-	Starting address of display memory	Enter most significant byte. (Refer to Table A-12.)
009A	-	-	Starting address of display memory	Enter least significant byte. (Refer to Table A-12.)
009B	0	1	High Printer data rate	TC4000 (300 bps).
	0	0	Low Printer data rate	B9354-6 (110 bps).
	1	1	MCR Code Translation Enabled	Converts ASCII 3A-3E to ASCII 1A-1E.
		0	No MCR Code Translation	
	2	1	256 msec CR delay for 300 bps TTY printer	Terminet Printer.
		0	No CR delay for TTY printer	
	3	1	Hold in Receive mode enabled	For operation without keyboard.
		0	Hold in Receive mode disabled	
	4	1	Security data option enabled	For magnetic card reader.
		0	Security data option disabled	
	5	1	Printer in extended-line mode	Used for TC4000 printer (150 character per line mode). Inhibits automatic carriage return to printer that occurs at end of each display line. Allows automatic carriage return to printer.
		0	Printer in non-extended-line mode	
	6	1	Enable A 9249 (ODEC) printer interface	Set Bits 6 and 7 to zero (0) for B9354-6 printer.
	7	1	Enable TC 4000 printer interface	
		0	Disable TC 4000 printer interface	

Table A-5. Terminal Configuration Firmware 2 (Cont.)

Address	Bit	State	Function	Remarks
009C	-	-	Starting Address of data comm buffer	Enter most significant byte. (Refer to table A-12.)
009D	-	-	Starting address of data comm buffer	Enter least significant byte. (Refer to table A-12.)
009E	-	-	End address of data comm buffer	Enter most significant byte. (Refer to table A-12.)
009F	-	-	End address of data comm buffer	Enter least significant byte. (Refer to table A-12.)
00A0	0	1	Write Data Comm HT into memory	
		0	Do not write Data Comm HT into memory	
	1	1	Spare	
		0	Spare	
	2	1	Automatic Cursor Advance with Data Comm ETX	
		0	No Cursor Advance with Data Comm ETX	
	3	1	Interpret Data Comm CR as carriage return without line feed	
		0	Interpret Data Comm CR as carriage return with line feed	
	4	1	Write Data Comm CR into memory	
		0	Do not write Data Comm CR into memory	
	5	1	Interpret keyboard CR (return key) as carriage return without line feed	
		0	Interpret keyboard CR as carriage return with line feed	
	6	1	Write keyboard CR into memory	
		0	Do not write keyboard CR into memory	
	7	1	Line-at-a-time transmission	Line home to cursor
		0	Standard Transmission	Transmission Point (Mobile Home).

Table A-6. Terminal Cinfiguration Firmware 3

Address	Bit	State	Function	Remarks
0080	0	1	Inhibit parity check	Maintenance aid.
		0	Check parity	Standard Operation.
	1	1	TD830 Series terminal	
		0	TD730 series terminal	
	2	1	Spare	Must be set to 0 state.
		0	Spare	
	3	1	DC1=Programmatic mode control	
		0	DC1=Line Erase	
	4	1	Transmit Page in Forms	Home to ETX/Home to end-of-page.
		0	Standard Forms transmit	Cursor to ETX/Home to cursor.
	5	1	SOH=clear Page	Up to max of 2400 bps.
		0	SOH=NOP	
	6	1	Point-to-point network	
		0	Multipoint network	
	7	1	Synchronous data comm	Also, 3270 operation.
		0	Asynchronous data comm	
0081	-	-	Baud rate	(Refer to Table A-9.)
0082	-	-	Clear-to-send delay	(Refer to Table A-10.)
0083	-	-	Spare	
0084	-	-	Lines per page	Enter the number of lines per page in hexadecimal code (Appendix A).
0085	-	-	Characters per line	Enter the number of characters per line in hexadecimal code. (Refer to Appendix A.)
0086	-	-	Left delimiter	
0087	-	-	Right delimiter	
0088	0	1	Optional Poll/Select character	7B/7C
		0	Standard Poll/Select character	70/71
	1	1	@ and A Data Transmission Numbers	Address 0088 bit 6 must be enabled to use Transmission Numbers.
		0	1 and 0 Data Transmission Numbers	
	2	1	Circuit 111/126 enabled	Required for certain CCITT data sets
		0	Circuit 111/126 enabled	
	3	1	Circuit 116 enabled	
		0	Circuit 116 disabled	
	4	1	Internal clear-to-send enabled	Refer to Table A-10
		0	Internal clear-to-send disabled	
	5	1	Transmit-to-receive delay enabled	128 msec, if enabled
		0	Transmit-to-receive delay disabled	
	6	1	Enable transmit number	Option in point-to-point and multipoint data comm procedures.
		0	Disable transmit number	
	7	1	Point-to-point switched	
		0	Point-to-point non-switched	
0089	-	-	AD1 (Burroughs)/Select address (3270)	Use any address between ASCII 0,0 and 7,F except 0,4.

Table A-6. Terminal Configuration Firmware 3 (Cont.)

Address	Bit	State	Function	Remarks
008A	-	-	AD2 (Burroughs)/Poll address (3270)	
008B	-	-	Group Select (GSL) address (Burroughs)/Device address (3270)	Insert 04, if not used.
008C	-	-	Data comm ACIA control	(Refer to Table A-9)
008D	-	-	Spare	
008E	-	-	Group Poll GPL-AD1 (Burroughs/Dummy Byte 1 (3270)	Insert 04, if not used.
008F	-	-	Group Poll CPL-AD2 (Burroughs/Dummy Byte 2 (3270)	Insert 04, if not used.
0090	-	-	Dummy Byte 3 (3270)	
0091	-	-	Total lines per system	Enter in hexadecimal, number of lines per system excluding status line (Appendix A).
0092	0	1	Interpret LF as line feed with automatic carriage return	
		0	Interpret LF as line feed without carriage return	
	1	1	Blink cursor }	Address 0092 bit 5
		0	Solid cursor }	must be enabled for cursor display.
	2	1	80 char/line display (TD830)	40x12 Screen format (TD730)
		0	40 char/line display (TD830)	32x8 Screen format (TD730)
	3	1	24 line display (TD830)	NOP (TD730)
		0	12 line display (TD830)	NOP (TD730)
	4	1	Field overflow inhibit	
		0	Field overflow allow	
	5	1	Cursor display inhibited	
		0	Cursor display enabled	
	6	1	Keyboard upper case only	Prevents keyboard entry of characters from ASCII Col. 6 and 7.
		0	Lower case enabled	For keyboards with lower case 3 bit.
	7	1	RTS Hold Enabled	Time Delay (Refer to Table A-11.)
		0	No RTS Hold	No Delay.
0093	-	-	Lines per display	Enter in hexadecimal, 24, 12, or 8 line display.
0094	-	-	End address of display memory	Enter most significant byte. (Refer to Table A-12.)
0095	-	-	End address of display memory	Enter least significant byte. (Refer to Table A-12.)
0096	0	1	Interpret DC2 as cursor advance	
		0	Interpret DC2 as Forms enable/disable	TD700/TD800 compatibility
	1	1	Interpret FF as Form Feed/Clear Variable Tab stops	
		0	Interpret FF as Form Feed only	
	2	1	TD700 Extended Memory VT Look-alike	Keyboard & Data Comm TD700. Page Advance Function.

Table A-6. Terminal Configuration Firmware 3 (Cont.)

