

Burroughs 

**TD 730/TD 830
System**

REFERENCE MANUAL

PRICED ITEM

Burroughs 

TD 730/TD 830 System

REFERENCE MANUAL

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7-1
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D-1 thru F-1

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Retain this PCN cover page as a record of changes made to the basic publication.

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INTRODUCTION

This manual describes Burroughs TD 730 and TD 830 series of input, output and display systems, including the system operations and capabilities. References in the manual to "enabled by Burroughs" or "installed by Burroughs" mean that Burroughs Field Engineers perform the functions described.

This manual is written for the TD 730/TD 830 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:

<u>Section</u>	<u>Title</u>
1	General Description of TD 730/TD 830 Series
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 manuals below.

<u>Form Number</u>	<u>Title</u>
1097805	TD Series Burroughs Data Comm Line Control Procedure Reference Manual
1094901	Binary Synchronous Multipoint IBM 3270 Line Control Procedure for TD 700/TD 800/TD 820 Reference Manual
1086956	Burroughs Basic Data Communications Line Control Procedures Reference Manual

Any comments or suggestions regarding this manual should

be forwarded to:

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SECTION 1

GENERAL DESCRIPTION OF TD 730/TD 830 SERIES

GENERAL DESCRIPTION.

The TD 730/TD 830 Series of terminals are input, output and display systems. The input consists of remote and/or local entries. The output may also be remote and/or local.

The display requirements differentiate the two TD Series. The TD 730 Series (figure 1-1) has a SELF-SCAN II(*1) screen. The TD 830 Series (figure 1-2) has a cathode ray tube (CRT) screen.

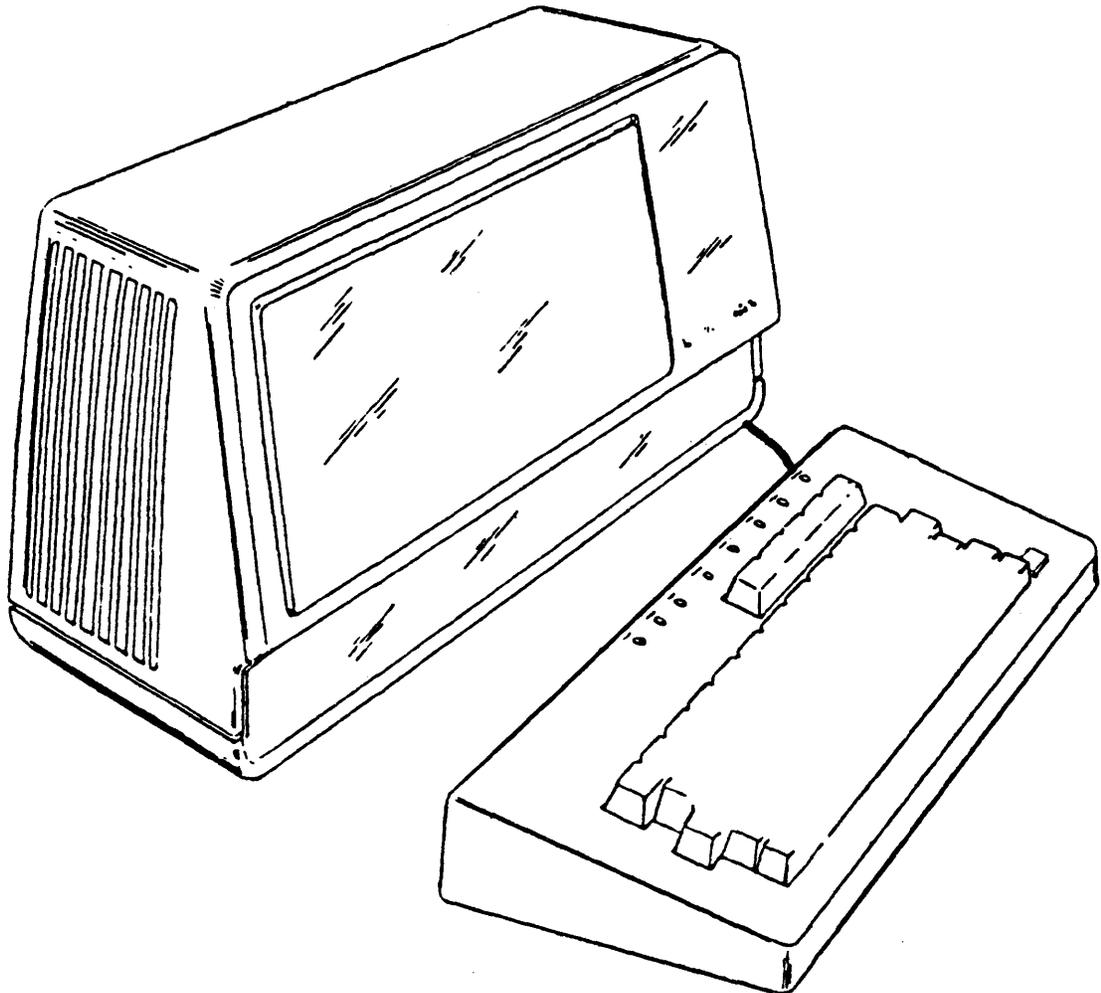


Figure 1-1. TD 730 Series

1 Registered Burroughs trademark.

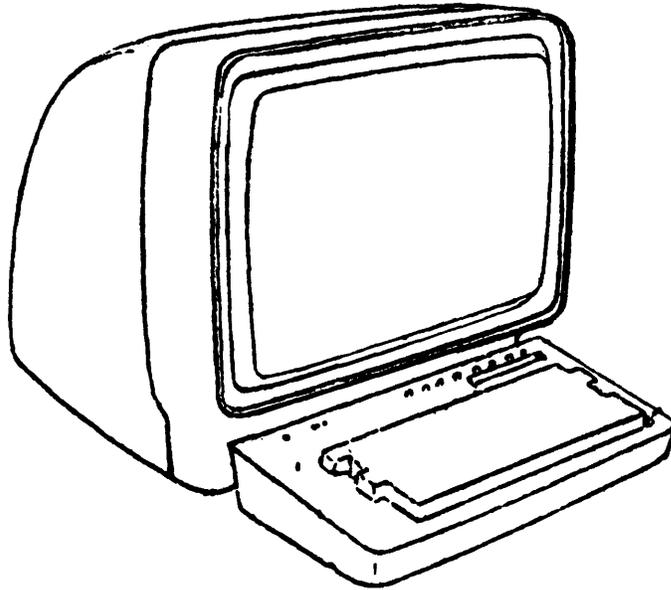


Figure 1-2. TD 830 Series

Remote input is from and remote output is to a central system via the 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 and output are alphanumeric data and/or special control characters.

SYSTEM CONFIGURATIONS.

The odd numbered styles are basic systems (figure 1-3). The even numbered styles are peripheral capable systems (figure 1-4). Both basic systems and peripheral capable systems are further divided by the data comm modes: Burroughs Asynchronous (TD 731/TD 732/TD 831/TD 832), Burroughs Synchronous (TD 733/TD 734/TD 833/TD 834) and IBM 3270 Binary Synchronous (TD 737/TD 738/TD 837/TD 838).

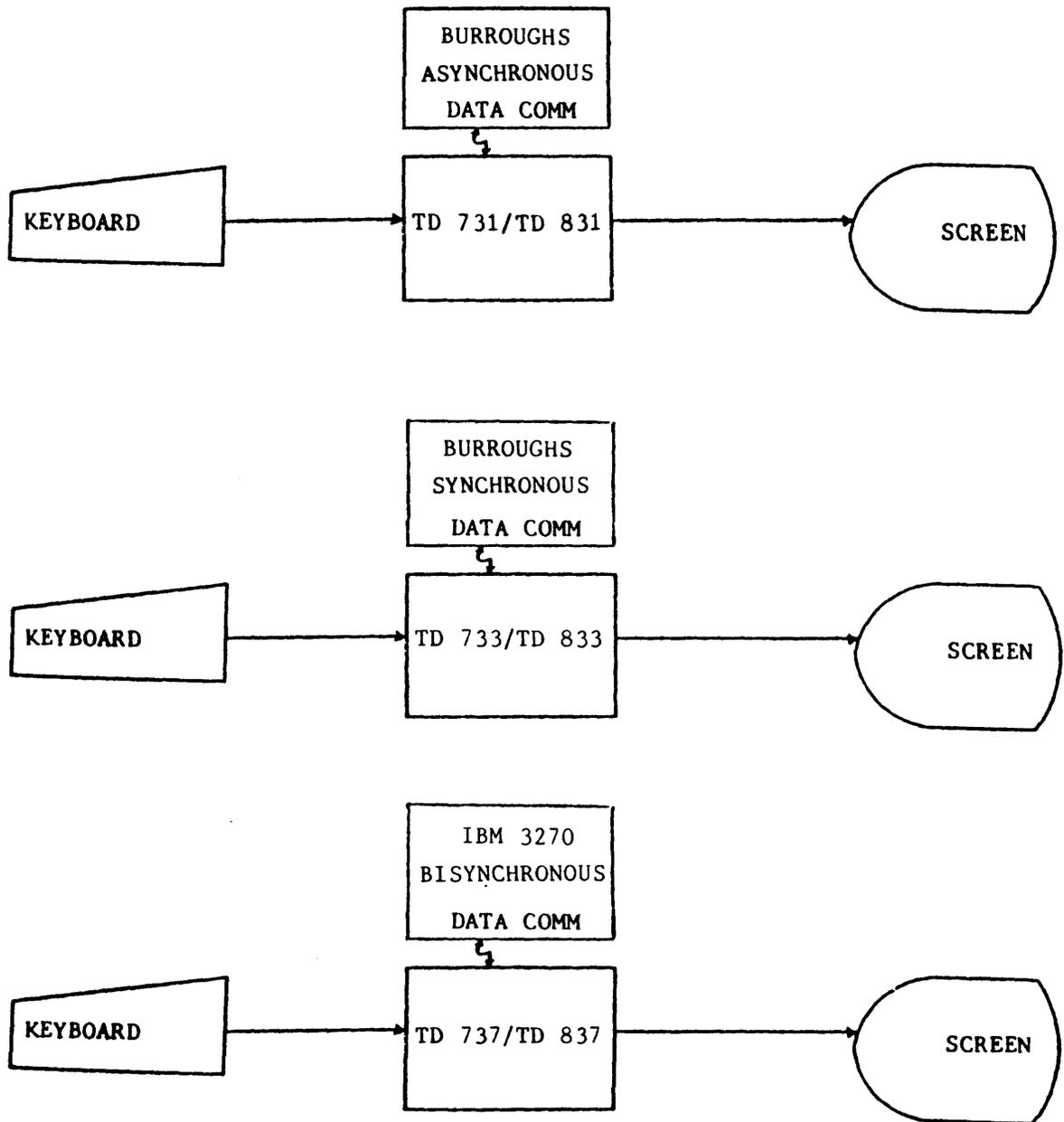


Figure 1-3. TD 730/TD 830 Basic System Configurations

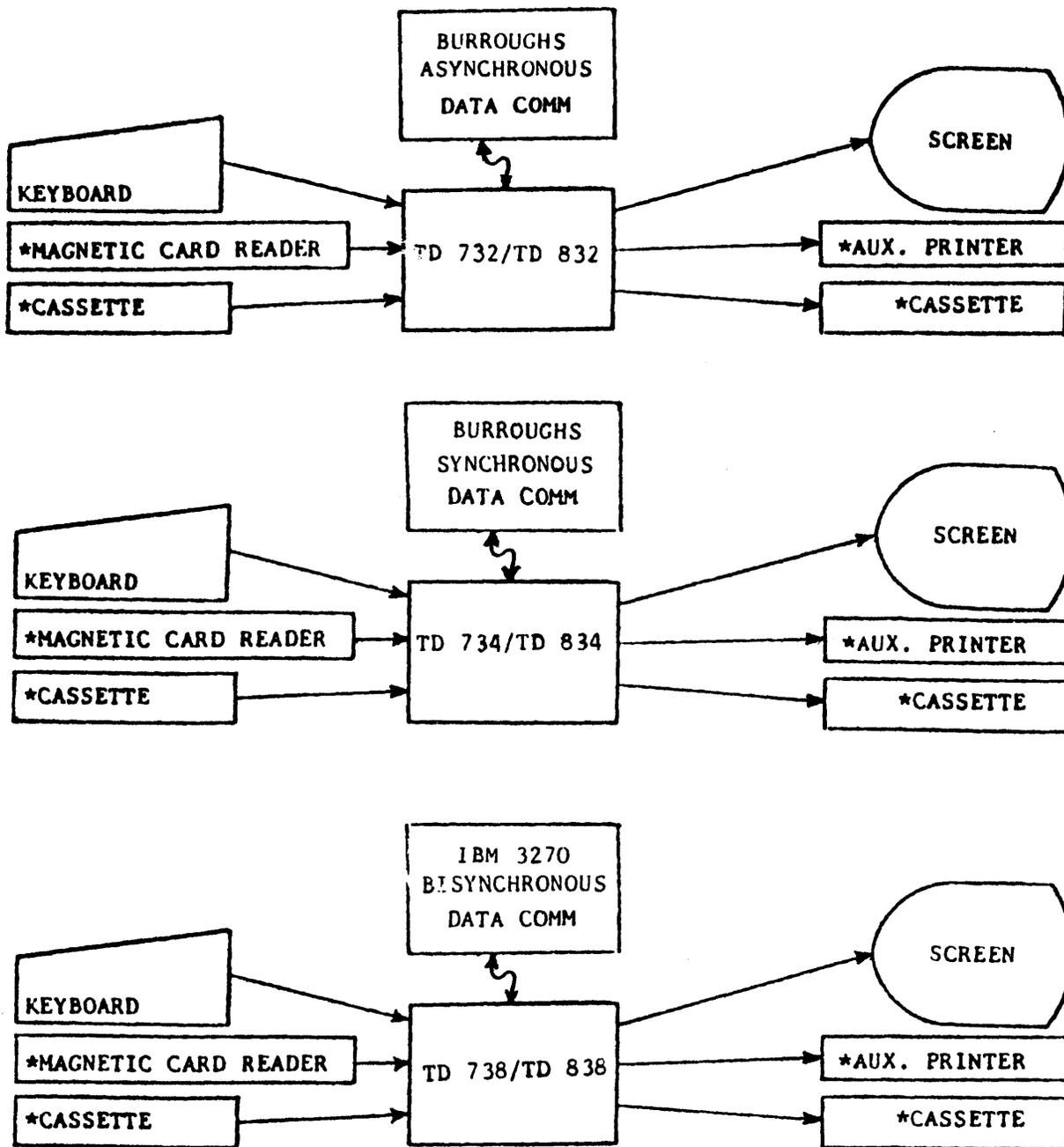


Figure 1-4. TD 730/830 Peripheral Capable System Configurations

SECTION 2

SYSTEM CHARACTERISTICS

GENERAL DESCRIPTION.

The system characteristics include the remote input/output, local input, processing characteristics, local output, and system confidence test. In this section the system data flow to and from the central system and peripherals is described (figure 2-1, 2-2).

