731-12 732-12 remote batch terminals



operating and programming guide



731-12 732-12 BATCH TERMINALS

OPERATING AND PROGRAMMING GUIDE

Sections in this Manual:

Section I — General Description

Section II — Operation

Section III —— Programming

Section IV —— Programming Aids

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731-12 732-12 REMOTE BATCH TERMINALS OPERATING AND PROGRAMMING GUIDE

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FOREWORD

This manual contains basic operating and programming information for the 731–12 Low Speed Remote Batch Terminal and the 732–12 Medium Speed Remote Batch Terminal. The information is directed toward the terminal operator and the computer programmer. Each should be familiar with this manual. Section II is operator information, while Sections III and IV are programmer oriented.

TABLE OF CONTENTS

Section		Page
I —	- GENERAL INFORMATION	
	Cathode-Ray-Tube Display Terminal Controller Keyboard Low Speed Line Printer Low Speed Card Reader Medium Speed Line Printer Medium Speed Card Reader Data Presentation Cperational Description Terminal Capabilities	1-2 1-2 1-2 1-3 1-3 1-3 1-4 1-5
II -	- OPERATION	
	Controller Operation Terminal Control Console Keyboard Display Operation Cursor Movement Format Control Transmission Control Terminal Power Supply Controller Power Microdrum Controller Cleaning Line Printer Station Operation Paper Loading Procedure Ribbon Changing 300 CPM Card Reader Operation Card Loading Procedure Off-Line Card Feeding On-Line Operation	2-1 2-4 2-7 2-7 2-8 2-9 2-10 2-11 2-12 2-12 2-13 2-15 2-17 2-17 2-18
	Correcting a Read Alert	2-18 2-18

TABLE OF CONTENTS (CONT)

Secti	on		Page
II	-	OPERATION	
		600 LPM Line Printer Station Operation	2-18
		Loading Procedure	2-19
		Changing the Ribbon	2-20
		500 CPM Card Reader Operation	2-22
		Clearing Card Jam	2-23
		Dark Check	2-24
		Cleaning	2-24
		Off Line Operations	2-25
		Display to Printer	2-25
		Card Reader to Printer	2-26
		On Line Operations	2-26
		General Instructions	2-27
III		PROGRAMMING	
		Functional Description	3-1
		Word Format	3-2
		Message Format	3-2
		Types of Messages	3-4
		Poll Message	3 - 5
		Alert Message	3-5
		Acknowledge Message	3-6
		Reject Message	3-6
		Read Message	3-7
		Write Message	3-9
		Error Message	3-12
		Code Repertoire	3-14
		Addresses	3-14
		Transmission Control	3-14
		Symbol Data	3-15
		Terminal Control Codes	3-17
		Display Instructions	3-17
		Backspace	3-17

82163400

TABLE OF CONTENTS (CONT)

Section	on —		Page
III		PROGRAMMING	
		New Line	3-17
		Line Skip	3-17
		Skip	3-17
		Reset	3-17
		Clear	3-17
		Start of Text	3-20
		El	3-20
		Line Printer Instructions	3-20
		Carriage Return	3-20
		End of Line	3-20
		E2	3-20
		E3	3-20
		Card Reader Instructions	3-21
		Read Binary	3-21
		End of File	3-21
		End of Record	3-21
		E2	3-21
		E3	3-21
I۷		PROGRAMMING AIDS	
		Message Responses	4-1
		Messages for Print	4-2
		Line Truncation	4-3
		Format Control	4-3
		Character Compression	4-5
		Card Read Sequence	4-5
		Redundant Responses	4-6
		Terminal Control Console Error Display	4-7
		Controlware Installation	4-11

LIST OF ILLUSTRATIONS

Section	Figure	Page
I —	GENERAL INFORMATION	
	1-2 Terminal Controller Keyboard and CRT Display 1-3 Low Speed Line Printer 1-4 Low Speed Card Reader 1-5 Medium Speed Line Printer 1-6 Medium Speed Card Reader 1-7 Symbol Formation 1-8 Display Presentation 1-9 Line Printer Sample	1-1 1-2 1-2 1-2 1-3 1-3 1-3 1-4
II —	OPERATION	
	2-2Terminal Control Console Switches22-3Terminal Control Console Indicators22-4Digital Display Readouts22-5Controller Keyboard22-6Display Intensity Control22-7Terminal Power Supply22-8Power Distribution Assembly22-9Terminal Controller Microdrum22-10Line Printer Control Panel22-11Tractor Flap22-12Paper Scale22-13Vertical Positioning Knob22-14Ribbon Arrangement22-15Ribbon Changing22-15Card Reader Controls22-17600 LPM Line Printer Controls22-18500 CPM Card Reader Controls2	2-1 2-2 2-3 2-4 2-6 2-10 2-11 2-12 2-13 2-14 2-14 2-14 2-15 2-16 2-18 2-22 2-23

LIST OF ILLUSTRATIONS

Section	Figure		Page
III	 PROG	RAMMING	
	3-1 3-2 3-3 3-4 3-5	Word Format	3-2 3-3 3-4 3-7 3-16
IV -	PROG	FRAMMING AIDS	
	4-1	Compression Codes	4-5