Address	Bit	State	Function	Remarks
		0	Standard VT interpretation	Set Variable Horizontal Tab Stop.
	3	1	Interpret CLEAR key to erase entire form	Forms Mode
		0	Interpret CLEAR key to erase only unprotected data	
	4	1	Write Data Comm TEX into memory	
		0	Do not write Data Comm ETX into memory	
	5	1	Variable Tab enabled	
		0	Fixed Tab enabled	
	6	1	Tab-field-identifier option enabled	HT (→) character is written into memory from keyboard.
		0	Tab-field-identifier option disabled	
	7	1	Cursor wrap-around inhibit (forms & non-forms keyboard only)	Inhibits Keyboard Data Entry beyond last position on page.
		0	Cursor wrap-around enabled	
0097	-	-	End-of-page alarm column detector	Enter in hexadecimal, column in which alarm is to sound (Refer to Table A-13.)
0098	-	-	End-of-page alarm row detector	Enter in hexadecimal, row in which alarm is to sound.
0099	-	-	Starting address of display memory	Enter most significant byte. (Refer to Table A-12.)
009A	-	-	Starting address of display memory	Enter least significant byte. (Refer to Table 1-12.)
009B	0	1	High Printer data rate	TC4000 (300 bps).
		0	Low Printer data rate	B9354-6 (110 bps).
	1	1	MCR Code Translation Enabled	Converts ASCII 3A-3E to ASCII 1A-1E.
		0	No MCR Code Translation	
	2	1	256 msec CR delay for 300 bps TTY printer	Terminet Printer.
		0	No CR delay for TTY printer	
	3	1	Hold in Receive mode enabled	For operation without keyboard.
		0	Hold in Receive mode disabled	
	4	1	Security data option enabled	For magnetic card reader.
		0	Security data option disabled	
	5	1	Printer in extended-line mode	Used for TC4000 printer (150 character per line mode). Inhibits automatic carriage return to printer that occurs at end of each display line.
		0	Printer in non-extended-line mode	Allows automatic carriage return to printer.
	6	1	Enable A 9249 (ODEC) printer interface	Set Bits 6 and 7 to zero (0) for B9354-6 printer.
	7	1	Enable TC 4000 printer interface	
		0	Disable TC 4000 printer interface	
009C	-	-	Starting Address of data comm buffer	Enter most significant byte. (Refer to table A-12.)

Table A-6. Terminal Configuration Firmware 3 (Cont.)

Address	Bit	State	Function	Remarks
009D	-	-	Starting address of data comm buffer	Enter least significant byte. (Refer to table A-12.)
009E	-	-	End address of data comm buffer	Enter most significant byte. (Refer to table A-12.)
009F	-	-	End address of data comm buffer	Enter least significant byte. (Refer to table A-12.)
00A0	0	1	Write Data Comm HT into memory	
		0	Do not write Data Comm HT into memory	
	1	1	SOH to leave all pages in forms mode	
		0	SOH to disable forms on all pages	
	2	1	Automatic Cursor Advance with Data Comm ETX	
		0	No cursor Advance with Data Comm ETX	
	3	1	Interpret Data Comm CR as carriage return without line feed	
		0	Interpret Data Comm CR as carriage return with line feed	
	4	1	Write Data Comm CR into memory	
		0	Do not write Data Comm CR into memory	
	5	1	Interpret Keyboard CR (return key) as a carriage return without line feed	
		0	Interpret keyboard CR as carriage return with line feed	
	6	1	Write Keyboard CR into memory	
		0	Do not write keyboard CR into memory	
	7	1	Line-at-a-time transmission	Line home to cursor Transmission Point (Mobile Home.)
		0	Standard Transmission	
0102 0103	-	-	Starting address of keyboard program area.	
0104 0105	-	-	End address of keyboard program area.	
0170	-	-	Enter A9 for initial installation to allow any keys to be programmed.	

Table A-7. Transmit-to-Receive Delay

To set up the terminal configuration for correct transmit-to-receive delay, convert the delay in milliseconds into hexadecimal code and load into register 0083. If no delay is required, set 0088 bit 5 to the ZERO state. Typical delays are:

TYPE OF DATA COMM	DELAY IN MILLISECONDS
V23 Data Set	100
RS232 Four-Wire	0
RS232 Two-Wire	100

Table A-8. Baud Time Delay

To set up the terminal configuration for the correct baud time delay (receive hold) set 008D to the following:

BAUD TIME DELAY	HEX CODE FOR REGISTER 008D
No Delay	00
1 Baud Time Delay	FF
2 Baud Time Delay	FE
3 Baud Time Delay	FD

NOTE

If a 1 or 2 baud time delay does not appear to give proper operation, a 3 baud time delay may be required. Transmit-to-receive delay may be required for TDI.

Table A-9. Baud Rate Conversion

Baud Rate	Hex Code for Address 0081	Hex Code for Address 008C
75	41	0A
110	7E	0A
150	A1	0A
200	B9	0A
300	D1	0A
600	A1	09
1200	D1	09
1800	E1	09
2400	E9	09
4800	F5	09
9600	A1	08
19.2K	D1	08
38.4K	E9	08

Table A-10. Clear-to-Send Delay

Type of Communications	Delay in Milliseconds	Hex Code for Address 0082
V23 (4-wire), 1200 or 600 baud	16/200	10/C8
V23 (2-wire), 1200 or 600 baud	200	C8
V21 and Bell 202 series	50	32
Bell 103 series	255	FF
Burroughs TA 713	16	10
Burroughs TA 783	16	10
TDI or BDI	0	00

Notes:

1. Internal clear-to-send is not required for use with Data Sets. Data Sets provide clear-to-send delays appropriate for its design. To simulate Data Set clear-to-send delays when needed, use the delay as listed in this table. The delay circuit is enabled by loading a logic 1 into Address 0088 bit 4. Note that a downstream TC700 requires the terminals Internal CTS signal enabled.

2. If no Internal CTS signal is required, disable by loading a logic 0 into Address 0088 bit 4.

Table A-11. Transmit-to-Receive and Baud-Time Delays

To set up terminal configuration for the transmit-to-receive delay, set address 0088, bit 5, to the ONE state for fixed 128 milliseconds delay in firmware 3. If no delay is required, set 0088, bit 5, to the ZERO state.

Type of Data Comm	Transmit-to-Receive Delay	Address 0088 Bit 5 State
V23 data set	128	1
RS232, four-wire	0	0
RS232, two-wire	128	1

RTS HOLD (Bit Time Delay)	Address 0092, Bit 7, State
0	0
3	1

The RTS hold delay is used with older style data sets (including Bell 202 C and D). If set, the terminal holds RTS (request-to-send) high for an additional three bit-times to assure that the data from the terminal is passed through the data set. Newer style data sets (Bell 202 S and T, Bell 209) and direct-connect networks do not require any RTS hold delay.

Table A-12. Memory Assignment and Address

Memory Assignment	Hex Address for 1920 Character Display System		Hex Address for 4000 Character Display System	
	Starting Address	Ending Address	Starting Address	Ending Address
Status Line	0300	034F	0300	034F
Data Comm Buffer	0350	084F	0350	0FFF
Display Memory	0850	0FFF	4000	4FFF

NOTE

To be compatible with TD 820 and TD 800 terminals 1920-character screen size, 3,000 data comm buffer is required = 8K RAM memory.