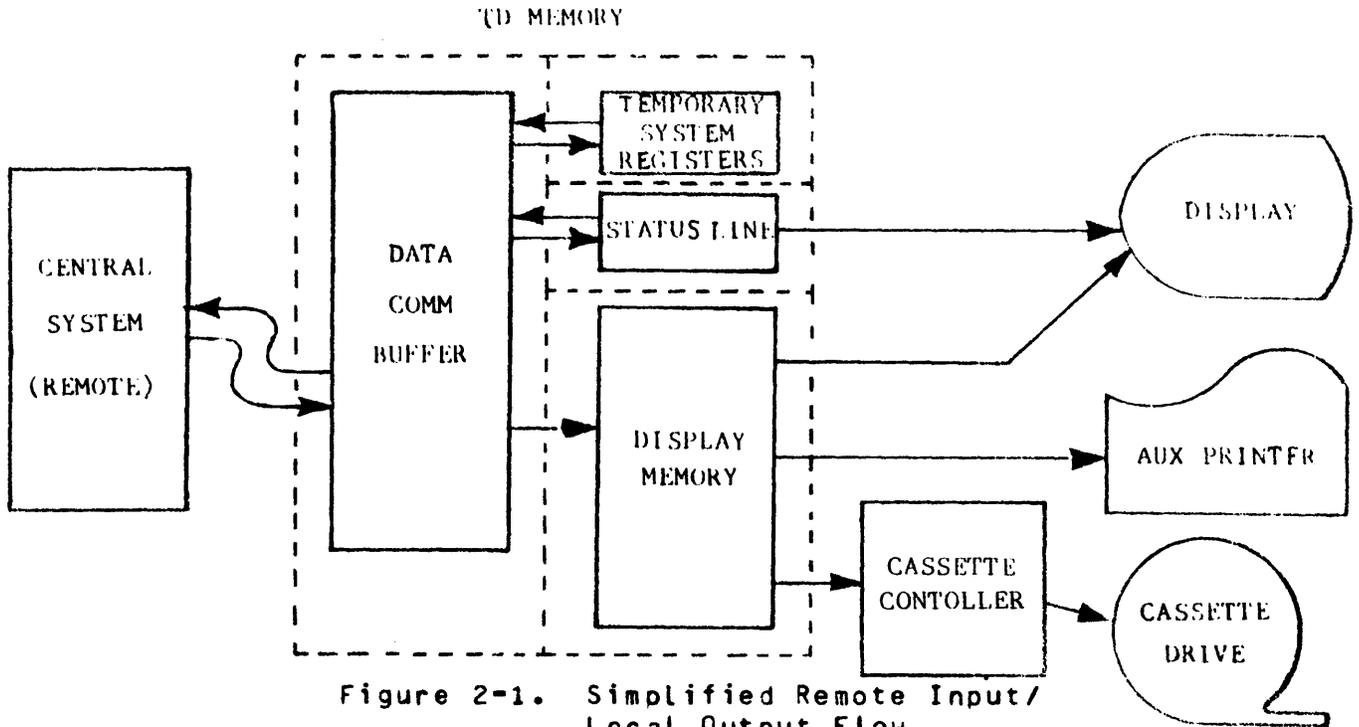


Figure 2-1. Simplified Remote Input/
Local Output Flow

REMOTE INPUT/OUTPUT: DATA COMMUNICATIONS.

The system has the capability to communicate with the data comm systems. The data comm capability is introduced under this heading. It is described in the TD Series Burroughs Data Comm Line Control Procedure Reference Manual. The data comm capability includes either Burroughs Asynchronous (TD 731/TD 732/TD 831/TD 832), Burroughs Synchronous (TD 733/TD 734/TD 833/TD 834), or IBM 3270 Binary Synchronous (TD 737/TD

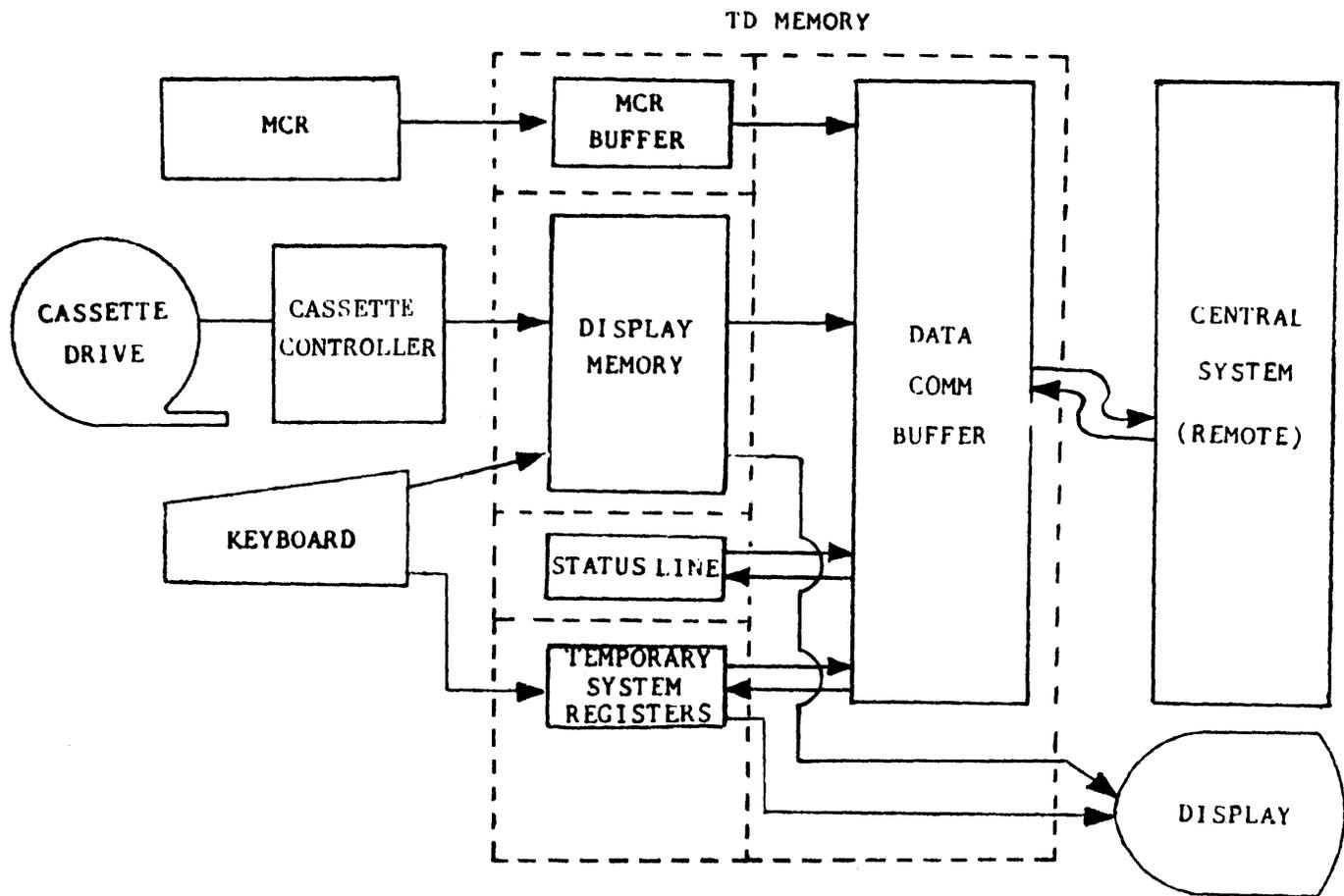


Figure 2-2. Simplified Local Input/
Remote Output Flow

738/TD 837/TD 838) mode of transmission (table 2-1). With Burroughs Asynchronous mode, the data comm line may be TDI (2-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.

Table 2-1

TD Data Comm Configurations

Line Disciplines	Direct-Connect		Data Sets	
	BDI	TDI	Multiple Terminals (Concatenation)	Single Terminal
Burroughs Asynchronous TD 731/TD 732/TD 831/TD 832 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.

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 section 4.

MAGNETIC CARD READER.

The magnetic card reader (MCR) reads magnetic 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 may be attached to peripheral capable systems. Data are transferred from a cassette drive via a cassette controller to the display terminal. The configurations and cassette operation 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.

The character generator can generate 128 character symbols (appendix C-4). Ninety-six characters may be called out from the U.S. Typewriter ASCII keyboard.

MEMORY.

Memory layout is provided in a simplified form in figure 2-3. 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. The instruction sequences control system functions (system firmware) and peripherals (device firmware). The 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.

BURROUGHS MEMORY. Burroughs (field engineer) uses special areas of memory. Burroughs configures the terminal permanently by installing the permanent system register options (refer to Burroughs Permanent Options, appendix A-II). Burroughs may also permanently customize error messages appearing on the status line such as PAGE and RECEIVING DATA by accessing scratchpad memory.

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 is used to transfer data to and from the central system. The data comm buffer size is 1200 characters in the basic system and 3000 characters with the expanded memory option. A 1920-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 are sent from the display memory to the central system and are received in display memory from the central system via the data comm buffer. The display memory size is 1920 characters in the basic system and 4000 characters with expanded memory.

The magnetic card reader buffer size is 40 characters. The MCR data are 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.

LOCAL OUTPUT.

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

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)	

Figure 2-3. TD 730/TD 830 Simplified Memory Layout

The TD 830 displays 2000 characters, consisting of 1920 characters of data and 80 characters of system information (status line). The configuration of the data field 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: A 9249, TC 4001, and B 9354-6. 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 to write to cassettes. Cassette operations are described in section 7.

SYSTEM CONFIDENCE TEST.

The system has a resident confidence test verifying functions of all major subsystems within the terminal. The confidence test may be initiated from any one of three sources: power up, keyboard control (appendix D), or program control (appendix E). This system confidence test takes about 11 seconds to complete. In addition, the terminal initiates confidence tests of printer and cassette controller interface through keyboard or program control.

The initiation of a confidence test causes the erasure of all data in the display memory. Successful completion of the confidence test causes this message to be displayed:

A confidence test detecting improper operation of a subsystem displays an error code (appendix F). Reporting the error code to Burroughs expedites repair service.

All program-initiated confidence tests except the display resident character set test attempt to transmit the resultant displayed data to the central system.

NOTE

Do not press any keyboard keys during the system confidence test, because doing so interferes with the test.

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 system registers 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 the system register 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 the permanent system register data are 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 4.

STATUS LINE.

The status line data are 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 out on the TD 730 by pressing the CTRL key twice. The TD 730 does not allow 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 key. 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 on those lines are stored in the display memory and reappear 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.

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, explained in table 3.1. Error messages are cleared by pressing the LOCAL key.

TD 830

16 Error Conditions	57 Special Messages	7 Page Number
------------------------	------------------------	------------------

TD 730

16 Error Conditions	24 Special-
------------------------	----------------

33 Messages	7 Page Number
----------------	------------------

Figure 3-1. Status Line Format

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 Incomplete tape command or CRC error
POWER FAULT	Momentary power loss

ERROR LOG. The terminal records up to 15 errors for data comm, cassette, A 9249 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 II):

ESC RL

The terminal leaves the Receive mode and enters the Transmit mode with the error log information ready for transmission. When polled, the terminal transmits the message identified in figure 3-2.

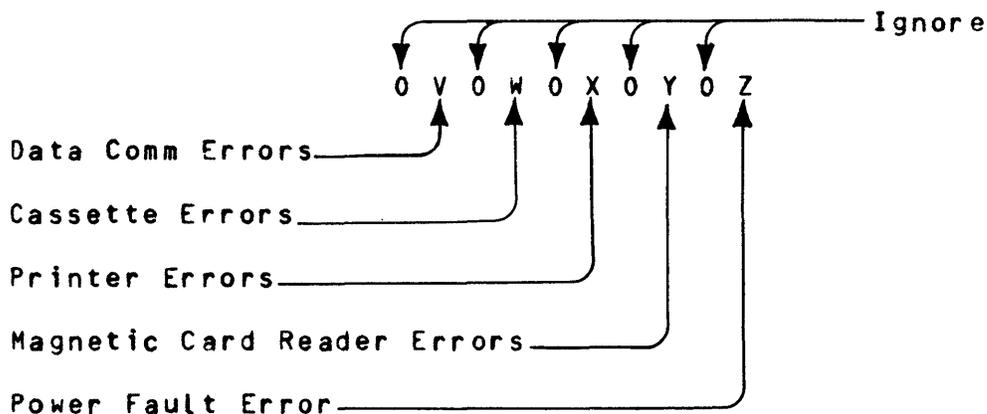


Figure 3-2. Error Log Format

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.

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 4 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 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.

The fast select, group select, and broadcast select procedures are used in conjunction with the ESC, RA sequence to write special messages. 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 would appear as follows:

ESC RA031039OPERATOR ALERT

Sending a message to the status line automatically erases the previous message in Firmware I only.

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 has been pressed, the operator may immediately advance to the next page and start entering data.

Data verification messages may also be transmitted back while operator is entering new information. For example, data have been 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, etc. 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 system 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 4-line increments (table 3-2).

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.

Table 3-2

Page/Screen/Display
Memory Relation

Page*	Screen			Display Memory			
				Basic (1920)*		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.

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.

Page advance	The page advance function is enabled through keyboard control (CTRL→) and advances the display cursor to the home position of the next page.
Page back	The page back function is enabled through keyboard control (CTRL←) and moves the display cursor to the home position of the preceding page.
Scroll up	<p>The scroll up function allows the operator to scan downward toward the end of the display memory. The data appear to move upward on the screen. See figure 3-3.</p> <p>When the display cursor is located on the last line of a page the scroll up function causes the cursor to appear at the same location in the first line line of the next page. CTRL↑ controls this function.</p>
Scroll down	<p>The scroll down function allows the operator to scan upward toward the beginning of the display memory. The data appear to move downward on the screen. See figure 3-3.</p> <p>When the display cursor is located 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.</p>
Cursor alignment	The cursor alignment function is 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	<p>The page select function, enabled through program control (ESC \$ Page) (appendix E) causes the data comm pointer to move to the home position of the selected page.</p> <p>Examples:</p> <p>ESC \$! homes the cursor on page 2.</p> <p>ESC \$ space homes the cursor on page 1.</p> <p>ESC \$ \$ homes the cursor on page 5.</p>
XMT key or RCV key	Pressing either the XMT key or the RCV key aligns the data comm pointer with the display cursor.

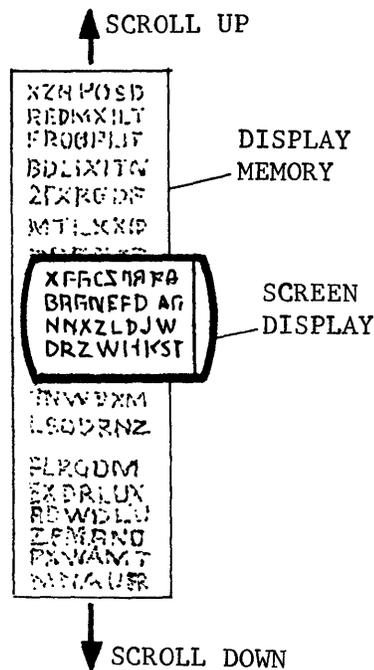


Figure 3-3. Scroll Up/Down

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. 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 are 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 are divided into unprotected and protected fields. The unprotected data may either be left-justified (normal unprotected data field) or right-justified (i.e., 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 are accessible for operator data entry and edit. 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 option enabled by Burroughs. Taking a page out of Forms causes the erasure of 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 Forms mode. 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 with keyboard CTRL control. If the terminal is in the Forms mode, the operator may change its status by initiating the CTRL G 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 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 that are transmitted begin at the cursor location and end 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 ESC 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 character sequence 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 inserted 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 are entered at the cursor position, existing data are shifted to the left in the unprotected data field as follows:

<u>Keyboard_Entry</u>	<u>Display_Result</u>
1	△ 1 ◁
2	△ 1 2 ◁
3	△ 1 2 3 ◁
4	△ 1 2 3 4 ◁
5	△ 1 2 3 4 5 ◁
6	△ 2 3 4 5 6 ◁

If the field is filled with data, additional information that is 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. The HOME position is not defined for this condition.

TRANSMITTABLE PROTECTED DATA FIELD. The field is enclosed by the opening delimiter FS (□ in TD 830, ◇ in TD 730) and the trailing delimiter RS (◁). The FS character has the 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 accidentally 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 that is 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 field 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 paragraph 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.

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 keyboard 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 O 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 4-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 \$) places the cursor into column 40, row 5.

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

ESC \$ \$ ESC " # % places 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.

PAGE 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 in a fixed position in relation to the page. During a roll up function, all the data on the display are simultaneously transferred line-for-line up the page. The data transferred from the top line appear on the bottom line causing a wrap-around effect. The roll down function is the converse of a roll up function. Where more than one page is displayed on the terminal display, data roll up or down 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 on 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 are simultaneously transferred line-for-line up the display. Data on the top line of the display shift off the display and new data appear 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 (see 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).