Table A-13. Decimal to HEX Code Conversion

DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX
1	00	25	18	49	30	73	48
2	01	26	19	50	31	74	49
3	02	27	1A	51	32	75	4A
4	03	28	1B	52	33	76	4B
5	04	29	1C	53	34	77	4C
6	05	30	1D	54	35	78	4D
7	06	31	1E	55	36	79	4E
8	07	32	1F	56	37	80	4F
9	08	33	20	57	38	81	50
10	09	34	21	58	39	82	51
11	0A	35	22	59	3A	83	52
12	0B	36	23	60	3B	84	53
13	0C	37	34	61	3C	85	54
14	0D	38	25	62	3D	86	55
15	0E	39	26	63	3E	87	56
16	0F	40	27	64	3F	88	57
17	10	41	28	65	40	89	58
18	11	42	29	66	41	90	59
19	12	43	2A	67	42	91	5A
20	13	44	2B	68	43	92	5B
21	14	45	2C	69	44	93	5C
22	15	46	2D	70	45	94	5D
23	16	47	2E	71	46	95	5E
24	17	48	2F	72	47	96	5F

MESSAGE REGISTERS

Sample temporary system register messages are given here.

1. To change the lines/page system register temporarily use: ESC RH 0084 01 0B ESC RC.
2. The terminal responds to the central system program with six asterisks (******) when the terminal change is complete. If a failure has occurred, the terminal responds with an error code (Appendix F). Power-up of the system confidence test restores the permanent system register configuration.
3. To temporarily change the TD 830 to the double-width character 40-character/lines, the central system program sends the following text message: ESC RH 0085 01 27 ESC RH 0092 01 04 ESC RC. Note that the 0092 system register also affects other features.
4. To change the lines per display in the TD 830 to 12, the central system program sends the following text message: ESC RH 0093 01 0B ESC RH 0092 01 00 ESC RC. The terminal responds as in step 2. Note that system register 0092 affects other features.
5. In the TD 830, to enable temporarily the following:
   4 Lines per page
   24 lines per display
   40 characters per line
   CR into memory

Cursor blink
Variable tabulation
ETX into memory
A9249 line printer

The central system program text message is:

ESC RH 0084 01 03
ESC RH 0085 01 4F
ESC RH 0093 01 17
ESC RH 0092 01 4A
ESC RH 0096 01 30
ESC RH 009B 01 40
ESC RH

READING FROM CENTRAL SYSTEM

To read from the central system the 32 bytes of the system registers, the program text message is:

ESC RT 0080 20

The terminal responds with 32 bytes of contiguous hexadecimal values.

Table A-14. CTRL H Sequence Code Chart

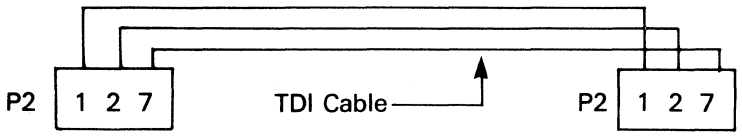
USACII	Keyboard	Video	USACII	Keyboard	Video
NUL	SPACE		DLE	0	
SOH	!		DC1	1	
STX	"		DC2	2	
ETX	#		DC3	3	
EOT	$		DC4	4	
ENQ	%		NAK	5	
ACK	&		SYN	6	
BEL	'		ETB	7	
BS	(		CAN	8(blink)	
HT	)		EM	9(secure)	
LF	*		SUB	:(bright	
VT	+		ESC	;	
FF	,		FS	<	
CR	-		GS	=	
SO	.(neg.vid.)		RS	>	
SI	/(underline)		US	?	

All highlighting character is not displayed, but will perform the highlight and will be transmitted.

CTRL H SEQUENCE

The CTRL H sequence can be used to display the characters that are in columns 0 and 1. For example, by pressing the CTRL key, H key, semicolon (;) key, the escape character is displayed. Refer to table 4-14 for all other characters that will give characters from columns 0 and 1.

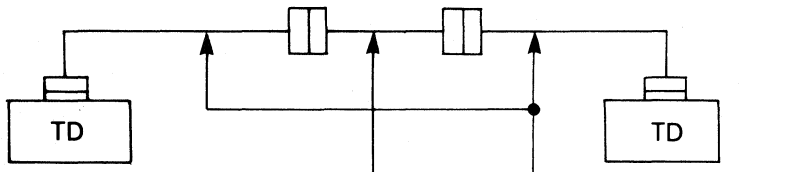
This feature can be used to test a program (text data) that is being received by the terminal. By setting up two terminals (TD 730 or TD 830) in the point-to-point mode (address 0080, bit 6 enabled) either TDI or data set interface can be used. First the PIA board must be strapped for TDI or data set interface. The cable used between the two terminals for TDI is pin 1 to pin 1, pin 2 to pin 2, and pin 7 to pin 7.



TDI CABLE
Pin 1 = shield
Pin 2 = data
Pin 7 = gnd

Address	Bit	State/Code
0080	6	1
0082		10
0088	4	1

For data set interface use two data set cables and a data set bypass cable as shown below:



EXAMPLE OF TRANSMITTED DATA

1. Screen Char Position 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 etc.
   [ ] [ ]θ W1 2

   The ESC char. is displayed by depressing CTRL key, H key, semicolon (;) key

   Receiving Terminal ▷1 2 ◁ ▷ ◁
   and terminal is in forms mode

2. To transmit negative video press: CTRL H, period (.), and transmit.

KEY PROGRAM ADDRESS

If the permanent EAROM locations are used for storage of the keyboard programs:

Address	Content
0102	01
0103	70
0104	01
0105	8A

If a temporary storage area is used as the keyboard program area, its starting address and end address must change accordingly.

FIRMWARE LEVEL IDENTIFICATION

Table A-15. Firmware Level Identification

Firmware Level	Peripherals	MPU Board	FC00/FC01 Contents	FB00/FB01 Contents
1.2	No	PROM	AFC2	–
1.2	Yes	PROM	5D54	–
1.3	No	ROM	7AD3	–
1.3	Yes	ROM	3720	–
2.12	No	PROM	72A5	–
2.12	Yes	Not Released		–
2.2	No	PROM	D8A9	–
2.2	Yes	PROM	51CF	–
3.1	No	ROM	–	DA71
3.1	Yes	ROM	–	99BE
4.0	Yes	ROM	–	E6F7
4.0	No	ROM	–	F541

Address FB00/FB01 and FC00/FC01 represents the two-byte CRC of the pointer table. To read the two-byte contents use the following:

From data comm:

ESC RTFB0002
ESC RTFC0002

From keyboard:

CTRL RWMODE/CTRL RHFB00
CTRL RWMODE/CTRL RHFC00

START-OF-TRANSMISSION POINT (MOBILE HOME)

Any position on a page may be defined as the start-of-transmission point. This feature is implemented by a new configuration register bit in conjunction with either keyboard or program control sequence.

This feature allows data comm transmission from the start-of-transmission point up to, but not including, the cursor position. If the cursor is positioned in a right-justified field, the entire right-justified field is transmitted.

If an ETX is written into memory, transmission is from cursor to ETX, independent of start-of-transmission point. If the ETX is written into a right-justified field, transmission is from cursor to ETX including all right-justified field positions to the left of the ETX.

To determine the start-of-transmission point:

1. Set configuration register address 00A0, bit 7, to the ZERO state.
2. Place the cursor to the desired new start-of-transmission point.
3. Use keyboard CTRL HOME sequence or program ESC D sequence.

NOTE

Performing the system confidence test automatically resets the start-of-transmission point to 0,0.

LINE-AT-A-TIME TRANSMISSION

The line-at-a-time transmission is a special case of the start-of-transmission point, where the transmission starting point is the first position of the line on which the cursor is located.

To enable this feature which is implemented in firmware 2, the new configuration register address 00A0, bit 7, must be set to the ONE state. To disable the line-at-a-time transmission feature, set the bit to the ZERO state.

XMT PAGE IN FORMS MODE

This feature transmits all unprotected data and transmittable protected data on the page from the start-of-transmission point, independent of cursor position. If no ETX is written into memory, transmission of unprotected data and transmittable protected data is from the start-of-transmission point to the ETX. If an ETX is written into a right-justified field, the unprotected data in the right-justified field to the left of the ETX is included in the transmission. The field engineer sets configuration register address 0080, bit 4, to the ONE state to enable this feature.

If configuration register address 0080, bit 4, is set to the ZERO state, standard forms transmission occurs. Standard forms transmission of unprotected data and transmittable protected data is from the start-of-transmission point to the cursor position, if no ETX is written into memory. If an ETX is written into memory, transmission of unprotected data and transmittable protected data is from the cursor position to the ETX.

NOTE

Keyboard data entry is allowed within an unprotected data field after any cursor movement into that date field.

For the CR character:

1. Write CR from data comm into TD memory (00A0/4/1)
2. Not to write CR from data comm into TD memory (00A0/4/0)
3. Write CR from keyboard into TD memory (00A0/4/0)
4. Not to write CR from keyboard into TD memory (00A0/6/0)
5. No line feed function with CR from data comm (00A0/3/1)
6. Line feed function with CR from data comm (00A0/3/0)
7. No line feed with CR from keyboard (00A0/5/1)
8. Line feed function with CR from keyboard (00A0/5/0)

For the ETX character:

1. Write ETX from data comm into TD memory (0096/4/1)
2. Not to write ETX from data comm into TD memory (0096/4/0)
3. Cursor advance on ETX from data comm (00A0/2/0)

4. No cursor advance on ETX from data comm (00A0/2/0)
5. Write ETX from keyboard into TD memory (press ETX key)
6. Not to write ETX from keyboard into TD memory (do not press ETX)

LOWER CASE LOCKOUT

This feature is used with keyboards having lower case capability and causes translation of ASCII columns 6 and 7 to columns 4 and 5 respectively. Control of this feature is by configuration address 0092, bit 6, set to the ONE state. If CTRL T is pressed (or caps key), the register changes on a temporary basis.

If the configuration address 0092, bit 6, is set to the ZERO state, both keyboard and program control sequences are active. CTRL Y enables the lower case lockout feature from the keyboard and affects keyboard-entered data. CTRL T disables the feature from the keyboard.

Keyboard lower case lockout is enabled from data comm by ESC Y. The ESC Z sequence disables the feature. If lower case data is sent by data comm it appears on the terminal screen in lower case.

DISABLE BUZZER

The CTRL ? sequence is used to disable the audible alarm. The audible alarm is enabled automatically upon power-up or pressing any Local key. Once disabled, use of the CTRL ? sequence re-enables the alarm and simultaneously causes it to sound.

The ESC ? sequence causes the audible alarm to sound if enabled.

SPECIAL MESSAGES TO STATUS LINE

The special message section of the status line is used to display data comm entered data that cannot be altered by the operator. Special messages of up to 72 characters may be displayed. Typical special messages may include computer or system status and operator notification of data entry on non-displayed pages. The fast select, group select, and broadcast select procedures are used in conjunction with the ESC RS sequence to write special messages. Program control of the status line special message has the following format:

ESC RSHH (message up to 72 characters)

where H is the message length in hexadecimal.

For example, the message OPERATOR ALERT appears as follows:

ESC RSOE OPERATOR ALERT

Pressing the LOCAL key clears the status line, except PAGE and page number. Sending the ESC RS00 sequence also clears the status line (excluding PAGE and page number).

For the HT character:

1. Write HT from data comm into TD memory (00A0/0/1)
2. Not to write HT from data comm into TD memory (00A0/0/0)
3. Write HT from keyboard (tab field identifier) into TD memory (0096/6/0)
4. Not to write HT from keyboard into TD memory (0096/6/0)

APPENDIX B
TD 830/TD 730 CHARACTERISTICS SUMMARY

TD 730 CHARACTERISTICS

Characteristic	Statements
Dimensions (without keyboard)	9.4 in. (23.88 cm) high; 15.5 in. (39.37 cm) wide; 6.25 in. (15.88 cm) deep
Weight	20 pounds (9.1 kilograms)
Display device	SELF-SCAN II
Display character capacity	480 characters
Display format	12 lines x 40 characters (standard) or 8 lines x 32 characters (optional)
Character format	5 x 7 dot matrix
Character generator	Up to 128 characters
Character code	Standard ASCII, optional modified ASCII
Data transfer rates	150 - 1,800 bps asynchronous, EIA RS232C 1,200 - 9,600 bps TDI (1000 ft.) Up to 38,400 bps BDI (15,000 ft.) 2,400, 4,800, or 9,600 bps synchronous, EIA RS232C
Display Memory	1,920 (optional 4,000) characters
Data comm buffer	1,200 (optional 3,000) characters
Status line	80 characters, displayable in two 40-character lines
Refresh rate	60 Hz or 50 Hz (input line frequency)
Relative humidity range	10 to 90 percent
Heat generated	500 BTU/hr.
Operating environment	40 to 122 degrees F (5 to 50 degrees C)
Nonoperating environment (storage)	-40 to 158 degrees F (-40 to 70 degrees C)
Input voltage range	100 to 240 volts ac at 50 or 60 Hz

TD 830 CHARACTERISTICS

Characteristic	Statement
Dimensions (without keyboard)	15.0 in. (38.1 cm) high; 16.1 in. (40,8 cm) wide; 13.0 (33.1 cm) deep
Weight (without keyboard)	35 pounds (15.9 kilograms)
Display device	Cathode ray tube (12 in. CRT)
Display capacity	1,920 or optional 960 characters plus 80-character status line
Display format	12 or 24-line with standard 80 or, double-width, 40 characters per line
Display character format	5 by 7 (optional 7 by 9) dot matrix
Character generator	Up to 128 characters
Character code	ASCII, standard or optional modified
Data transfer rates	150 to 1,800 bps, EIA RS232C asynchronous 2,400, 4,800, or 9,600 bps, EIA RS232C synchronous Up to 9,600 bps TDI (1,000 ft.) Up to 38,400 bps BDI (15,000 ft.)
Display memory	1,920 (optional 4,000) characters
Data comm buffer	1,200 (optional 3,000) characters
Status line	80 characters, displayed in 25th line
Display refresh rate	60 Hz or 50 Hz (input line frequency)

TD 830 Characteristics (Cont.)

Characteristic	Statement
Input voltage range	100 to 240 volts ac to 50 or 60 Hz
Heat generated	500 BTU/hr
Relative humidity range	10 to 90 percent
Operating environment	40 to 122 degrees F (5 to 50 degrees C)
Nonoperating environment (such as storage)	-40 to 158 degrees F (-40 to 70 degrees C)

APPENDIX C
CHARACTER VARIATIONS

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	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	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