PAGE WRAP-AROUND INHIBIT. The terminal inhibits the cursor from advancing beyond the last character position of a page as additional keyboard data are entered. The wrap-around function is inhibited by Burroughs. It causes character overwriting in the last character position of the page. The feature prevents the operator from unknowingly advancing to the beginning of the same page. The wrap-around inhibit function operates in Non-forms mode only.

After correction of data, with the terminal still in the Forms mode and search enabled, activation of the XMT key causes the total form (protected and unprotected data) to be transmitted.

In Non-forms, the search feature operates the same as in Forms except that it 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. Only the TD 830 display pages have the negative video feature. 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 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 by the pressing of the keyboard 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 O 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 video.

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

FIELD VIDEO.

The display screen has the capability of highlighting 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. The highlighting is accomplished through use of six control codes: SQ, 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 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 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 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 is able to 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 until an end highlight code is reached.

The bright video highlight causes brighter characters to appear when the display is in the normal video mode. Actuation of the bright video highlight when the display is 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 without regard to in-process highlighting or to 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 has the capability of transmitting 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 the CTRL key, 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 CHAR's 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 the SPCFY key when the terminal is polled automatically transmits the message: SJH, 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 for the transmission of data on a page basis

in both Forms and non-forms as follows:

Forms Mode

- a. Cursor to ETX.
- b. All unprotected data.
- c. Beginning of form to cursor position.
- d. Entire form (Search mode).

Non-forms Mode

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

PROGRAMMATIC MODE CONTROL.

The terminal has programmatic mode control to permit the central system to select the operating mode of the terminal following a successful transmission from the central system. Normally, when in the Receive mode the terminal switches to the Local mode at the successful completion of the 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. The DC1 character 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 are 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 keyboards. 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 U.S. Typewriter keyboard layout. The function keys, control keys, and indicators of this keyboard 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 for this keyboard. 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.

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

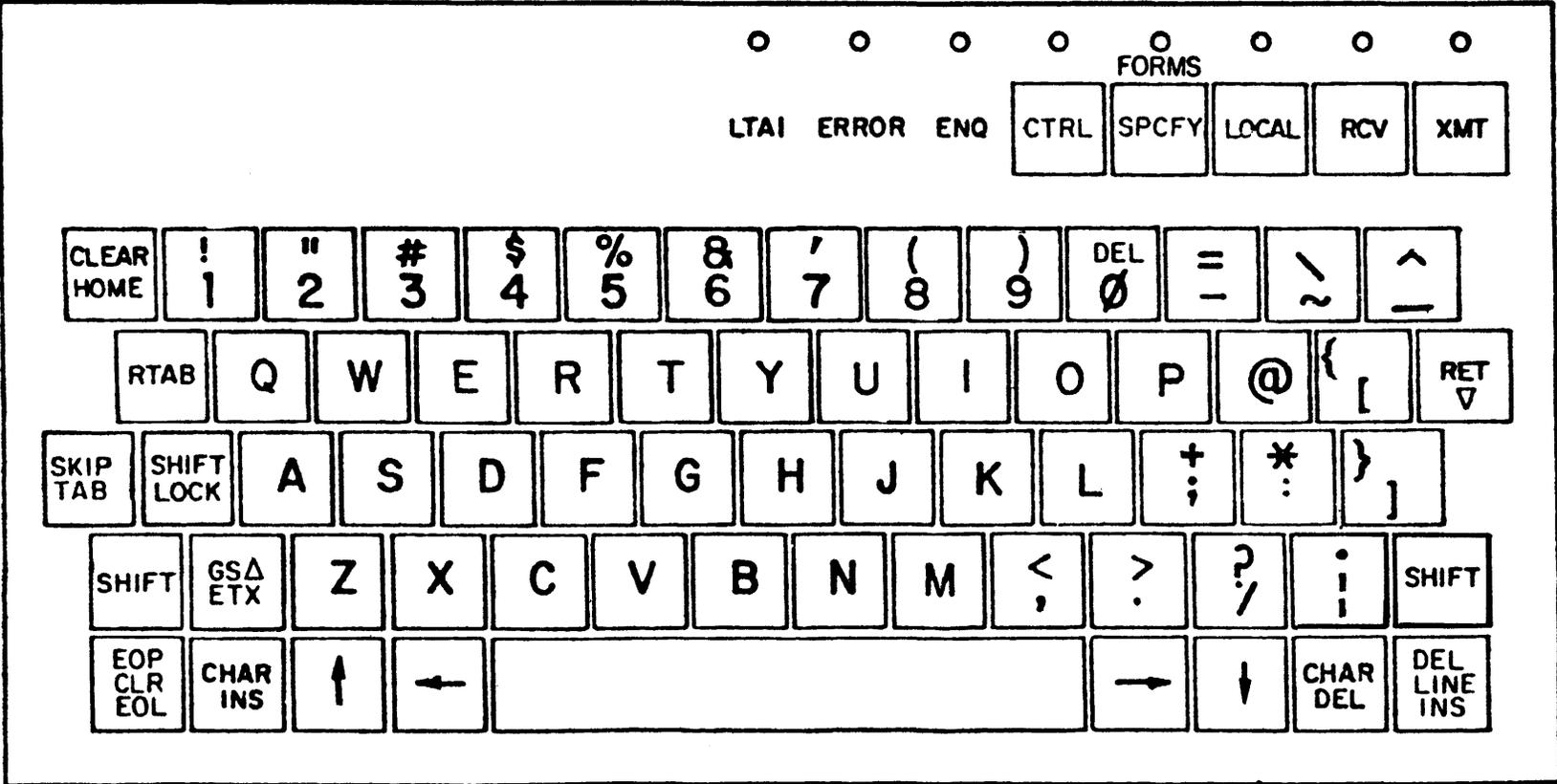
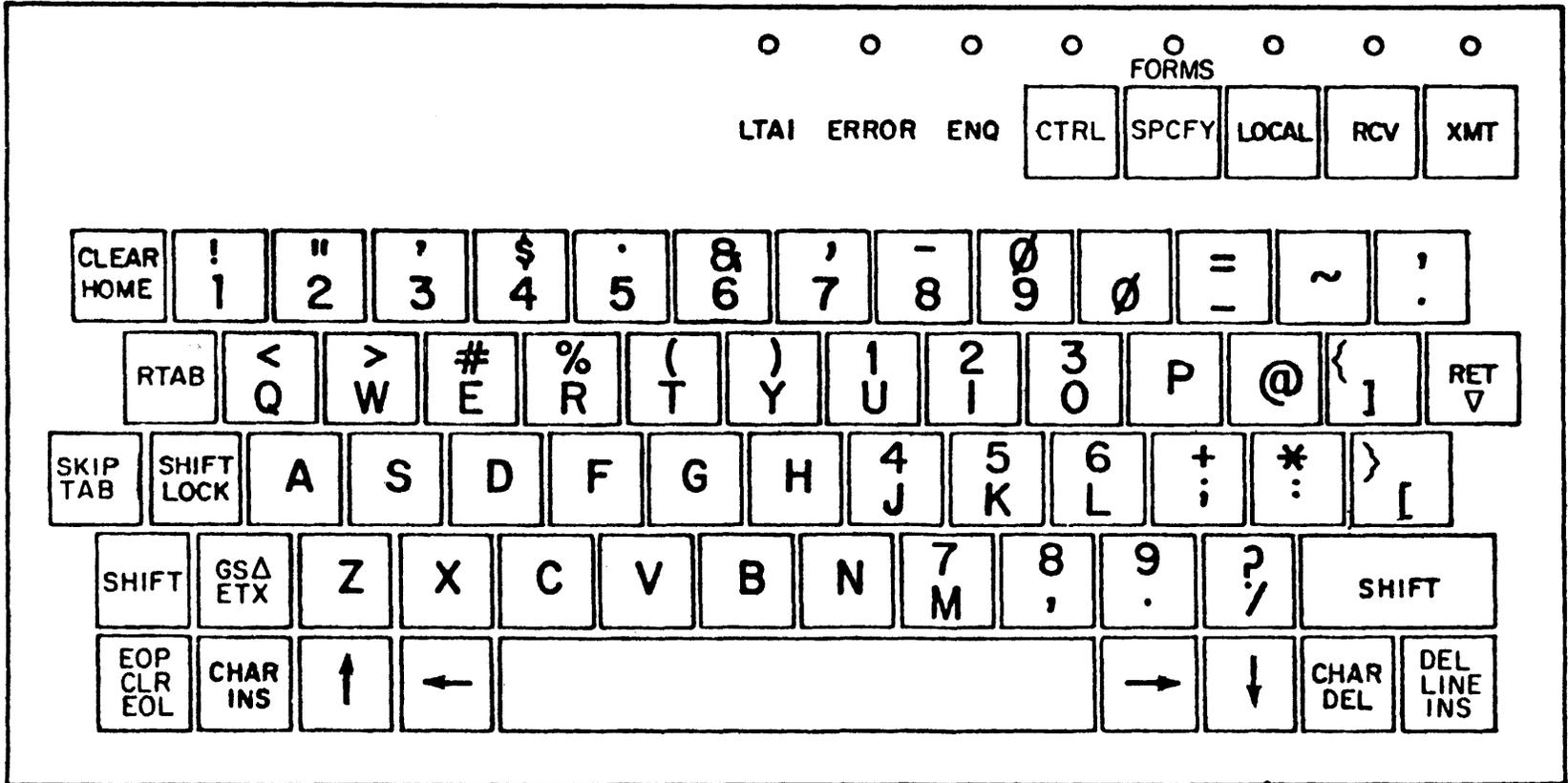


Figure 4-2. Data Preparation Keyboard



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).

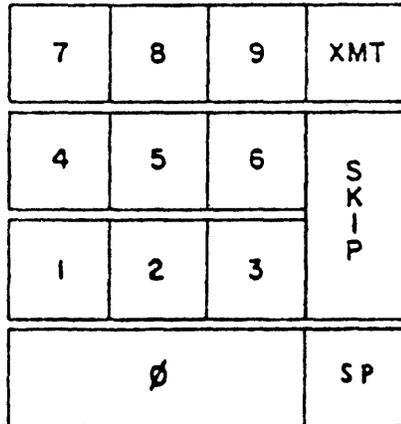


Figure 4-3. 10-Key Auxiliary Keyboard

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 control keys 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 continues with all unprotected and transmittable protected data up to but not including the position of the cursor. Pressing the XMT key 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.

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 from the 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 places the terminal in the Local mode of operation and lights the LOCAL indicator.

SPCFY - SPECIFY KEY.

The SPCFY (specify) key puts the terminal in the 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 places the terminal in the 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 the Control mode.

INDICATORS.

The indicators show the status (or mode of operation) 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 the XMT or SPCFY key is pressed. The XMT indicator goes out when a transmission from the terminal has been positively acknowledged by the central system or when the terminal is switched to the local mode.

RCV - RECEIVE MODE INDICATOR.

The RCV indicator 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 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 the 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 the 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 receives either a CTRL W or An ESC W control. CTRL Q or ESC X causes the FORMS indicator to go out.

CTRL - CONTROL MODE INDICATOR.

The lighted CTRL mode indicator shows that the terminal is in the Control mode. The CTRL indicator lights when the CTRL key is activated. The CTRL indicator 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 the Receive mode. The ENQ indicator goes out when the terminal is placed in the Receive mode or when the operator presses the LOCAL key. The audible alarm sounds when the ENQ indicator lights to alert the operator.

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

FUNCTION KEYS (KEYBOARD SYMBOL).

Function keys are designed to perform the following:

AUTOMATIC KEY REPEAT (ALL NONCONTROL KEYS).

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 causes the cursor to be moved 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 causes the cursor to be moved to the first position on the next line of the page. If the cursor is at the last position 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 the 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 moves the cursor to the home position. In the 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 causes both Home and clear functions. 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 causes the cursor to move 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 the 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 the SKIP key 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. The SKIP function 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 causes the cursor to move 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 position 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 are lost. This function is inhibited in Forms mode.

The shifted LINE INS/DEL key causes the erasure of the line in which the cursor is positioned and all data in the lines below are moved up one line. This function is inhibited in Forms mode.

END-OF-TEXT/GROUP SEPARATOR (ETX/GS△).

The unshifted ETX/GS△ key causes the X symbol to be written into memory and onto the screen if enabled by Burroughs. The X symbol (ASCII 0,3) is interpreted as the end-of-text character. Pressing the ETX key automatically moves the cursor to the home position.

The shifted ETX/GS Δ key enters the Δ symbol into memory and onto the screen. With Forms mode enabled, this Δ 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 character 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 (\triangleright) 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 \triangleright . 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 option, 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 \triangleleft . 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 transmittible protected data field.

CHARACTER INSERT (CHAR INS).

Pressing the CHAR INS key places the terminal into the 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 by line. 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 cursor location, but the data are moved from left to right. Spaces are inserted at the opening delimiter of the right-justified field.

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

KEYBOARD SECURITY LOCK.

A security lock is optionally provided with each keyboard (figure 4-4). 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 the Receive or Local modes.

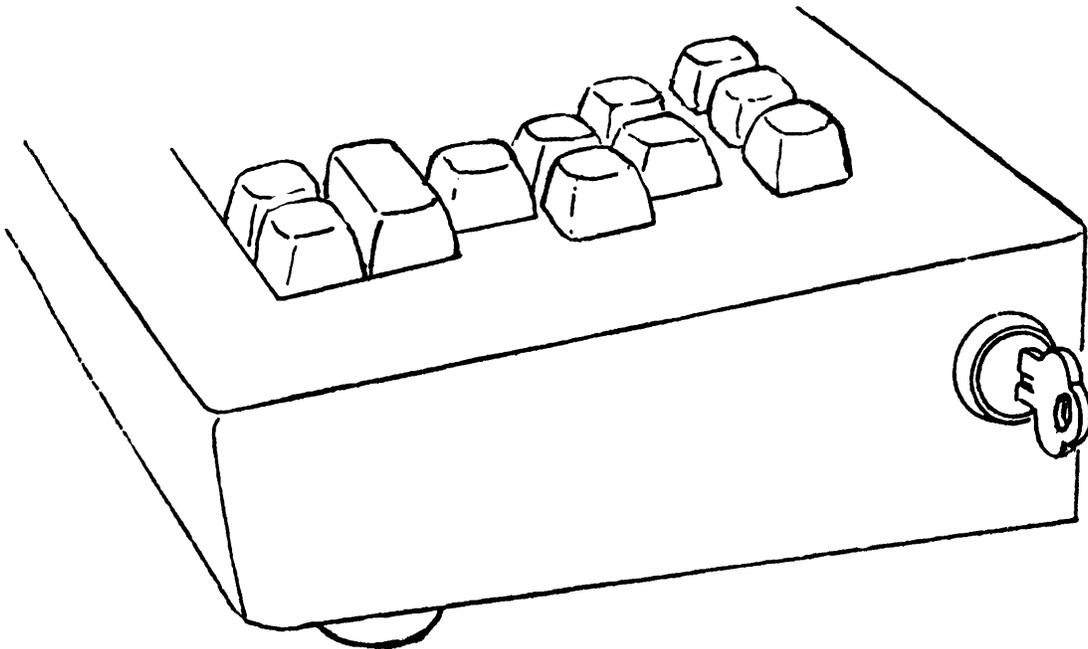


Figure 4-4. Keyboard Security Lock

SECTION 5

MAGNETIC CARD READER

GENERAL DESCRIPTION.

The peripheral capable terminal has an I/O interface for the connection of the TD 078-1 Magnetic Card Reader. The TD 078-1 Magnetic Card Reader is a separately contained unit which accepts magnetic cards conforming to American Banking Association (ABA) standards.

The TD 078-1 Magnetic Card Reader may be interfaced to any peripheral capable system utilizing either the TD 015-A or the TD 016 keyboard. This reader has its own cable and may be located up to 10 feet from the TD (figure 5-1).

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

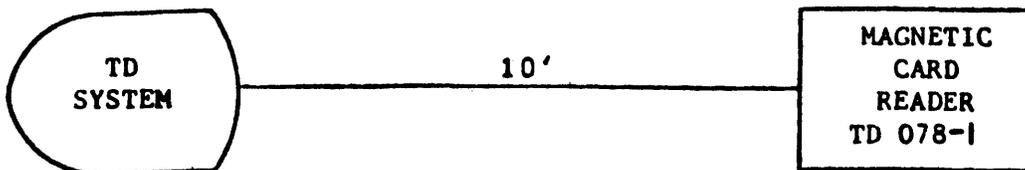


Figure 5-1. TD/MCR Configuration

MCR FUNCTION.