*CON - ALTERNATE CODE FOR CONTENTION

Figure C-1. TD 830/TD 730 U.S. ASCII Chart

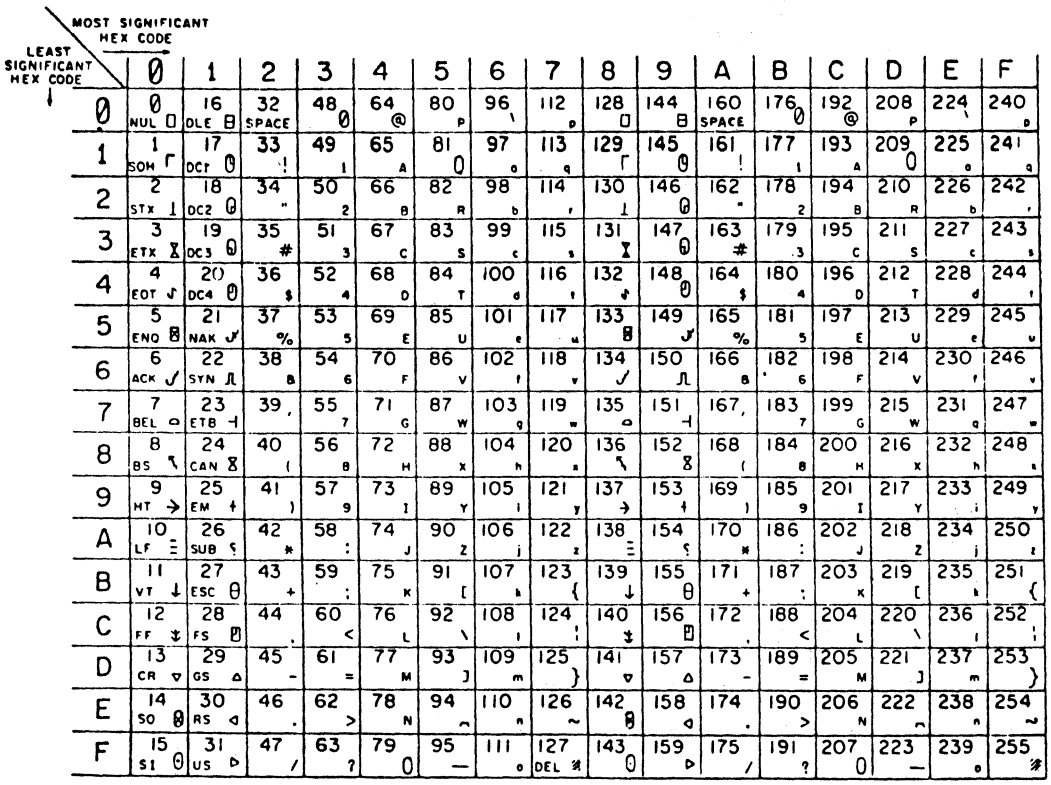
COLUMN → / ROW ↓	2	3	4	5
0	Sp	ø	@	P
1	!	1	A	Q
2	"	2	B	R
3	#	3	C	S
4	$	4	D	T
5	%	5	E	U
6	&	6	F	V
7	'	7	G	W
8	(	8	H	X
9	)	9	I	Y
10	*	:	J	Z
11	+	;	K	[
12	,	<	L	~
13	-	=	M	]
14	.	>	N	}
15	/	?	O	{

Figure C-2. Modified U.S. ASCII Chart

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					ℒ		
SPAIN / LATIN AMER.	Ps				Ñ		
UNITED KINGDOM	£				\		
GER./AUS./SWITZ.			§	Ä	Ö	Ü	
PORTUGAL / BRAZIL				Õ	Ã	Ç	
SOUTH AFRICA				'N	Ê	Ö	
SWEDEN/FINLAND	£		È	Ä	Ö	Å	
NORWAY / DENMARK	Æ	Å	ø		Ü		¡

Figure C-3. International Character Sets



	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0 NUL	16 DLE	32 SPACE	48 0	64 @	80 P	96 `	112 p	128 Ç	144 É	160 á	176 ▒	192 └	208 ð	224 Ó	240 ≡
1	1 SOH	17 DC1	33 !	49 1	65 A	81 Q	97 a	113 q	129 ü	145 æ	161 í	177 ▓	193 ┴	209 Ð	225 ß	241 ±
2	2 STX	18 DC2	34 "	50 2	66 B	82 R	98 b	114 r	130 é	146 Æ	162 ó	178 │	194 ┬	210 Ê	226 Ô	242 ‗
3	3 ETX	19 DC3	35 #	51 3	67 C	83 S	99 c	115 s	131 â	147 ô	163 ú	179 ┤	195 ├	211 Ë	227 Ò	243 ¾
4	4 EOT	20 DC4	36 $	52 4	68 D	84 T	100 d	116 t	132 ä	148 ö	164 ñ	180 ┼	196 ─	212 È	228 õ	244 ¶
5	5 ENQ	21 NAK	37 %	53 5	69 E	85 U	101 e	117 u	133 à	149 ò	165 Ñ	181 ╡	197 ┼	213 ı	229 Õ	245 §
6	6 ACK	22 SYN	38 &	54 6	70 F	86 V	102 f	118 v	134 å	150 û	166 ª	182 ╢	198 ╞	214 Í	230 µ	246 ÷
7	7 BEL	23 ETB	39 '	55 7	71 G	87 W	103 g	119 w	135 ç	151 ù	167 º	183 ╖	199 ╟	215 Î	231 þ	247 ¸
8	8 BS	24 CAN	40 (	56 8	72 H	88 X	104 h	120 x	136 ê	152 ÿ	168 ¿	184 ╕	200 ╚	216 Ï	232 Þ	248 °
9	9 HT	25 EM	41)	57 9	73 I	89 Y	105 i	121 y	137 ë	153 Ö	169 ⌐	185 ╣	201 ╔	217 ┘	233 Ú	249 ¨
A	10 LF	26 SUB	42 *	58 :	74 J	90 Z	106 j	122 z	138 è	154 Ü	170 ¬	186 ║	202 ╩	218 ┌	234 Û	250 ·
B	11 VT	27 ESC	43 +	59 ;	75 K	91 [	107 k	123 {	139 ï	155 ¢	171 ½	187 ╗	203 ╦	219 █	235 Ù	251 ¹
C	12 FF	28 FS	44 ,	60 <	76 L	92 \	108 l	124 ¦	140 î	156 £	172 ¼	188 ╝	204 ╠	220 ▄	236 ý	252 ³
D	13 CR	29 GS	45 -	61 =	77 M	93]	109 m	125 }	141 ì	157 ¥	173 ¡	189 ╜	205 ═	221 ¦	237 ³	253 ²
E	14 SO	30 RS	46 .	62 >	78 N	94 ^	110 n	126 ~	142 Ä	158 ₧	174 «	190 ╛	206 ╬	222 Ì	238 ´	254 ■
F	15 SI	31 US	47 /	63 ?	79 O	95 _	111 o	127 DEL	143 Å	159 ƒ	175 »	191 ┐	207 ¤	223 ▀	239 ¯	255 NBSP

Figure C-4. Standard ASCII Character Generator

APPENDIX D
LOCAL KEYBOARD CONTROL

Key Sequence	Function Description
CTRL ! NNN	Search tape 1 for selected file
CTRL " NNN	Search tape 2 for selected file
CTRL # M	Read page from tape
CTRL $ M	Read block from tape
CTRL % M	Read page from tape and transmit
CTRL $ M	Read tape file and transmit
CTRL ' M	Write data to tape
CTRL (M	Write unprotected data to tape
CTRL) M	Backspace one tape record
CTRL \	Write tape mark
CTRL ^ M	Rewind
CTRL NN	Numeric control message
CTRL :	Print unprotected data
CTRL ;	Print whole page
CTRL < COLM ROW	Programmable cursor column/row
CTRL =	TC4001 formatting (table 6-4)
CTRL >	Align display cursor to data comm pointer
CTRL ?	Sound audible alarm
CTRL A	Enable search mode
CTRL B	Line movement down
CTRL E CHAR	Set search character
CTRL I	Negative video off (TD 830 only)
CTRL M	Roll down
CTRL N	Roll up
CTRL O	Clear all variable tab stops
CTRL P	Set or reset a tab stop
CTRL Q	Forms disable
CTRL S	Disable search mode
CTRL T	Enable lower case from keyboard
CTRL U	Negative video on (TD 830 only)
CTRL V	Line movement up
CTRL W	Forms enable
CTRL Y	Disable lower case from keyboard
CTRL CTRL	Display status line (TD 730 only)
CTRL ↑	Scroll up
CTRL ↓	Scroll down
CTRL →	Page advance
CTRL @	Print continuously from display (maintenance firmware 3.1)
CTRL ←	Page back
CTRL space C CTRL	Display resident character set
CTRL space D CTRL	Initiate system confidence test
CTRL space F CTRL	Initiate printer test
CTRL space G CTRL	Initiate cassette test
CTRL space M CTLR	Memory saturation test
CTRL space H CTRL	Data rate: 600 bps
CTRL space J CTRL	Data rate: 1,200 bps
CTRL space K CTRL	Data rate: 2,400 bps if synchronous, 1,800 bps if asynchronous
CTRL space L CTRL	Program keyboard (FW 3.0 and higher)

N is any number where $0 \leq n \leq 9$. For special messages to remote controller or to access a certain data block on a tape cassette.
M identifies tape drive: 1 = tape drive 1, 2 = tape drive 2.
COLM and ROW are specified in table E-1.
CHAR means insert the character for which the search is to be made.

APPENDIX E
PROGRAM CONTROL (DATA COMM)

ESC Sequence	Function
ESC !	Character insert by line per character
ESC " COLM ROW	Programmable cursor, column/row
ESC #	Clear all variable tab stops
ESC $ PAGE	Select page
ESC %	Character delete by line per character
ESC &	Align display cursor to data comm pointer
ESC (	Transmit page
ESC - CHAR	Set search character
ESC .	Set/reset tab stop
ESC :	Print unprotected data
ESC ;	Print whole page
ESC <	Line movement down
ESC =	TC4001 formatting (table 6-4)
ESC >	Line movement up
ESC ?	Sound audible alarm
ESC @	Character insert by page per character
ESC C	Space right
ESC D	Start-of-transmission point (mobile home)
ESC E	Search enable
ESC F	Search disable
ESC J	Clear to end-of-page
ESC K	Clear to end-of-line
ESC L	Line insert
ESC M	Line delete
ESC N	Negative video on (TD 830 only)
ESC O	Negative video off (TD 830 only)
ESC P	Character delete by page per character
ESC S	Roll up
ESC T	Roll down
ESC W	Forms enable
ESC X	Forms disable
ESC Y	Disable lower case from data comm
ESC Z	Enable lower case from data comm
ESC * M	Read page from tape
ESC + M	Read tape file and transmit
ESC , M	Read page and transmit
ESC A M	Write tape mark
ESC B M	Backspace one tape block
ESC G M	Write data to tape
ESC H M	Read block from tape
ESC I M	Rewind tape
ESC Q M	Write unprotected data to tape
ESC U NNN	Search tape drive 1 to selected file
ESC V NNN	Search tape drive 2 to selected file
ESC space C	Display resident character set
ESC space D	Initiate system confidence test
ESC space F	Initiate printer test
ESC space G	Initiate cassette test
ESC RT009201	Read and transmit 0092 system register content
ESC RA031039message	System message to status line, special message area
ESC RH0084010B ESC RC	Temporary system register change to 12 lines/page

COLM and ROW are specified in table E-1.
CHAR means insert the character for which the search is to be made.
PAGE is clarified in table E-1.
N is any number where $0 \leq n \leq 9$; used for special messages to remote controller or to access a certain data block on a tape cassette.
M identifies tape drive: 1 = tape drive 1, 2 = tape drive 2.

Table E-1. Programmable Cursor and Select Page Control

Position COLM/ ROW/ Page	Graphic Character	USASCII Code	Position COLM/ ROW/ Page	Graphic Character	USASCII Code	Position COLM/ ROW/ Page	Graphic Character	USASCII Code
1	space	20	33	@	40	65		60
2	!	21	34	A	41	66	a	61
3	"	22	35	B	42	67	b	62
4	=	23	36	C	43	68	c	63
5	$	24	37	D	44	69	d	64
6	%	25	38	E	45	70	e	65
7	&	26	39	F	46	71	f	66
8	'	27	40	G	47	72	g	67
9	(	28	41	H	48	73	h	68
10	)	29	42	I	49	74	i	69
11	*	2A	43	J	4A	75	J	6A
12	+	2B	44	K	4B	76	k	6B
13	,	2C	45	L	4C	77	l	6C
14	–	2D	46	M	4D	78	m	6D
15	.	2E	47	N	4E	79	n	6E
16	/	2F	48	O	4F	80	o	6F
17	0	30	49	P	50	81	p	70
18	1	31	50	Q	51	82	q	71
19	2	32	51	R	52	83	r	72
20	3	33	52	S	53	84	s	73
21	4	34	53	T	54	85	t	74
22	5	35	54	U	55	86	u	75
23	6	36	55	V	56	87	v	76
24	7	37	56	W	57	88	w	77
25	8	38	57	X	58	89	x	78
26	9	39	58	Y	59	90	y	79
27	:	3A	59	z	5A	91	z	7A
28	;	3B	60	[	5B	92	{	7B
29	<	3C	61	\	5C	93	¦	7C
30	=	3D	62	]	5D	94	}	7D
31	>	3E	63	^	5E	95	~	7E
32	?	3F	64	_	5F	96	DEL	7F

APPENDIX F
SYSTEM CONFIDENCE TESTS

GENERAL

The input and display system (referred to as system and/or terminal) firmware set includes confidence tests designed to ensure proper operation of the terminal and to report any error detected. The confidence tests are executed during the power-up sequence and may be activated by keyboard CTRL or data comm ESC sequences.

This appendix lists areas covered by the confidence tests in the order tested. Notes describe details of the error codes.

The error code format is six characters. Errors are classified as fatal or non-fatal. When detected, a fatal error is reported immediately and further terminal operation is suspended. To continue operation, press the space bar on the keyboard.

The ability of the confidence test programs to perform diagnosis of a failure and to display an error message depends upon the type of failure. For example, an MPU failure, voltage failure, or a grounded line on the address or data bus may prevent the proper execution of instructions in the confidence test program.

Non-fatal errors are those which effect a single functional area and which do not render the terminal inoperable. Up to 16 non-fatal errors are reported (the first 16 detected). The terminal is placed in an operating mode after execution of the error display routine with a configuration based on EAROM contents. However, if the error is associated with an EAROM read operation, an assumed set of configuration data is placed in memory by the restart firmware.

Keyboard indicators remain set throughout execution of the power-up restart program, which includes all confidence tests. Total execution time is 20 to 30 seconds, depending on terminal configuration. Because the keyboard interface is tested, the keyboard should not be touched during execution of the restart program.

Successful completing of the restart program is indicated by a display of six stars (******) at the home position of the screen, followed by the cursor. The remaining display memory area is blanked. The status line is cleared except for the page number, which is displayed as PAGE 1. The page number does not appear in a single page system if the page locations are blanked in the EAROM. All keyboard indicators are then cleared except for LOCAL and the keyboard is unlocked.

Escape sequences designed for remote execution of confidence and diagnostic testing are:

ESC Sequence	Function
ESC space C	Display resident character set (no feedback to CPU)
ESC space D	Execute confidence test
ESC space F	Printer test
ESC space G	Cassette test
ESC R	(Refer to Section 3)

The following ESC sequences (after successful completion) return the six stars (******) to the CPU upon receiving the next poll:

ESC space D
ESC space F
ESC space G

Certain CTRL sequences in LOCAL may be useful in verifying terminal operation or diagnosing a fault. These are:

Key Sequence	Function
CTRL space C CTRL	Display resident character set
CTRL space D CTRL	Execute confidence tests
CTRL space E CTRL	Extended RAM test
CTRL space F CTRL	Printer test
CTRL space G CTRL	Cassette test
CTRL space M CTRL	Memory saturation
CTRL R	(Refer to Section 3)

The extended RAM test cycles through the RAM test section of the restart program until aborted by pressing the space bar. The RAM test then exits to the restart program which runs to completion. If a RAM error is detected, the test is aborted and the error code is displayed. Following an error, pressing the space bar causes re-initiation of the extended RAM test.