The function of the MCR is to read the ABA stripe of a magnetic card, to detect read errors, and to forward MCR data to the 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 are not displayed; the terminal is automatically placed in the Transmit mode and the magnetic card data in the terminal memory are 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 are read into the terminal memory and are 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.

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,

- a. The terminal must be in either Local or Receive mode.
- b. A magnetic card must be inserted, which lights the READ key on the MCR.

- c. 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 the 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 II.

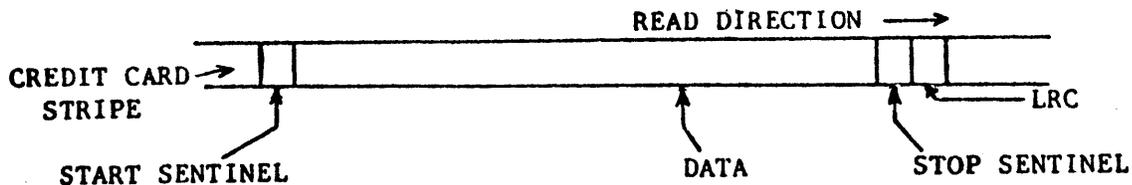


Figure 5-2. ABA Magnetic Stripe Data Format

The start sentinel precedes the stripe data; the stop sentinel and the Longitudinal Redundancy Check (LRC) character follow the data.

The LRC character provides a check of the transfer of stripe data to the terminal. Before the data are transferred to the 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.

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)
	<u>40</u> , 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, A 9249, TC 4001, and B 9354-6. The first two printers may be shared by several TD terminals. The B 9354-6 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. The print commands, A 9249 line printer, and TC 4001 serial printer, and B 9354-6 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 is to print the whole page from home to cursor position. This operation is performed in either Forms or Non-forms mode. The second print operation is to print 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.

Table 6-1

Print Commands

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

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

The critical point to 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.

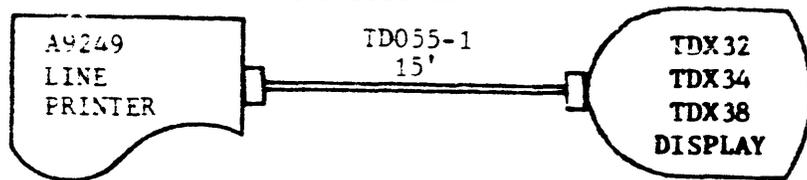
In the shared printer configuration, requests for print service during periods of printer activity are stored in a queue in the terminal peripheral interface. The queue allows print service to be supplied in the order of request. Furthermore, a terminal operator requesting printer service is able to 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.

A 9249 LINE PRINTER

The peripheral capable system may interface to one of three styles of A 9249 Line Printers. The three styles, A 9249-1, A 9249-2, and A 9249-3 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, A 9249 does not perform the LF function unless a CR (▽) is placed in TD memory.

The peripheral interface in each terminal permits print operations of an A 9249 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, 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. The maximum distance from the A 9249 to the last TD is 50 feet.

DEDICATED A9249 LINE PRINTER



SHARED A9249 LINE PRINTER

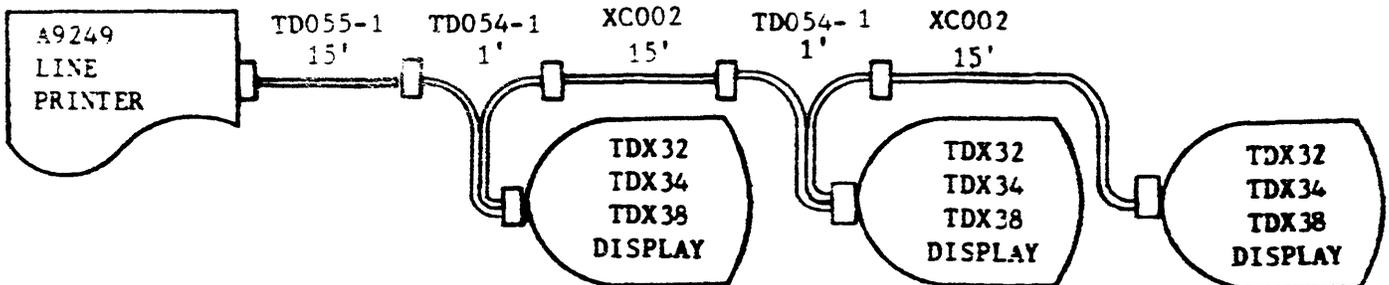


Figure 6-1. TD/A 9249 Configurations

SHARED OPERATION.

Up to three TD terminals may be concatenated to share one A 9249 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 status line.

The FORM FEED and LINE FEED push-buttons on the printer are active either if the STOP push-button on A 9249 has been pressed or if the PRINT push-button has not been pressed.

If the STOP push-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 A 9249 printer displays PRINTER ERROR on all terminals and cancels all print requests automatically.

Each terminal may cancel its request to print at any time by the pressing of the LOCAL key. The next print request from this terminal establishes it as 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 A 9249 printer either by the central system program to the terminal or through keyboard control. Two print commands (table 6-1) are available to the A 9249. 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 code 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 mode of printing.

TC 4001 SERIAL PRINTER.

The peripheral capable system provides an I/O interface for connection to the TC 4001 Serial Printer. The interface permits either the operation of a single terminal to a dedicated TC 4001 Printer, or the shared operations of up to 15 terminals to a TC 4001 Printer on a first-in/first-out basis. Typical dedicated and shared configurations are shown in figure 6-2. Burroughs enables the TC 4001 at the 300 bps per second printer rate.

The TC 4001 requires:

- XA 177 TD Interface kit.
- A 6400-1 Transmission speed of 300 bits per second.
- A 6410-1 Teletype async firmware.
- A 6411-1 Forms compose option.
- A 6420-1 Data comm controller.

The TC 4001 prints up to 30 characters per second in this system. The Interface is a modified Burroughs Direct Interface (BDI). The TC 4001 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 TC 4001 printer to the last terminal is up to 765 feet when fifteen terminals are shared.

DEDICATED TC4001 SERIAL PRINTER

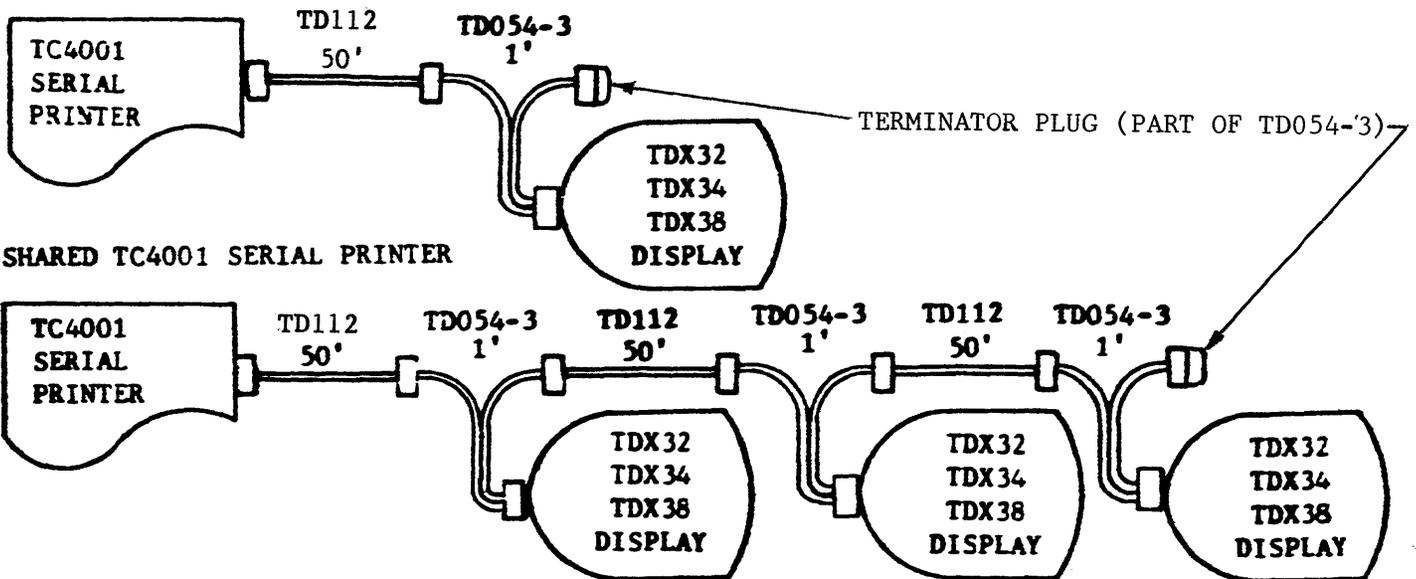


Figure 6-2. TD/TC 4001 Configurations

The TC 4001 Serial Printer requires printer functions, such as margins, tab stops, etc., 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 can not 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 TC 4001 functions performed is provided (Table 6-2).

Each terminal may queue printer messages up to two levels. Message 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 are placed on another page of memory. The pages are programmatically connected through the terminal paging function.

Table 6-2

TC 4001 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) reverse paper movement.
= CTRL =	= ESC =	Initiate carrier return to print position zero.

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

2 ESC =

which causes the TC 4001 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 the CTRL = sequence causes the TC 4001 to perform the same function as the 2 ESC = sequence.

Multiple TC 4001 functions may be performed with only a single program ESC = sequence or keyboard CTRL = sequence. For example,

280 ESC =
 or
280 CTRL =

causes the TC 4001 to perform

the above example function, to change the line feed mode to single-line or double-line paper feed, depending on previous setting, and to cancel the right margin stop.

DATA MESSAGES.

The data message is transmitted to the TC 4001 printer either by central system program control to the terminal or through keyboard control. Two print commands (table 6-4) are available to the TC 4001. ■

The data message to the printer may contain certain positional/format control characters. The terminal translates these characters into codes which cause the printer to perform the required positional/format action. Table 6-3 provides a list of these characters, and the function performed.

Table 6-3

TC 4001 Positional/Format
Control Characters

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

The positional/format control characters given in the above table 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 the total displayed data in the Forms mode. When the terminal has been instructed by the central system to print only unprotected data in the Forms mode (ESC :), the control characters in the above table cause the printer to react only when characters are detected in an unprotected field. Also, while under instruction to print only unprotected data, the I/O interface scans all characters prior to a US (▷) or GS (△) character without sending them to the printer. The data following US or GS are printed 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 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 6-4

TC 4001 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.

B 9354-6 PRINTER.

This printer is dedicated to one terminal, see figure 6-3. The B 9354-6 printer operates at 10 characters per second (110bps). Burroughs adjusts the terminal for either 20mA or 60mA current loop operation, depending on the printer requirements.



Figure 6-3. TD/B 9354-6 Printer Configuration

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 transmitted to the printer when a CR character is written into the display of the page written to the printer.

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 A 9490-25 cassette drives. This section describes cassette controller configurations and operational considerations.

CASSETTE CONTROLLER CONFIGURATIONS.

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

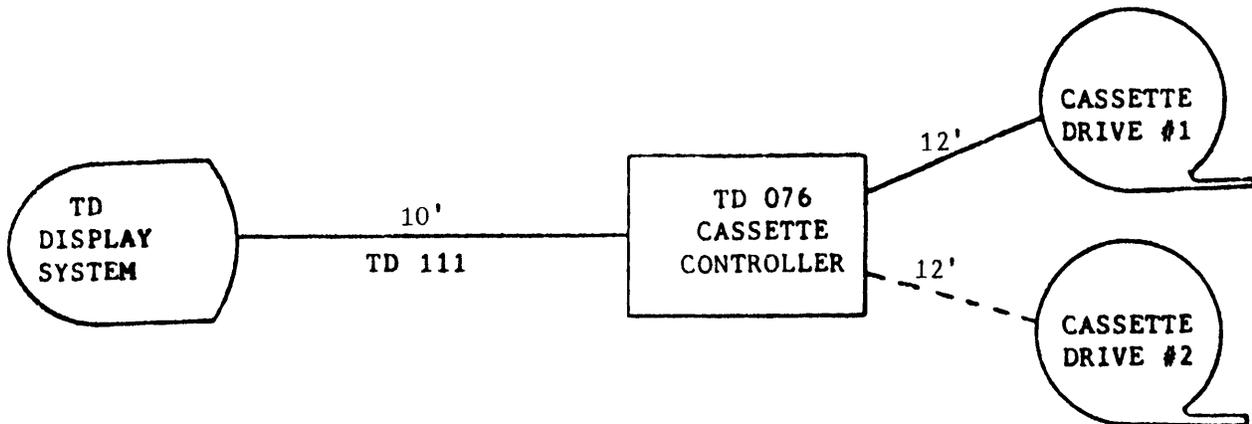


Figure 7-1. Single TD/Cassette Controller Configuration

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 one or two cassette drives dedicated to one terminal cannot be accessed by the second terminal.

The third TD/cassette configuration uses the cassette controller with up to four TD terminals. This configuration allows up to four cassette drives. Each cassette 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 provides the power to the cassette drives.