Note

Memory saturation sequence may be used as a linearity check of video or visual check of memory operation.

CONFIDENCE TESTS AND ERROR CODES

Test	Error Code	Fatal	See Note
Keyboard indicators	None		1
4K RAM read-after-write	Bnhhhh	X	2
Walking ones	BAhhhh	X	3
	1Ahhhh	X	3
RAM addressing	ADhhhh	X	4
RAM locations 0004-0FF0	Bnhhhh	X	10
ROM/PROM	CEhhhh	X	5
	00hhhh	X	5
Keyboard PIA, side A	A10000		
Keyboard character Ready FF	CF00000		6
Keyboard PIA, side B	A20000		
EAROM PIA	A30000		7
EAROM read-after-write CRC	EE0000		7
EAROM interface error	ED0000		7
EAROM data line	EA0000		7
EAROM clock	EC0000		7
EAROM CRC	000000		7
EAROM read-after-write RAM	EB0000		7
Data comm buffer memory	Bnhhhh		10
Display RAM	Bnhhhh		10
Data comm PIA-1, side A	DC00A1		
Data comm PIA-1, side B	DC00B1		
Data comm PIA-2, side A	DC00A2		
Data comm PIA-2, side B	DC00B2		
Data comm USRT	DC0081		11
Data comm time out	DC0082		12
Data comm ACIA	DC008C		13
Device 1 ACIA	D10000		13
Device 2 PIA, side A	D2000A		
Device 2 PIA, side B	D2000B		

Test	Error Code	Fatal	See Note
Device 2 ACIA	D2000C		13
Device 3 PIA, side A	D3000A		
Device 3 PIA, side B	D3000B		
Configuration data	DChhhh		9
Indicator PIA	A40000		
1 ms clock	1C0000	X	8

Notes

1. Verification of indicators is visual.
2. Initially, RAM locations 0000-0FFFF are set to all 0's. A read-after-write check is done on each location to ensure proper clearing. An error branch is taken on the first location that checks incorrectly: n = bad bit number, 0-7; hhhh = Hex address of failure.
3. An addressing test is done by walking an all 1's character (FF) through memory locations 0002 through 0800, and reading locations 0002 through 0FF0. If the FF character is found at any address other than the test location, hhhh of BAhhhh identifies the incorrect or "bad" address, and hhhh of 1Ahhhh (which always follows) identifies the test location or "ones address" where the FF character is originally placed. A comparison of the two hexadecimal addresses should identify the addressing problem. For example, BA0042 1A0002 shows that an FF character was written into location 0002 and found in location 0042. A fault is present on the address bit 6 signal line.
4. This error indicates that data written into hhhh is also written into location 0000. This may be caused by a shorted address line in the RAM circuitry.
5. CE = CRC error; hhhh = starting address of program with CRC error; 00hhhh = end address of program with CRC error. CRCs are done on program blocks. The address limits above can be used to isolate a failure to one ROM chip or one to four PROM chips.
6. If the character ready flip flop will not reset, the displayed error code is followed with data appearing at the character repeat rate.
7. EAROM-related errors force the terminal to operate with an assumed set of configuration data.
8. The 1 ms clock error is fatal; and, therefore, terminal operation is halted. The "continue" function does not work in this case since basic system operations require a 1 ms interrupt.
9. Configuration registers for starting and ending addresses of display memory and the data comm buffer are checked to ensure that data entered does not cause the terminal to hang up; hhhh is the incorrect hexadecimal configuration data. The configuration registers should be checked for the hhhh pattern and corrected.
10. N = bad bit number, 0-7; hhhh = hexadecimal address of failure.
11. The USRT is tested by looping the transmit data output back to the receive data input with data verification.
12. For synchronous data comm, a time out error indicates no external clock present. For asynchronous data comm, this error code results from a baud clock malfunction.
13. All ACIAs are tested by looping the transmit data output back to the ACIA receive data input with data verification.

APPENDIX G
TERMINAL CONFIGURATION REQUEST FORM

Burroughs TD730/TD830 INSTALLATION FORM

REFER TO TD730/TD830 REFERENCE MANUAL FORM 1093788

SERIAL NUMBER _____ STYLE _____

CUSTOMER _____

COMPLETED BY _____ BRANCH _____

This side to be completed by Account Manager and/or System Analyst.

DATA COMMUNICATION OPTIONS

1	LINE SPEED – BITS PER SECOND	☐☐☐☐				
2	TERMINAL ADDRESS	☐☐				
3	GROUP POLL ADDRESS	☐☐				
4	GROUP SELECT ADDRESS	☐☐				
5	DATA COMM BUFFER SIZE:	1200 (4K) ☐				3000 (8K) ☐
6	TRANSMISSION MODE: ASYNCHRONOUS	☐				SYNCHRONOUS ☐
7	LINE:	SWITCHED 2W ☐	2W ☐	4W ☐	TDI ☐	BDI ☐
8	BACKUP:	NONE ☐	SWITCHED ☐			LEASED ☐
9	ENVIRONMENT:	POINT TO POINT ☐	MULTIPNT ☐	ODT ☐		IBM 3270 ☐
10	TRANSMISSION NUMBERS:	NONE ☐	0 AND 1 ☐			A AND @ ☐
11	HOLD IN RECEIVE MODE:	YES ☐				NO ☐
12						
13						

PERIPHERAL OPTIONS

14	PRINTER:	INSTALLED ☐		NONE ☐
15		TC 4001 ☐	B9354-6 ☐	A9249 ☐
16		DATE RATE 110 BPS ☐	300 BPS ☐	600 BPS ☐
17		EXTENDED LINE MODE ☐		PRINTER LINE = DISPLAY LINE ☐
18		256 mS TTY DELAY ☐		NO TTY DELAY ☐
19	MCR:	INSTALLED ☐		NONE ☐
20		SECURE DATA OPTION ☐		SECURE DATA DISABLED ☐
21		CODE TRANSLATION ☐		CODE TRANSLATION DISABLED ☐
22	CASSETTE:	INSTALLED ☐		NONE ☐
23	KEYBOARD LOWER CASE ENABLED ☐			LOWER CASE DISABLED ☐
24	KEYBOARD PROGRAMS USED ☐			NOT USED ☐
25				
26				