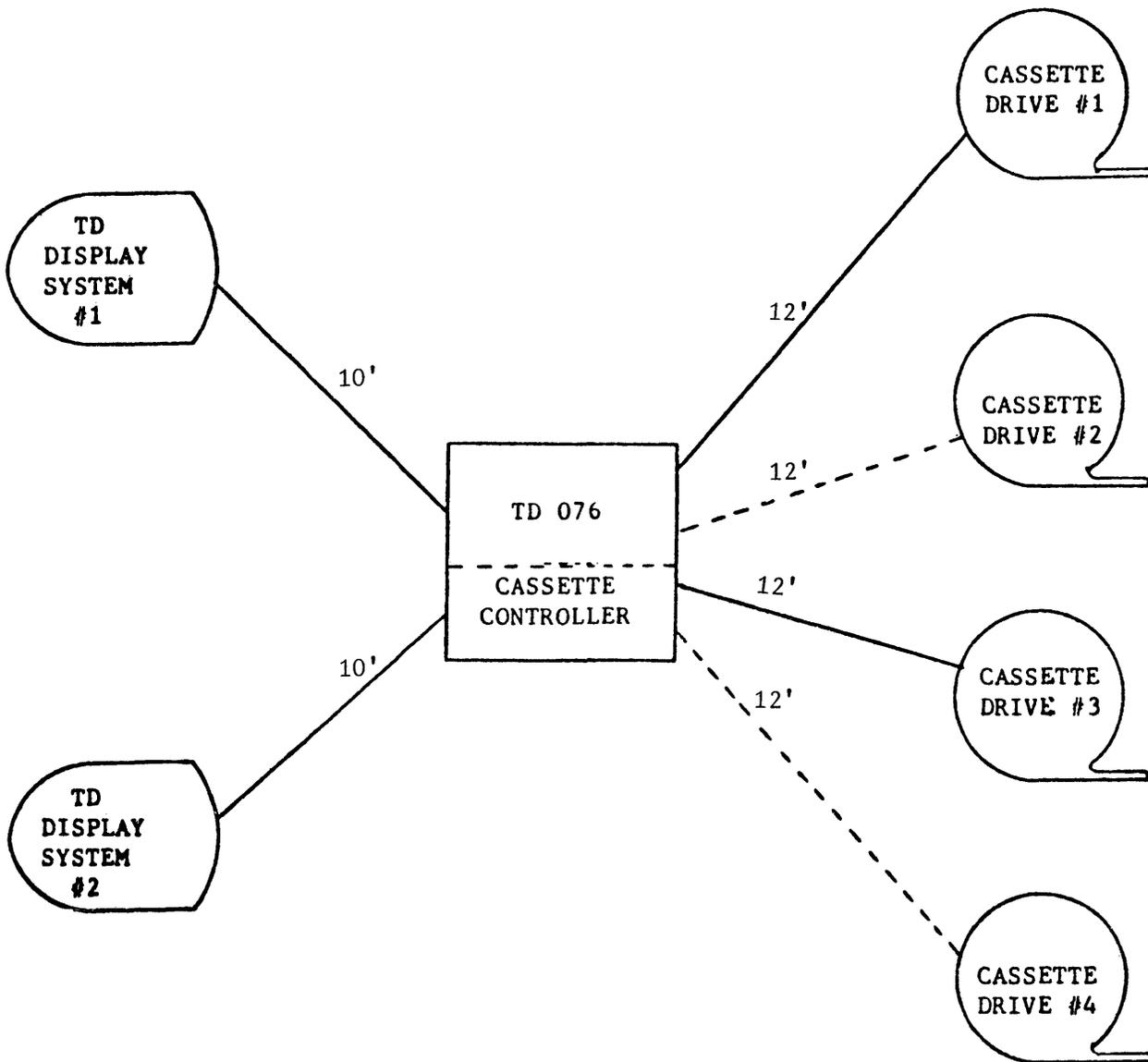


Figure 7-2. Two TD/Cassette Configuration

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

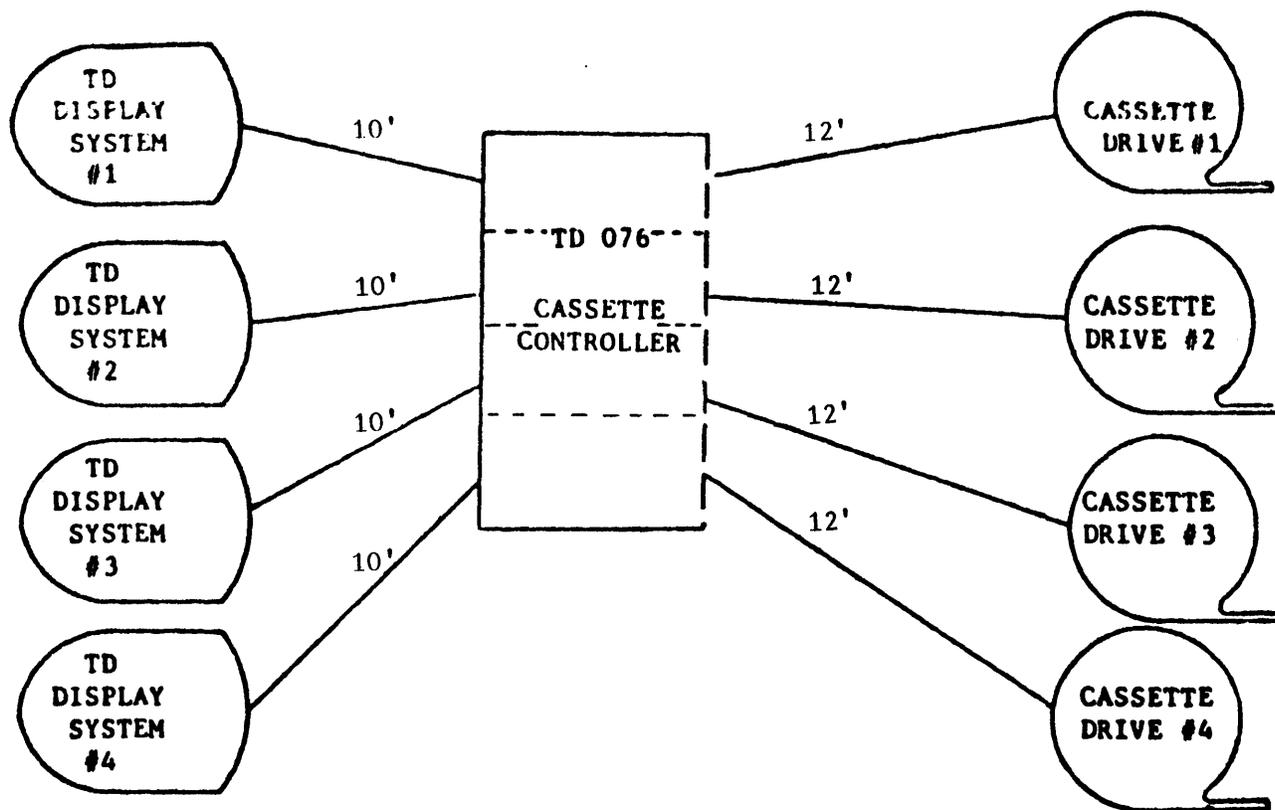


Figure 7-3. Four TD/Cassette Configuration

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.

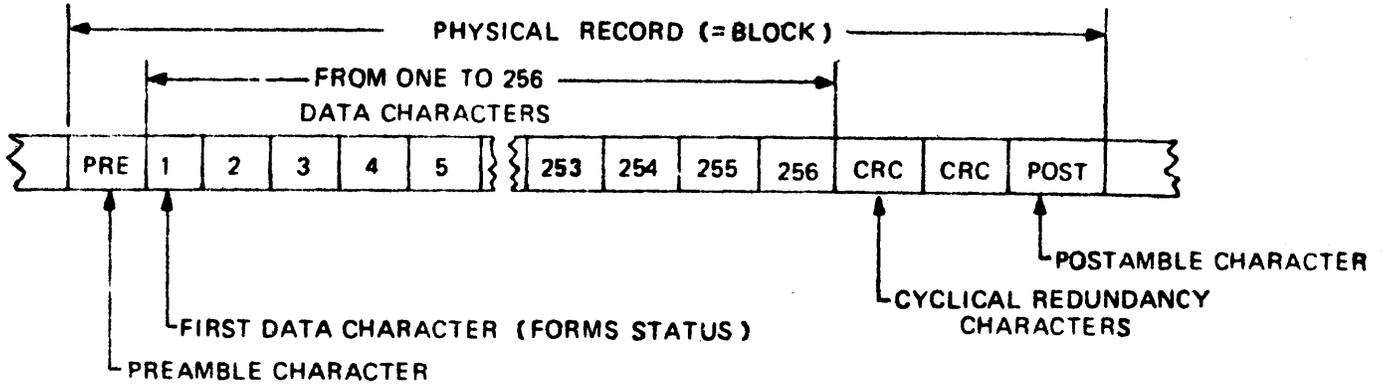
The following paragraphs describe the operation of the magnetic tape cassette with the peripheral capable terminal. Figure 7-4 identifies cassette tape formats.

MODES OF OPERATION.

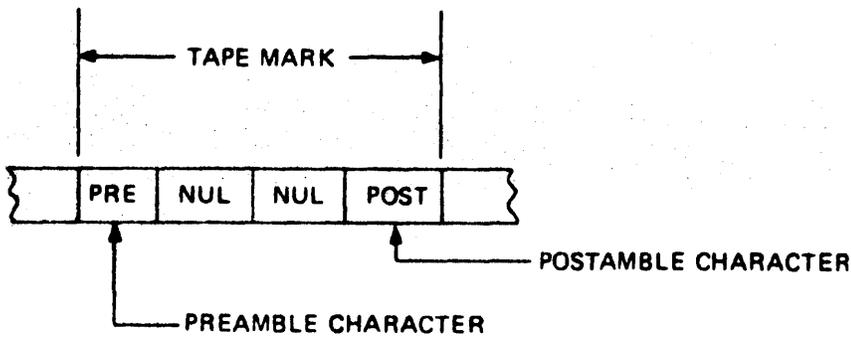
The cassette controller may be operated either locally by an operator through the terminal keyboard, or remotely by a central system. It operates in the following basic modes:

- a. Read - 10 inches per second.
- b. Write - 10 inches per second.
- c. Backspace - 10 inches per second.
- d. Search Forward/Reverse - 30 inches per second.
- e. Rewind - 60 inches per second.

CASSETTE DATA RECORD FORMAT:



CASSETTE TAPE MARK FORMAT:



CASSETTE TAPE AND EXAMPLE FORMAT:

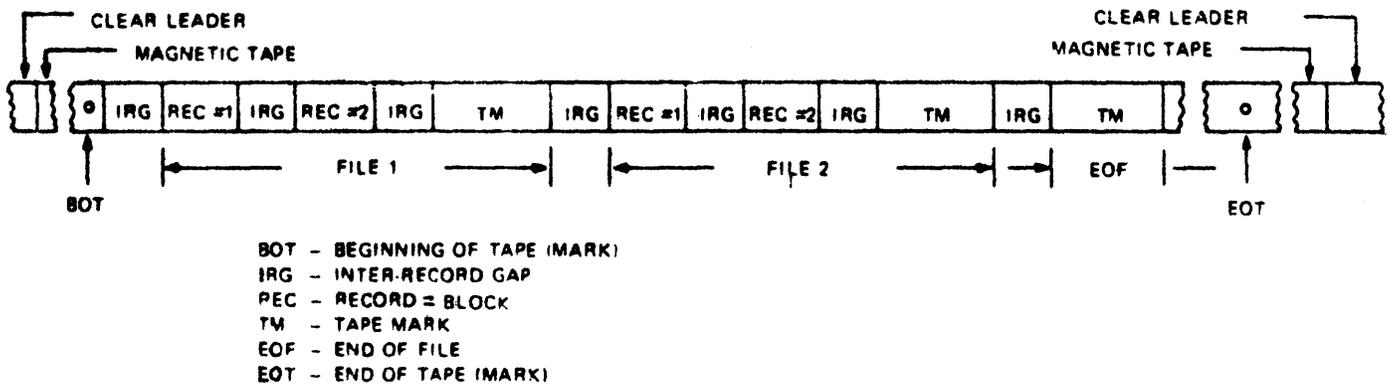


Figure 7-4. Cassette Tape Formats

COMMANDS.

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

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 3-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 dedicated drive.

WRITE MODES.

The following paragraphs 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 the Forms mode, the entire page is written to tape regardless of the cursor position. After positioning the cursor, the central system/operator issues the Write Data To Tape command. The cursor does not move during a Write Data To Tape command.

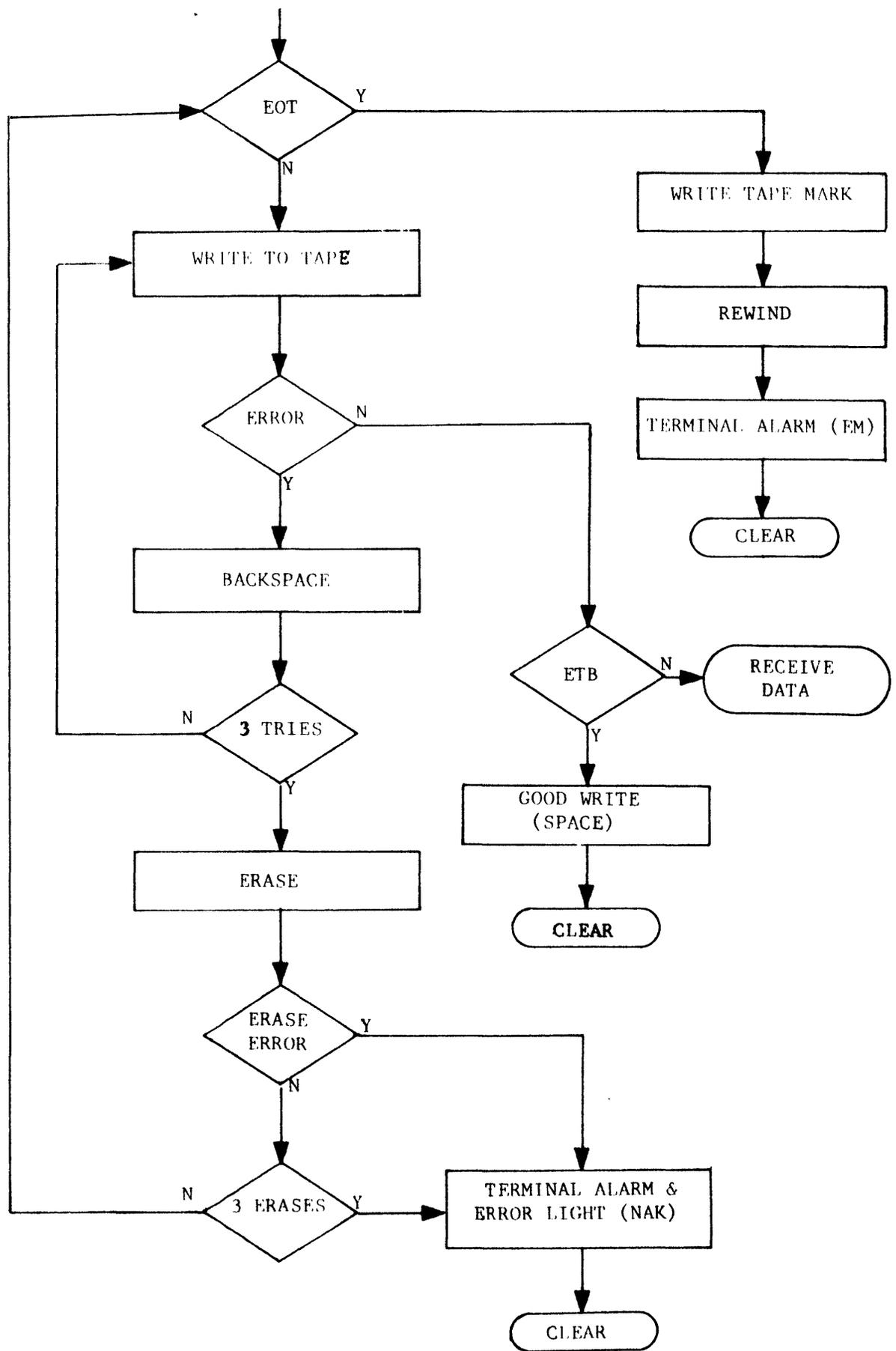


Figure 7-5. Write Flow

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 the 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 the 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. The controller 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 are 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 the Burroughs Information Recording Format (NRZI). All tape marks are checked for errors and a maximum of two retries are attempted.

READ MODES.

The following paragraphs 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.

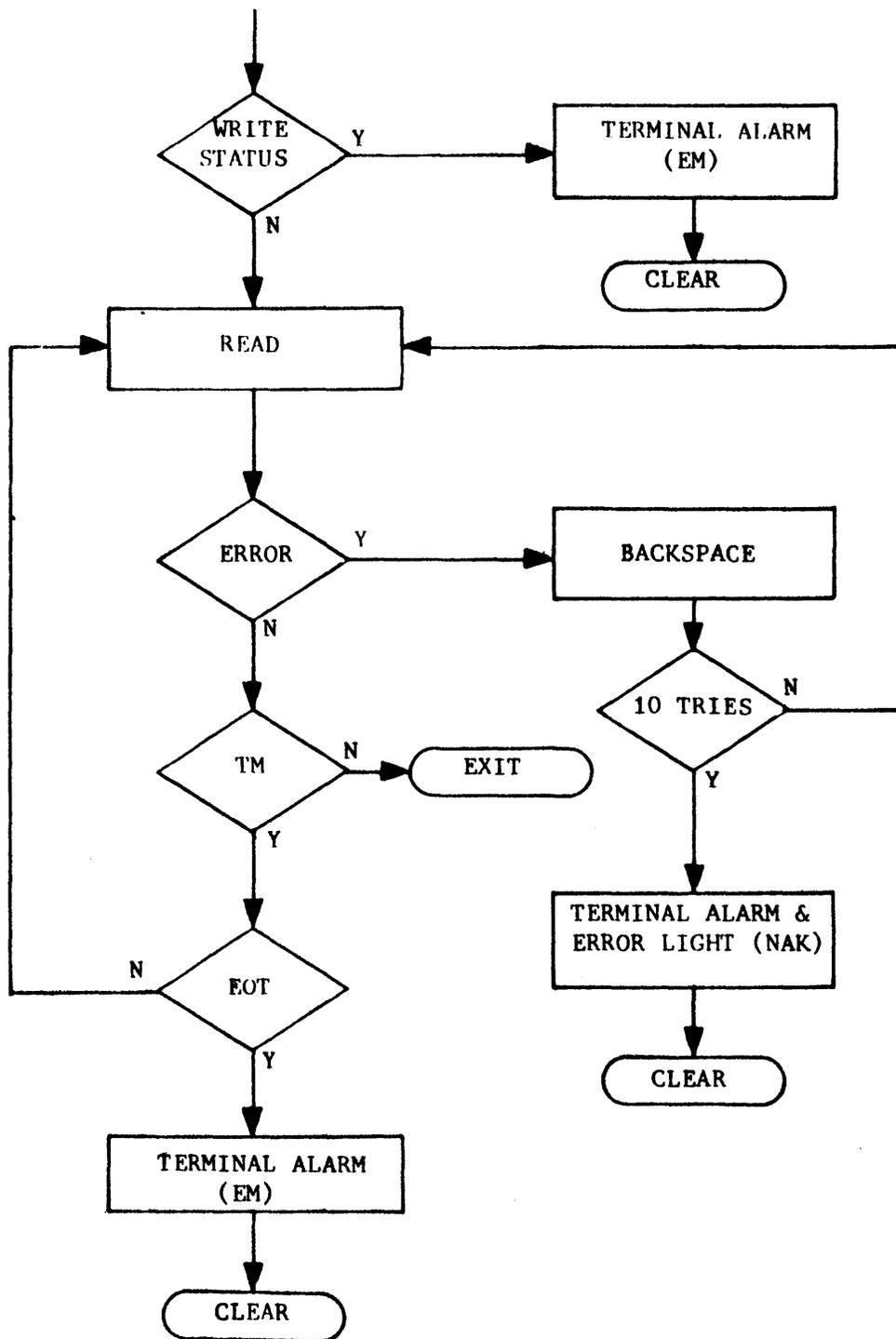


Figure 7-6. Read Flow

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.

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 status line. The controller resumes polling. Pressing the LOCAL key causes the ERROR indicator to go out.

READ PAGE FROM 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 character 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 the following addition: Upon completion of the Read Page, the terminal transmits the entire page to the central system. If the terminal is in the Forms mode, only unprotected data are 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 of Tape takes place offline. Rewinding is at 60 inches per second until the beginning of the clear leader is reached.

A rewind occurs if:

- a. The central system or the operator issues the command.
- b. EOT is sensed.
- c. Power is turned on.
- d. 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 as follows.

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:

- a. 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.
- b. Preamble/Postamble Check - since neither the preamble nor the postamble is included in the CRC check, each is checked individually for accuracy.
- c. Tape Mark Check - the tape mark character (16 consecutive zeros) is checked for accuracy.
- d. 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.
- e. Inter-record Gap (IRG) identification - lack of clock pulses for 3 milliseconds.

- f. Tape Mark Identification - preamble, 16 consecutive zeros, and postamble.

Operator Alerts.

The following operator alerts are provided:

- a. Two indicators are provided with each cassette drive:
 - 1) Write Status (WS) - lights when a cassette with write enable plugs is properly inserted.
 - 2) Ready Light (RL) - goes out when at end leader.
- b. Read/Write errors are 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.
- c. End-of-Tape (EOT) or an attempt to read while in a Write mode is indicated by the audible alarm of the terminal.

APPENDIX A
SYSTEM REGISTER OR
CONFIGURATION OPTIONS

This appendix covers:

- a. Program temporary options and
- b. Burroughs permanent options.

I. - APPLICATION PROGRAM TEMPORARY OPTIONS.

1. ADDRESS 0084 - LINES PER PAGE.

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

2. ADDRESS 0085 - CHARACTERS PER LINE.

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

3. ADDRESS 0093 - LINES PER DISPLAY.

Lines per Display	0093 Register Content	Address 0092 Bit 3	Remarks
12	0B	0 or 1	TD 730
12	0B	0	TD 830
24	17	1	TD 830

4. ADDRESS 0097 - END-OF-PAGE ALARM COLUMN.
(See table A-1 for Register Contents.)

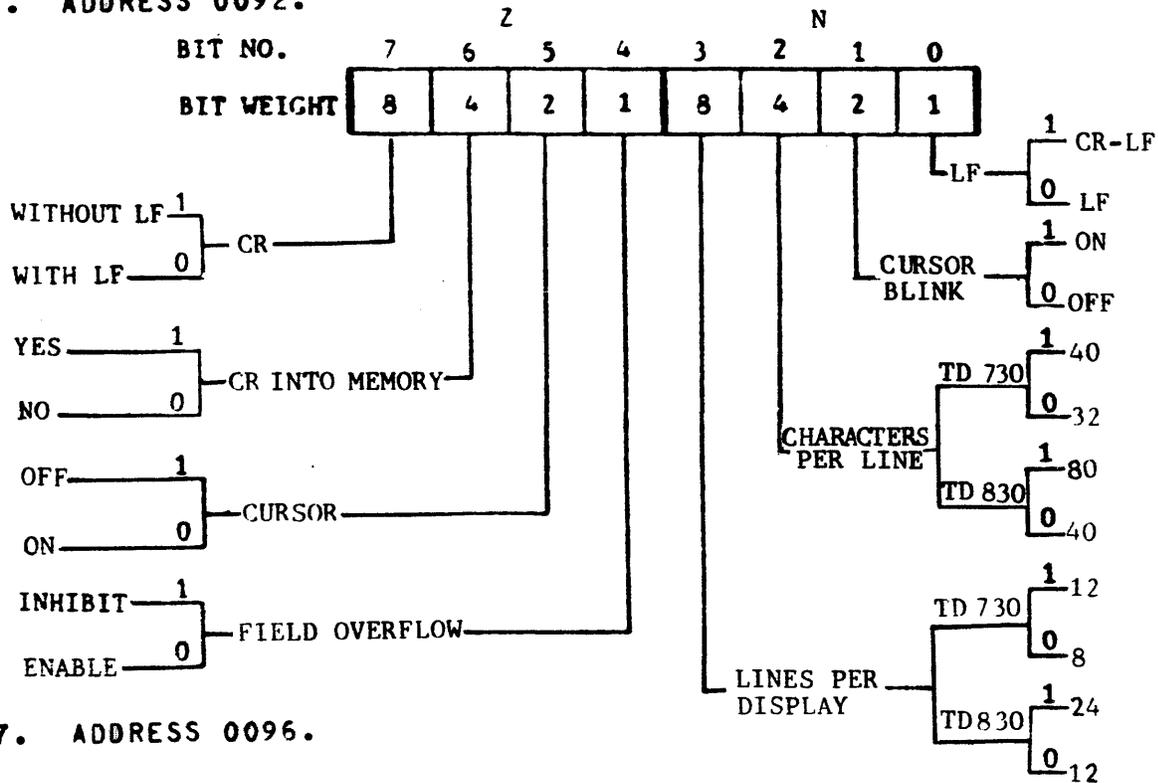
5. ADDRESS 0098 - END-OF-PAGE ALARM ROW.
(See table A-1 for Register contents.)

Table A-1

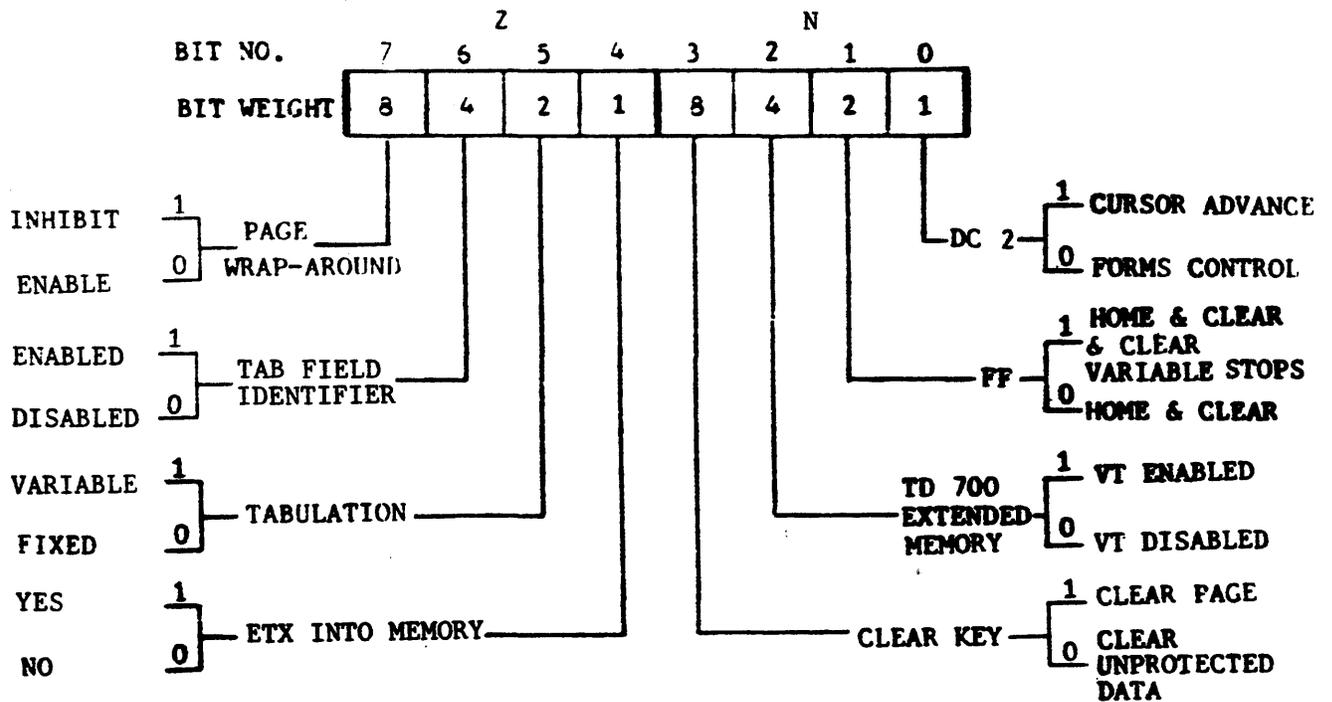
Position End-of-Page Alarm

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

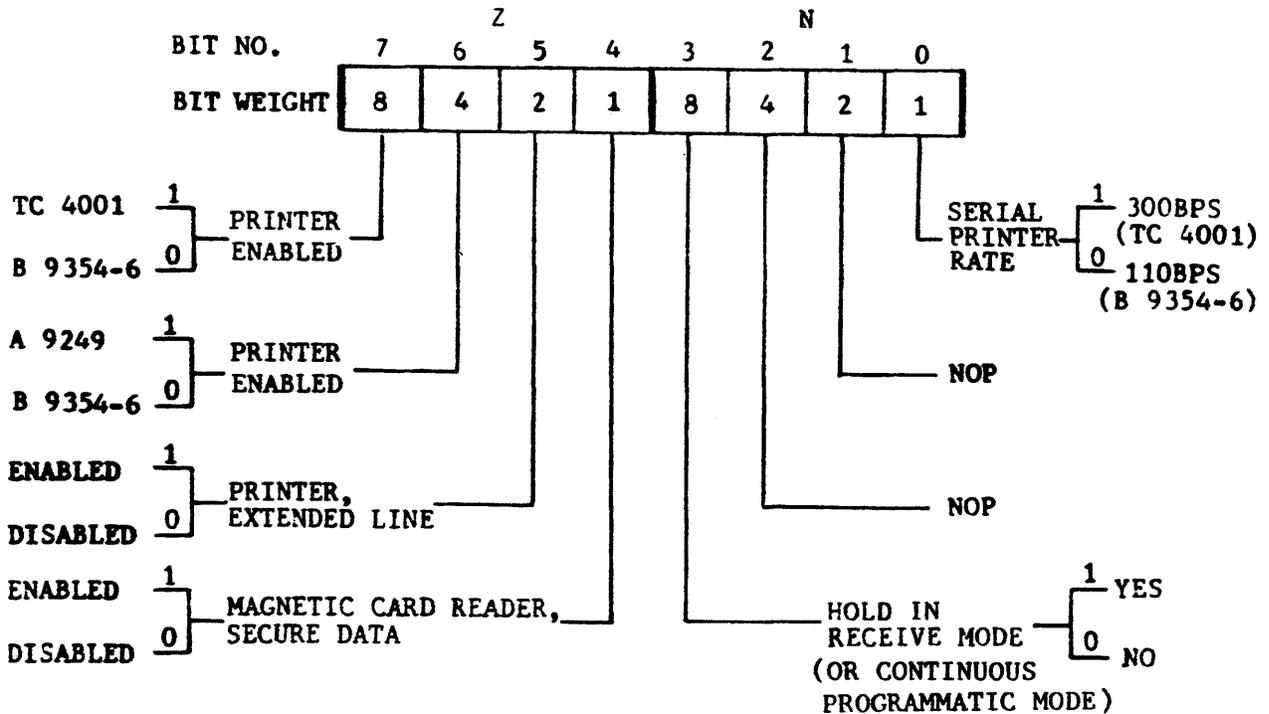
6. ADDRESS 0092.



7. ADDRESS 0096.



8. ADDRESS 0098. PERIPHERAL OPTIONS



9. SAMPLE SYSTEM REGISTERS CONFIGURATION.

Sample 31-byte system registers configuration for terminal is:

Address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
008_	02	E1	10	64	17	4F	5F	5E	10	31	41	7F	09	00	38	38
009_	00	2F	5E	17	4F	FF	60	48	17	40	00	40	04	00	0F	FF

- a. Address 009B has register content 40, which enables the A 9249 printer.
- b. Address 0096 has register content 60, which enables variable tabulation and the tab field identifier.
- c. Address 0092 has register content 5E: which writes CR into memory, inhibits field overflow, sets 24 lines/display, 80 characters/line and cursor blinking.
- d. Address 0084 has register content 17, which sets the lines per page to 24.

10. SAMPLE TEMPORARY SYSTEM REGISTER MESSAGES.

- a. To change the Lines/Page system register temporarily to 12, the central system program sends the following text message:

ESC RH 0084 01 0B ESC RC

- b. 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.

- c. To change temporarily 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, which is followed by 10b above. Note that the 0092 system register also affects other features, see 6 above.
- d. 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 10b above. Note that system register 0092 affects other features, see 6 above.

- e. In the TD 830, to enable temporarily the following:

4 lines/page
24 lines/display
40 characters/line
CR into memory
Cursor blink
Variable tabulation
ETX into memory
A 9249 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 RC

The terminal responds as in 10b above.

11. TO READ FROM THE 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 similar to 9 above.

II - BURROUGHS PERMANENT OPTIONS (FIELD ENGINEER).

NOTE: Options identified with * may be altered temporarily by the application program (I above).