DISPLAY/EDIT OPTIONS

27	LINES PER PAGE:	4 ☐	8 ☐	12 ☐	16 ☐	20 ☐	24 ☐	48 ☐		
28	CHARACTERS PER LINE (TD730 DISPLAY)				40 (32X8) ☐			80 (40X12) ☐		
29	LINES PER DISPLAY (TD830 ONLY)				12 ☐			24 ☐		
30	TOTAL DISPLAY:				1920 CHARS (4K) ☐			3840 CHARS (8K) ☐		
31	CURSOR:				BLINK ☐		SOLID ☐	NONE ☐		
32	CURSOR WRAPAROUND:				ENABLED ☐			DISABLED ☐		
33	FIELD OVERFLOW:				ENABLED ☐			DISABLED ☐		
34	FIXED TAB:				ENABLED ☐			DISABLED ☐		
35	TAB FIELD IDENTIFIER:				ENABLED ☐			DISABLED ☐		
36	END OF PAGE ALARM:			DECIMAL COLUMN/ROW ☐☐☐☐				NONE ☐		
37	LEFT FORMS DELIMETER:			☐☐						
38	RIGHT FORMS DELMETER:			☐☐						
39	SOH TO CLEAR SCREEN						YES ☐	NO ☐		
40	AUTO CARRIAGE RETURN WITH LINE FEED						YES ☐	NO ☐		
41	TD700 EXTENDED MEMORY LOOK ALIKE						YES ☐	NO ☐		
42	WRITE DATA COMM HORIZ. TAB INTO MEMORY						YES ☐	NO ☐		
43	SOH TO LEAVE ALL PAGES IN FORMS MODE						YES ☐	NO ☐		
44	AUTO CURSOR ADVANCE WITH DATA COMM ETX						YES ☐	NO ☐		
45	WRITE DATA COMM ETX INTO MEMORY						YES ☐	NO ☐		
46	AUTO LINE FEED WITH DATA COMM CARRIAGE RETURN						YES ☐	NO ☐		
47	WRITE DATA COMM CARRIAGE RETURN INTO MEMORY						YES ☐	NO ☐		
48	AUTO LINE FEED WITH KEYBOARD CR (RETURN KEY)						YES ☐	NO ☐		
49	WRITE KEYBOARD CR (RETURN KEY) INTO MEMORY						YES ☐	NO ☐		
50	MOBILE HOME/LINE AT A TIME TRANSMISSION						YES ☐	NO ☐		
51	DC1 AS PROGRAMMATIC MODE CONTROL	☐							DC1 AS LINE ERASE ☐	
52	DC2 AS CURSOR ADVANCE	☐							DC2 AS FORMS ENABLE ☐	
53	FF AS FORMFEED ONLY	☐							FF WITH CLEAR VERT TAB STOPS ☐	
54	CLEAR KEY TO ERASE ENTIRE FORM	☐							UNPROTECTED DATA ONLY ☐	
55	TRANSMIT PAGE IN FORMS	☐							STANDARD FORMS TRANSMIT ☐	

Burroughs COMPLETED BY _____ BRANCH _____ DATE _____ FIRMWARE LEVEL _____

	7 6 5 4	3 2 1 0	HEX	REF
0080				6, 9, 39, 55, 51, -, -, -,
1				1.
2				-.
3				-.
4				27.
5				28.
6				37.
7				38.
8				9/8, 10, -, -, -, -, 10, 12.
9				2.
A				2.
B				4.
C				1.
D				-.
E				3.
F				3.
•				

	7 6 5 4	3 2 1 0	HEX	REF
0090				-,
1				27/29/30.
2				-, 23, 31, 33, 29, 29, 31, 40.
3				29.
4				30.
5				30.
6				32, 35, 34, 45, 54, 41, 53, 52.
7				36.
8				36.
9				30.
A				30.
B				15, 15, 17, 20, -, 18, 21, 16.
C				5.
D				5.
E				5.
F				5.
00A0				50, 49, 48, 47, 46, 44, 43, 42.

ADDRESS	STANDARD MESSAGE	VARIATION
010C	PAGE	
0110	DATACOM OVERFLOW	
0120	CASSETTE ERROR	
0130	PRINTER ERROR	
0140	POWER FAULT	
0150	KEYBD DATA LOST	
0160	MESSAGE, PAGE	

NOTES

THIS SIDE TO BE COMPLETED BY THE
FIELD ENGINEER. FORM TO BE LEFT WITH MACHINE.

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APPENDIX H
TD 700 LOOK-ALIKE

The following terminal layout is used for TD 700 look-alike minimum configuration:

Address	Bit	State/Data
0080	1	0
0084	-	1F
0085	-	1F
0091	-	1F
0092	1	1
0092	2	0
0093	-	07
0096	2	1

NOTE

TD 730 = 32 X 32 by configuration register, no page boundaries for data comm.

Documentation Evaluation Form

Title: TD 730/TD 830 System Reference Manual

Form No: 1093788

Date: November, 1979

Burroughs Corporation is interested in receiving your comments and suggestions regarding this manual. Comments will be utilized in ensuing revisions to improve this manual.

Please check type of Suggestion:

☐ Addition ☐ Deletion ☐ Revision ☐ Error

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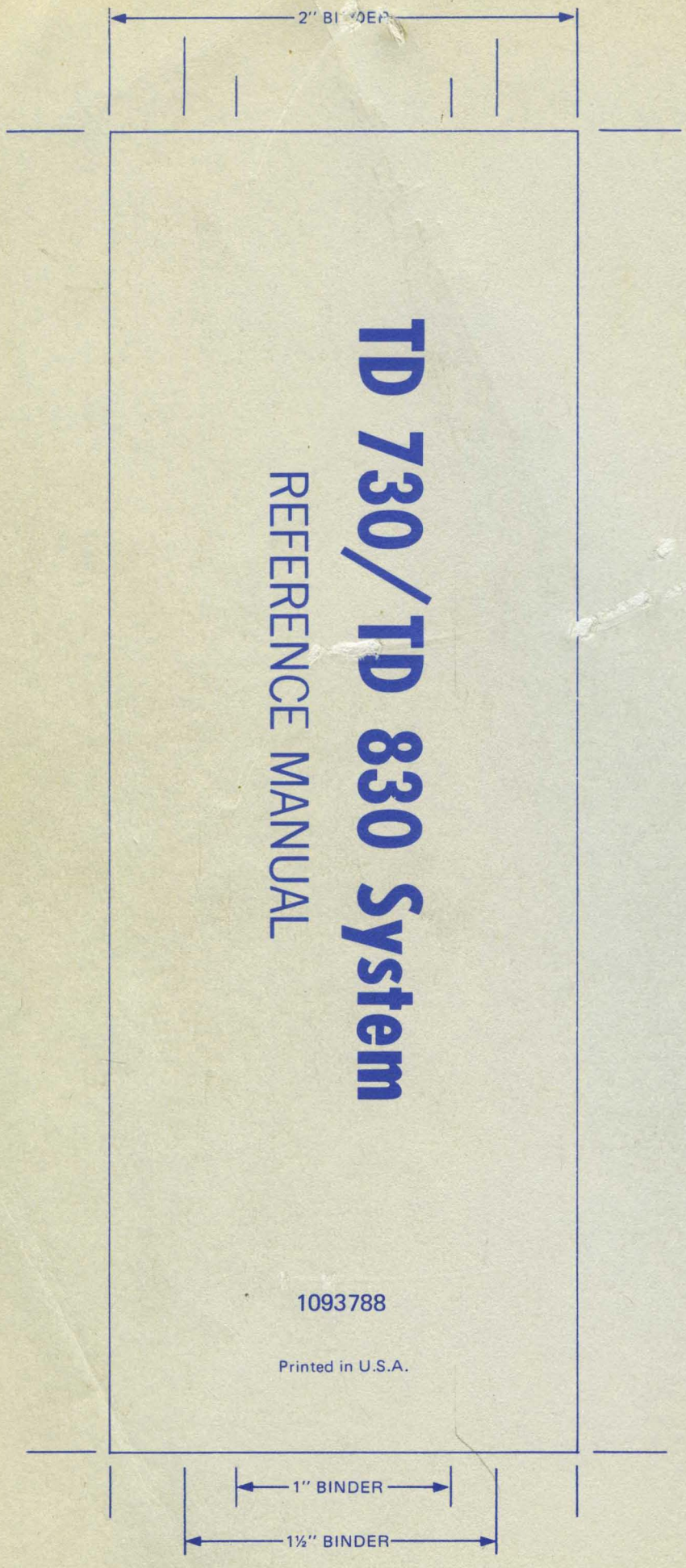

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