- * 32/40 characters per line (TD 730 only)
- * 40/80 characters per line (TD 830 only)
- * Lines per page
 - 12 line display
- * 12/24 line display (TD 830 only)
 - Data Comm baud rate (up to 38,400bps)
 - Terminal address selection
 - Transmission number
 - Clear-to-send delay (up to 255ms)
 - Transmit-to-receive delay (up to 255ms)
 - Request-to-send delay (up to 265ms)
 - Multipoint/Point-to-point network
 - Point-to-point switched/leased line
 - Optional Poll/Select characters
 - Parity ignore
 - Data Comm line monitor enable/disable (temporary F.E. change)
 - Data Comm loop-back through firmware (temporary F.E. change only)
- * Continuous programmatic (hold in receive) mode
 - DC1 character interpretation (programmatic mode)
- * DC2 character interpretation
- * FF character interpretation
- * LF character interpretation
- * CR character interpretation
 - SDH clear screen
- * CR character, write into memory
- * ETX character, write into memory (variable data transmission)
- * Tab field identifier (→), enable (write into memory)
 - FORMS delimiters
- * CLEAR key interpretation in Forms mode
- * Field overflow inhibit
- * Page wrap-around inhibit
- * Fixed/Variable tabulation
- * Position end-of-page alarm
- * Cursor none/solid/blinking
- * Printer and printer extended line
- * Serial printer data rate
- * Magnetic card reader, secure data option
- * TD 700 extended memory environment
- * B 9348 (ODT) environment

APPENDIX B

TD 730/830 CHARACTERISTICS
- SUMMARY

TD 730 Characteristics

Characteristic	Statements
Dimensions (without keyboard)	9.4" (23.88cm) high, 15.5" (39.37cm) wide, 6.25" (15.88cm) 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 - 1800 bps Asynchronous, EIA RS232C 1200 - 9600 bps TDI (1000 ft.) Up to 38,400 bps BDI (15,000 ft.) 2400, 4800 or 9600 bps Synchronous, EIA RS232C
Display Memory	1920 (optional 4000) characters
Data comm buffer	1200 (optional 3000) characters
Status line	80 characters, displayable is two 40-character lines
Refresh rate	60 Hz or 50 Hz (input line frequency)
Relative humidity range	10 to 90 per cent
Heat generated	500 BTU/hr.
Operating environment	40 to 122 degrees F (5 to 50 degrees C)
Nonoperating environment (e.g., 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

<u>Characteristic</u>	<u>Statement</u>
Dimensions (without keyboard)	15.0" (38.1cm) high, 16.1" (40.8cm) wide, 13.0 (33.1cm) deep
Weight (w/o keyboard)	35 pounds (15.9 kilograms)
Display device	Cathode ray tube (12" CRT)
Display capacity	1920 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 1800 bps, EIA RS232C Asynchronous 2400, 4800, or 9600 bps, EIA RS232C Synchronous Up to 9600 bps TDI (1000 ft) Up to 38,400 bps BDI (15,000 ft)
Display memory	1920 (optional 4000) characters
Data comm buffer	1200 (optional 3000) characters
Status line	80 characters, displayed in 25th line
Display refresh rate	60 Hz or 50 Hz (input line frequency)
Input voltage range	100 to 240 volts ac to 50 or 60 Hz
Heat generated	500 BTU/hour
Relative humidity range	10 to 90 per cent
Operating environment	40 to 122 degrees F (5 to 50 degrees C)
Nonoperating environment (e.g., storage)	-40 to 158 degrees F (-40 to 70 degrees C)

APPENDIX A
SYSTEM REGISTER OR
CONFIGURATION OPTIONS

This appendix covers:

- a. Program temporary options and
- b. Burroughs permanent options.

I. APPLICATION PROGRAM TEMPORARY OPTIONS.

1. ADDRESS 0084 - LINES PER PAGE.

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

2. ADDRESS 0085 - CHARACTERS PER LINE.

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

3. ADDRESS 0093 - LINES PER DISPLAY.

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

4. ADDRESS 0097 - END-OF-PAGE ALARM COLUMN.
(See table A-1 for Register Contents.)

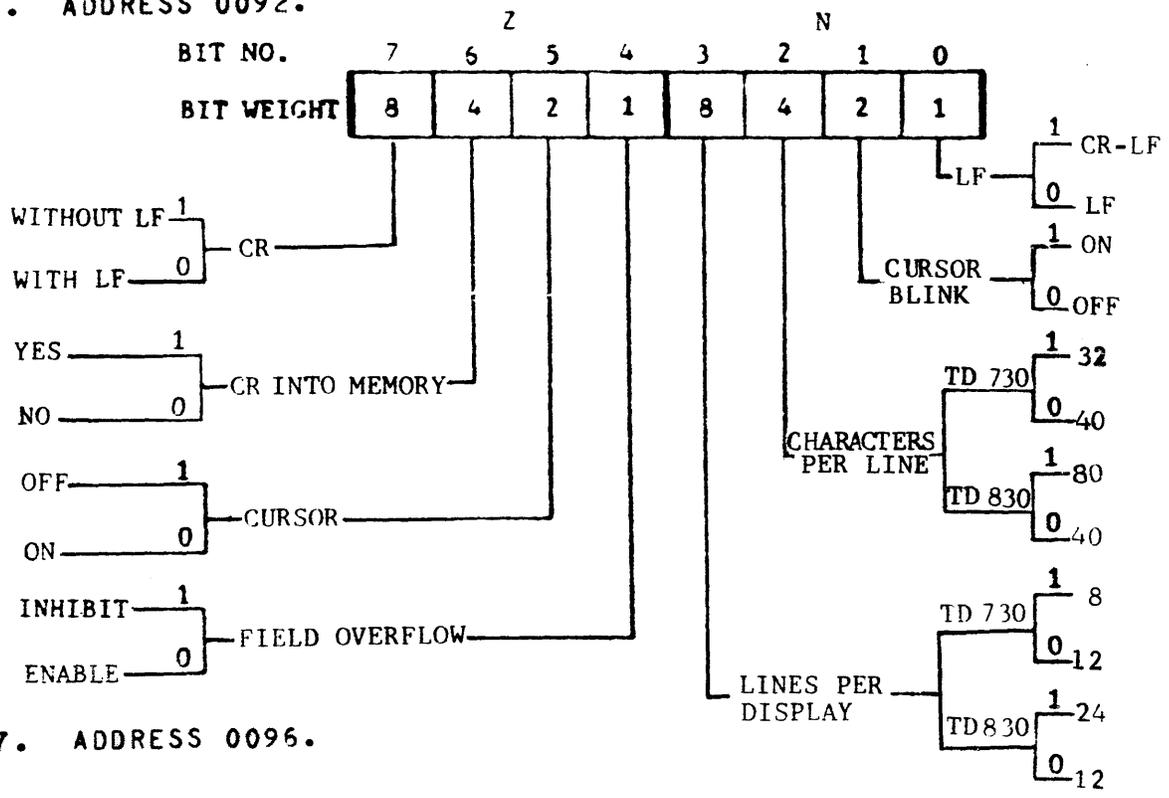
5. ADDRESS 0098 - END-OF-PAGE ALARM ROW.
(See table A-1 for Register contents.)

Table A-1

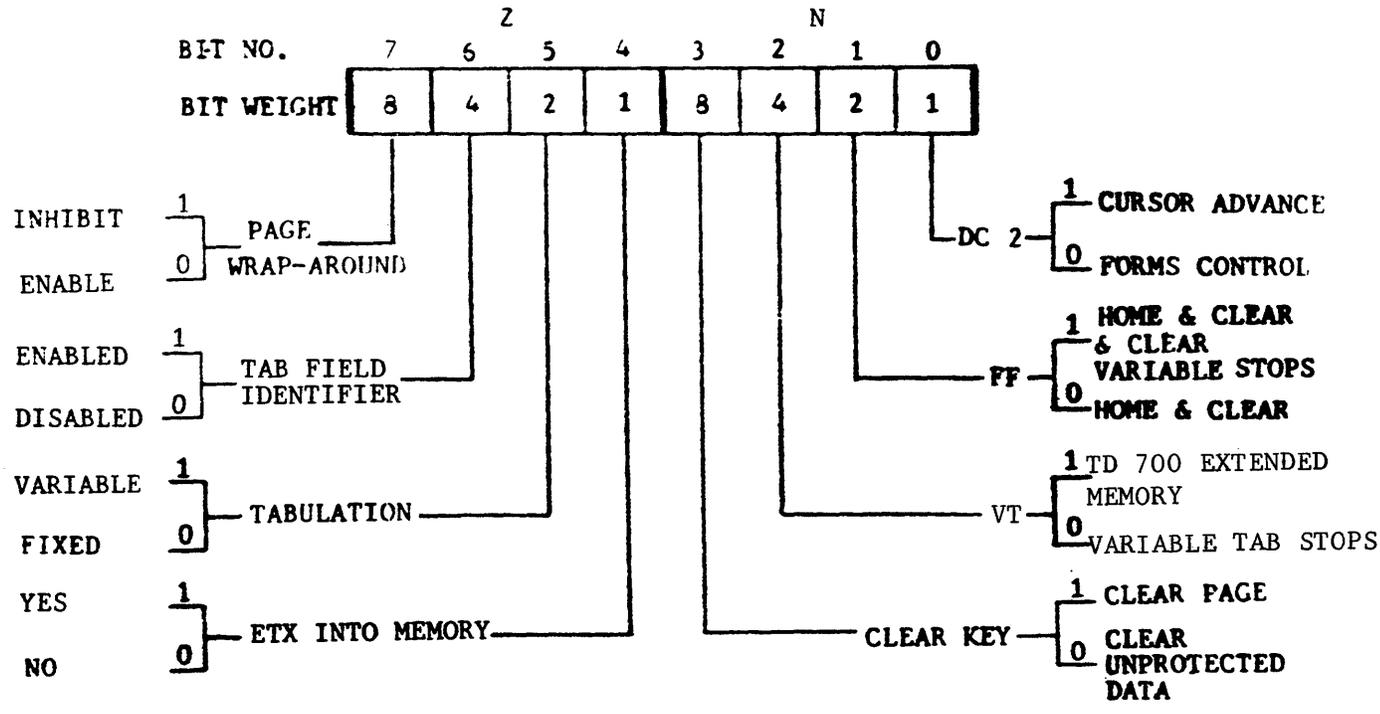
Position End-of-Page Alarm

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

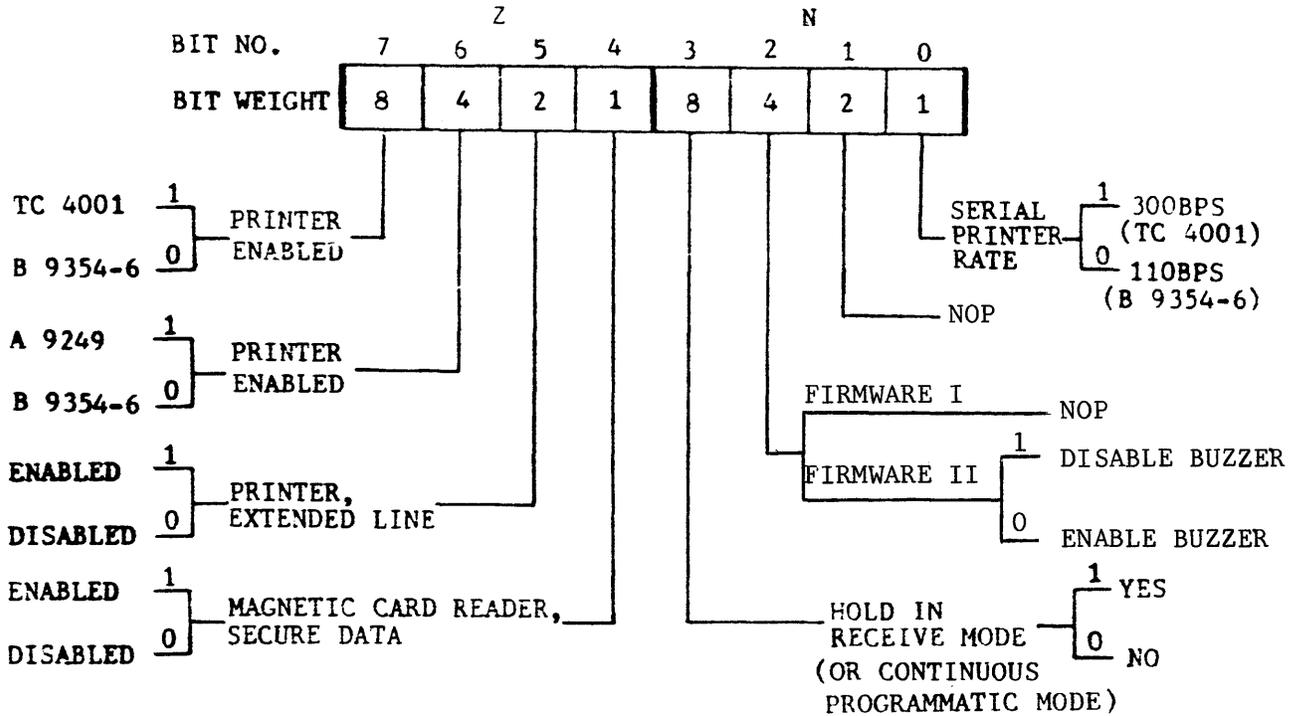
6. ADDRESS 0092.



7. ADDRESS 0096.



8. ADDRESS 009B. PERIPHERAL OPTIONS



9. SAMPLE SYSTEM REGISTERS CONFIGURATION.

Sample 32-byte system registers configuration for terminal is:

Address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
008_	02	E1	10	64	17	4F	5F	5E	10	31	41	7F	09	00	38	38
009_	00	2F	5E	17	4F	FF	60	48	17	40	00	40	04	00	0F	FF

- a. Address 009B has register content 40, which enables the A 9249 printer.
- b. Address 0096 has register content 60, which enables variable tabulation and the tab field identifier.
- c. Address 0092 has register content 5E: which writes CR into memory, inhibits field overflow, sets 24 lines/display, 80 characters/line and cursor blinking.
- d. Address 0084 has register content 17, which sets the lines per page to 24.

10. SAMPLE TEMPORARY SYSTEM REGISTER MESSAGES.

- a. To change the Lines/Page system register temporarily to 12, the central system program sends the following text message:

ESC RH 0084 01 0B ESC RC

- b. 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.

- c. To change temporarily 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, which is followed by 10b above. Note that the 0092 system register also affects other features, see 6 above.
- d. 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 10b above. Note that system register 0092 affects other features, see 6 above.

- e. In the TD 830, to enable temporarily the following:

4 lines/page
24 lines/display
40 characters/line
CR into memory
Cursor blink
Variable tabulation
ETX into memory
A 9249 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 RC

The terminal responds as in 10b above.

11. TO READ FROM THE 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 similar to 9 above.

II. BURBROUGHS PERMANENT OPTIONS (FIELD ENGINEER).

NOTE: Options identified with * may be altered temporarily by the application program (I above).

- * 8 by 32/12 by 40 screen format (TD 730 only)
- * 80/40 characters per line (TD 830 only)
- * Lines per page
- * 24/12 line display (TD 830 only)
- Data Comm baud rate (up to 38,400bps)
- Terminal address selection
- Transmission number
- Clear-to-send delay (up to 255ms)
- Transmit-to-receive delay (up to 255ms)
- Request-to-send delay (up to 265ms)
- Multipoint/Point-to-point network
- Point-to-point switched/leased line
- Optional Poll/Select characters
- Parity ignore
- Data Comm line monitor enable/disable (temporary F.E. change)
- Data Comm loop-back through firmware (temporary F.E. change) - FWII
- SOH clear screen
- * Continuous programmatic (hold in receive) mode
- DC1 character interpretation (programmatic mode)
- * DC2 character interpretation
- * FF character interpretation
- * LF character interpretation
- * CR character interpretation
- * VT character interpretation
- * CR character, write into memory
- * ETX character, write into memory (variable data transmission)
- * Tab field identifier (→), enable (write HT into memory from keyboard)
- FORMS delimiters
- * CLEAR key interpretation in Forms mode
- * Field overflow inhibit
- * Page wrap-around inhibit
- * Fixed/Variable tabulation
- * Position end-of-page alarm
- * Cursor none/solid/blinking
- * Printer and printer extended line
- * Serial printer data rate
- * Magnetic card reader, secure data option
- * TD 700 extended memory environment
- B 9348 (ODT) environment

APPENDIX B

TD 730/830 CHARACTERISTICS
- SUMMARY

TD 730 Characteristics

Characteristic	Statements
Dimensions (without keyboard)	9.4" (23.88 cm) high, 15.5" (39.37 cm) wide, 6.25" (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 - 1800 bps Asynchronous, EIA RS232C 1200 - 9600 bps TDI (1000 ft.) Up to 38,400 bps BDI (15,000 ft.) 2400, 4800 or 9600 bps Synchronous, EIA RS232C
Display Memory	1920 (optional 4000) characters
Data comm buffer	1200 (optional 3000) 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 per cent
Heat generated	500 BTU/hr.
Operating environment	40 to 122 degrees F (5 to 50 degrees C)
Nonoperating environment (e.g., 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" (38.1cm) high, 16.1" (40.8cm) wide, 13.0 (33.1cm) deep
Weight (w/o keyboard)	35 pounds (15.9 kilograms)
Display device	Cathode ray tube (12" CRT)
Display capacity	1920 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 1800 bps, EIA RS232C Asynchronous 2400, 4800, or 9600 bps, EIA RS232C Synchronous Up to 9600 bps TDI (1000 ft) Up to 38,400 bps BDI (15,000 ft)
Display memory	1920 (optional 4000) characters
Data comm buffer	1200 (optional 3000) characters
Status line	80 characters, displayed in 25th line
Display refresh rate	60 Hz or 50 Hz (input line frequency)
Input voltage range	100 to 240 volts ac to 50 or 60 Hz
Heat generated	500 BTU/hour
Relative humidity range	10 to 90 per cent
Operating environment	40 to 122 degrees F (5 to 50 degrees C)
Nonoperating environment (e.g., storage)	-40 to 158 degrees F (-40 to 70 degrees C)

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

					0	0	0	0	1	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	∅	Ⓚ	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

COLUMN ROW ↘	2	3	4	5
0	Sp	∅	@	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,	COL. 2,	COL. 4,	COL. 5,	COL. 5,	COL. 5,	COL. 2,
	ROW 3	ROW 4	ROW 0	ROW 11	ROW 12	ROW 13	ROW 1
FRANCE / BELGIUM		FR			l		
ITALY					ç		
SPAIN / LATIN AMER.	P _s				ñ		
UNITED KINGDOM	£				l		
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		i

Figure C-3. International Character Sets

LEAST SIGNIFICANT HEX CODE		MOST SIGNIFICANT HEX CODE															
		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 0	128 □	144 □	160 SPACE	176 0	192 @	208 P	224 \	240 P
1	1	SOM Γ	17 DCF 0	33 !	49 1	65 A	81 0	97 a	113 q	129 Γ	145 0	161 !	177 i	193 A	209 0	225 o	241 q
2	2	STX ↓	18 DC2 0	34 "	50 2	66 B	82 R	98 b	114 r	130 ↓	146 0	162 "	178 2	194 B	210 R	226 b	242 r
3	3	ETX X	19 DC3 0	35 #	51 3	67 C	83 S	99 c	115 s	131 X	147 0	163 #	179 3	195 C	211 S	227 c	243 s
4	4	EOT ↓	20 DC4 0	36 \$	52 4	68 D	84 T	100 d	116 t	132 ↓	148 0	164 \$	180 4	196 D	212 T	228 d	244 t
5	5	ENO □	21 NAK J	37 %	53 5	69 E	85 U	101 e	117 u	133 □	149 J	165 %	181 5	197 E	213 U	229 e	245 u
6	6	ACK ✓	22 SYN L	38 B	54 6	70 F	86 V	102 f	118 v	134 ✓	150 L	166 B	182 6	198 F	214 V	230 f	246 v
7	7	BEL □	23 ETB ↓	39 ,	55 7	71 G	87 W	103 g	119 w	135 □	151 ↓	167 ,	183 7	199 G	215 W	231 g	247 w
8	8	BS ↖	24 CAN X	40 (	56 8	72 H	88 X	104 h	120 x	136 ↖	152 X	168 (	184 8	200 H	216 X	232 h	248 x
9	9	HT →	25 EM †	41)	57 9	73 I	89 Y	105 i	121 y	137 →	153 †	169)	185 9	201 I	217 Y	233 i	249 y
A	10	LF ≡	26 SUB †	42 *	58 :	74 J	90 Z	106 j	122 z	138 ≡	154 †	170 *	186 :	202 J	218 Z	234 j	250 z
B	11	VT ↓	27 ESC 0	43 +	59 ;	75 K	91 [	107 k	123 {	139 ↓	155 0	171 +	187 ;	203 K	219 [	235 k	251 {
C	12	FF ↓	28 FS □	44 ,	60 <	76 L	92 \	108 l	124 !	140 ↓	156 □	172 ,	188 <	204 L	220 \	236 l	252 !
D	13	CR ▽	29 GS Δ	45 -	61 =	77 M	93]	109 m	125 }	141 ▽	157 Δ	173 -	189 =	205 M	221]	237 m	253 }
E	14	SO 0	30 RS ◁	46 .	62 >	78 N	94 ~	110 n	126 ~	142 0	158 ◁	174 .	190 >	206 N	222 ~	238 n	254 ~
F	15	SI 0	31 US ▷	47 /	63 ?	79 0	95 -	111 o	127 #	143 0	159 ▷	175 /	191 ?	207 0	223 -	239 o	255 #

Figure C-4. Standard ASCII Character Generator

APPENDIX D
LOCAL KEYBOARD CONTROL

Key Sequence	Function Description
CTRL } NNN (*2)	Search tape 1 for selected file
CTRL * NNN (*2)	Search tape 2 for selected file
CTRL # M (*3)	Read page from tape
CTRL \$ M (*3)	Read block from tape
CTRL % M (*3)	Read page from tape and transmit
CTRL & M (*3)	Read tape file and transmit
CTRL ' M (*3)	Write data to tape
CTRL (M (*3)	Write unprotected data to tape
CTRL) M (*3)	Backspace one tape record
CTRL \ M (*3)	Write tape mark
CTRL Δ M (*3)	Rewind
CTRL NN (*2)	Numeric control message
CTRL :	Print unprotected data
CTRL ;	Print whole page
CTRL < COLM ROW (*4)	Programmable cursor column/row
CTRL =	TC 4001 formatting (table 6-2)
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 (*5)	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 R	Configuration control
CTRL S	Disable search mode
CTRL T	Enable lower case
CTRL U	Negative video on (TD 830 only)
CTRL V	Line movement up
CTRL W	Forms enable
CTRL Y	Disable lower case
CTRL CTRL	Display status line (TD 730 only)
CTRL ↑	Scroll up
CTRL ↓	Scroll down

2 NNN - N is any No. where $0 \leq n \leq 9$. For special messages to remote controller or to access a certain data block on a tape cassette.

3 M identifies tape drive: 1 = tape drive 1, 2 = tape drive 2.

4 COLM and ROW are specified in table E.

5 CHAR - Insert the character for which the search is to be made.

APPENDIX D (cont)

Key Sequence	Function Description
CTRL →	Page advance
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 CTRL	Memory saturation test
CTRL space H CTRL	Data rate: 600bps
CTRL space J CTRL	Data rate: 1200bps
CTRL space K CTRL	Data rate: 2400bps if synchronous 1800bps if asynchronous

APPENDIX E

PROGRAM CONTROL (DATA COMM)

ESC Sequence	Function
ESC }	Character insert by line per character
ESC " COLM ROW (*4)	Programmable cursor, column/row
ESC #	Clear all variable tab stops
ESC \$ PAGE (*6)	Select page
ESC %	Character delete by line per character
ESC &	Align display cursor to data comm pointer
ESC (	Transmit page
ESC - CHAR (*5)	Set search character
ESC .	Set/reset tab stop
ESC :	Print unprotected data
ESC ;	Print whole page
ESC <	Line movement down
ESC =	TC 4001 formatting (Table 6-2)
ESC >	Line movement up
ESC ?	Sound audible alarm
ESC @	Character insert by page per character
ESC C	Space right
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	Lower case disable
ESC Z	Lower case enable
ESC * M (*3)	Read page from tape
ESC + M (*3)	Read tape file and transmit
ESC . M (*3)	Read page and transmit
ESC A M (*3)	Write tape mark
ESC B M (*3)	Backspace one tape block
ESC G M (*3)	Write data to tape

3 M identifies tape drive: 1 = tape drive 1, 2 = tape drive 2.

4 COLM and ROW are specified in table E.

5 CHAR - Insert the character for which the search is to be made.

6 PAGE - See table E.

ESC_Sequence	Function
ESC H M (*3)	Read block from tape
ESC I M (*3)	Rewind tape
ESC @ M (*3)	Write unprotected data to tape
ESC U NNN (*2)	Search tape drive 1 to selected file
ESC V NNN (*2)	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 RA031038 message	System message to status line, special message area
ESC RH0084010B } ESC RC	Temporary system register change to 12 lines/page

 2 NNN - N is any No. where $0 \leq n \leq 9$. For special messages to remote controller or to access a certain data block on a tape cassette.

3 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	USACII CODE	POSITION COLM/ ROW/ PAGE	GRAPHIC CHARACTER	USACII CODE	POSITION COLM/ ROW/ PAGE	GRAPHIC CHARACTER	USACII CODE
1	space	20	33	2	40	65	\	60
2	!	21	34	A	41	66	a	61
3	"	22	35	B	42	76	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 TEST
FAULT DIAGNOSIS

Test	Error_Code	Fatal	Reference
Alarm	None		Note 1
Keyboard Indicators	None		Note 2
RAM Addressing	ADaaaa	X	Note 3
RAM locations 0004-0FF0	Bnbbbb	X	Note 4
System ROM/PROM	CEcccc	X	Note 5
Keyboard PIA, side A	A10000		
Keyboard Char. Rdy. FF	CF0000		Note 6
Keyboard PIA, side B	A20000		
EAROM PIA	A30000		Note 7
Indicator PIA	A40000		
1 ms Clock	1C0000	X	
EAROM Data Line	EA0000		Note 7
EAROM Clock	EC0000		Note 7
EAROM CRC	000000		Note 7
Configuration Data	CDdddd		Note 8
Data Comm Buffer Memory	Bnbbbb		Note 4
Display RAM	Bnbbbb		Note 4
Device ROM	CEcccc		Note 5
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		Note 9
Data Comm Time Out	DC0082		Note 10
Data Comm ACIA	DC008C		Note 11
Device 1 ACIA	DC1000		Note 11
Device 2 PIA, side A	D2000A		
Device 2 PIA, side B	D2000B		
Device 2 ACIA	D2000C		Note 11
Device 3 PIA, side A	D3000A		
Device 3 PIA, side B	D3000B		

Notes

- NOTE 1: The alarm should sound momentarily following power up.
- NOTE 2: Verification of indicators is visual.
- NOTE 3: The RAM Addressing Test is done by shifting an all ones character (FF) through memory locations 0002 through 0FF0. If the FF character is found at any address other than the test location, aaaa identifies the incorrect address.
- NOTE 4: N = bad bit number, 0-7
bbbb = address of failure.
- NOTE 5: CE = CRC error
cccc = starting address of program which CRC Error.

APPENDIX F (cont)

- NOTE 6: If the Character Ready flip-flop does not reset, the displayed error code is followed with data appearing at the character repeat rate.
- NOTE 7: EAROM related errors force the terminal to operate with an assumed set of configuration data.
- NOTE 8: Some configuration registers are checked to insure that data entered do not cause the terminal to hang up. dddd identifies the incorrect configuration data.
- NOTE 9: The USRT is tested by looping the transmit data output back to the receive data input with data verification.
- NOTE 10: For synchronous data comm, a time out error indicates no external clock present.
- For asynchronous data comm, a time out error indicates a baud clock malfunction.
- NOTE 11: All ACIA's are tested by looping the transmit data output back to the ACIA receive data input with data verification.

APPENDIX D
LOCAL KEYBOARD CONTROL

Key_Sequence	Function_Description
CTRL ! NNN (*2)	Search tape 1 for selected file
CTRL " NNN (*2)	Search tape 2 for selected file
CTRL # M (*3)	Read page from tape
CTRL \$ M (*3)	Read block from tape
CTRL % M (*3)	Read page from tape and transmit
CTRL & M (*3)	Read tape file and transmit
CTRL ' M (*3)	Write data to tape
CTRL (M (*3)	Write unprotected data to tape
CTRL) M (*3)	Backspace one tape record
CTRL \ M (*3)	Write tape mark
CTRL ^ M (*3)	Rewind
CTRL NN (*2)	Numeric control message
CTRL :	Print unprotected data
CTRL ;	Print whole page
CTRL < COLM ROW (*4)	Programmable cursor column/row
CTRL =	TC 4001 formatting (table 6-2)
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 (*5)	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

2 NNN - N is any No. where $0 \leq n \leq 9$. For special messages to remote controller or to access a certain data block on a tape cassette.

3 M identifies tape drive: 1 = tape drive 1, 2 = tape drive 2.

4 COLM and ROW are specified in table E.

5 CHAR - Insert the character for which the search is to be made.

Key.Sequence	Function.Description
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 CTRL	Memory saturation test
CTRL space H CTRL	Data rate: 600bps
CTRL space J CTRL	Data rate: 1200bps
CTRL space K CTRL	Data rate: 2400bps if synchronous 1800bps if asynchronous

APPENDIX E

PROGRAM CONTROL (DATA COMM)

ESC Sequence	Function
ESC !	Character insert by line per character
ESC * COLM ROW (*4)	Programmable cursor, column/row
ESC #	Clear all variable tab stops
ESC \$ PAGE (*6)	Select page
ESC %	Character delete by line per character
ESC &	Align display cursor to data comm pointer
ESC (	Transmit page
ESC - CHAR (*5)	Set search character
ESC .	Set/reset tab stop
ESC :	Print unprotected data
ESC ;	Print whole page
ESC <	Line movement down
ESC =	TC 4001 formatting (Table 6-2)
ESC >	Line movement up
ESC ?	Sound audible alarm
ESC @	Character insert by page per character
ESC C	Space right
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 (*3)	Read page from tape
ESC + M (*3)	Read tape file and transmit
ESC . M (*3)	Read page and transmit
ESC A M (*3)	Write tape mark
ESC B M (*3)	Backspace one tape block
ESC G M (*3)	Write data to tape

 3 M identifies tape drive: 1 = tape drive 1, 2 = tape drive 2.

4 COLM and ROW are specified in table E.

5 CHAR - Insert the character for which the search is to be made.

6 PAGE - See table E.

ESC Sequence	Function
ESC H M (*3)	Read block from tape
ESC I M (*3)	Rewind tape
ESC Q M (*3)	Write unprotected data to tape
ESC U NNN (*2)	Search tape drive 1 to selected file
ESC V NNN (*2)	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}	Temporary system register change to 12 lines/page
ESC RC	

2 NNN - N is any No. where $0 \leq n \leq 9$. For special messages to remote controller or to access a certain data block on a tape cassette.

3 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	a	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 TEST
FAULT DIAGNOSIS

Test	Error Code	Fatal	Reference
Alarm	None		Note 1
Keyboard Indicators	None		Note 2
RAM Addressing	ADaaaa	X	Note 3
RAM Locations 0004-0FF0	Bnbbbb	X	Note 4
System ROM/PROM	CEcccc	X	Note 5
Keyboard PIA, side A	A10000		
Keyboard Char. Rdy. FF	CF0000		Note 6
Keyboard PIA, side B	A20000		
EAROM PIA	A30000		Note 7
Indicator PIA	A40000		
1 ms Clock	1C0000	X	
EAROM Data Line	EA0000		Note 7
EAROM Clock	EC0000		Note 7
EAROM CRC	000000		Note 7
Configuration Data	CDdddd		Note 8
Data Comm Buffer Memory	Bnbbbb		Note 4
Display RAM	Bnbbbb		Note 4
Device ROM	CEcccc		Note 5
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		Note 9
Data Comm Time Out	DC0082		Note 10
Data Comm ACIA	DC008C		Note 11
Device 1 ACIA	DC1000		Note 11
Device 2 PIA, side A	D2000A		
Device 2 PIA, side B	D2000B		
Device 2 ACIA	D2000C		Note 11
Device 3 PIA, side A	D3000A		
Device 3 PIA, side B	D3000B		

Notes

- NOTE 1: The alarm should sound momentarily following power up.
- NOTE 2: Verification of indicators is visual.
- NOTE 3: The RAM Addressing Test is done by shifting an all ones character (FF) through memory locations 0002 through 0FF0. If the FF character is found at any address other than the test location, AAAA identifies the incorrect address.
- NOTE 4: n = bad bit number, 0-7
bbbb = address of failure.
- NOTE 5: CE = CRC error
cccc = starting address of program which CRC Error.

- NOTE 6: If the Character Ready flip-flop does not reset, the displayed error code is followed with data appearing at the character repeat rate.
- NOTE 7: EARAM related errors force the terminal to operate with an assumed set of configuration data.
- NOTE 8: Some configuration registers are checked to insure that data entered do not cause the terminal to hang up. dddd identifies the incorrect configuration data.
- NOTE 9: The USRT is tested by looping the transmit data output back to the receive data input with data verification.
- NOTE 10: For synchronous data comm, a time out error indicates no external clock present.
- For asynchronous data comm, a time out error indicates a baud clock malfunction.
- NOTE 11: All ACIA's are tested by looping the transmit data output back to the ACIA receive data input with data verification.