LIST OF TABLES

Section	<u>1</u>	<u>Table</u>	Page
I		GENERAL INFORMATION	
II		OPERATION	
		2-2 Terminal Control Console Indicators 2-3 Keyboard Keys 2-4 Power Supply Controls/Indicators 2-5 Line Printer Control Functions 2-6 Card Reader Control Functions 2-7 600 LPM Line Printer Control Functions	2-2 2-3 2-5 2-11 2-13 2-16 2-19 2-22
III		3-2 Alert Message Format	3-5 3-6 3-6 3-7 3-8 3-9 3-10
		3-9 Clear-Write Message Format 3-10 Diagnostic-Write Message Format 3-11 Message Errors 3-12 Error Message Format 3-13 Addresses 3-14 Transmission Control Code Repertoire 3-15 Symbol Code Repertoire	3-11 3-12 3-13 3-13 3-14 3-15 3-16

82163400

LIST OF TABLES

Section	Table		Page
IV	 PROG	RAMMING AIDS	
	4-1	Message Responses	
	4-2	Format Control	4-3
	4-3	Data Source Print Message Format	4-4
	4-4	Error Display	

section 1_____general information

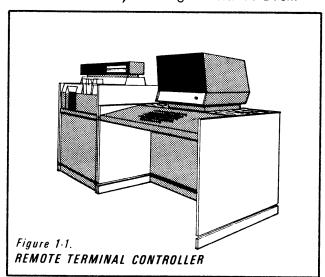
The growth of super computers in large data processing centers, and improvements in time sharing techniques, has encouraged the development of a simple inexpensive, Remote Terminal. Users of Remote Terminals share the capabilities and costs of the central processor unit, for greater efficiency and savings. To minimize the cost of computer time, the new Remote Terminal performs simple operations without the central processor. Computer time is then used for the more complex tasks beyond the present capabilities of the Remote Terminal.

The Remote Terminal Controller handles all the data processing tasks for the Remote Terminal. A data set connects the Remote Terminal Controller to the central processing unit (CPU) by way of commercial communications lines. The communications lines used classify the Terminal as Remote, regardless of the distance involved.

A variety of data input and output devices can be used with the Remote Terminal Controller. The peripheral devices covered in this manual include the following:

- Entry Keyboard
- Cathode-Ray-Tube Display
- Card Reader
- Line Printer

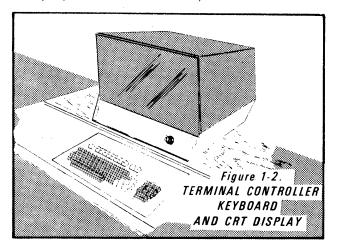
The Remote Terminal Controller is composed of a Buffer Controller, Adapter Logic Chassis, Micro Drum Memory, Entry Keyboard, Terminal Control Console, Power Supply, and stored controlware routines. The Buffer Controller, Adapter Logic, and Entry Keyboard are contained in one Terminal Console. Beside the console is the Power Cabinet Assembly holding the Micro Drum



memory, Power Supply, and Terminal Control Console. The Buffer Controller memory contains program routines frequently used in the control of the Terminal. These routines "call up" other less frequently used programs (overlays) from the Micro Drum memory. Core resident routines include device drivers and device monitors. The drivers pass data between the device and the Terminal Controller. The monitors perform formatting and conversion functions and call other routines which service the communications line.

CATHODE-RAY TUBE DISPLAY

The CRT Display is normally positioned on the Controller cabinet, behind the Keyboard. The Display is used as an on-line output device, to compose data messages from the Keyboard, or to monitor data being processed. The 15 inch CRT displays symbols in a raster which are 10 inches wide by 6.5 inches high. Format is 80 symbols horizon-tally by 13 lines vertically.

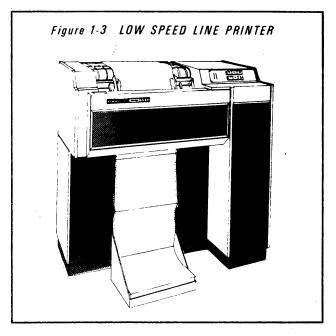


TERMINAL CONTROLLER KEYBOARD

The Keyboard allows the operator to control the processing, and to enter new data for a job. In addition to the standard type-writer keys, the Keyboard has keys for performing several processing functions, and keys for arranging data layouts.

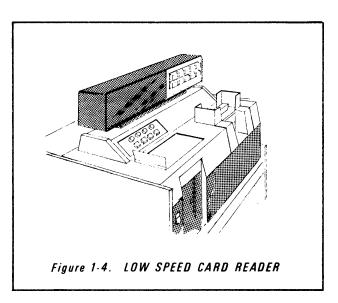
LOW SPEED LINE PRINTER

The Low Speed Line Printer makes a printed copy of output data. Printout is 136 characters per line, at 300 lines per minute capability. The 63 character ANSI symbol set is used. Vertical spacing can be either 6 or 8 lines per inch, as selected by the operator.



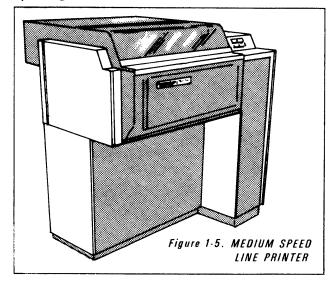
IOW SPEED CARD READER

A Low Speed Card Reader can be mounted on the Controller Power Cabinet.
Data contained in punched cards can be fed to the Controller for processing. This Card Reader can handle 300 cards per minute, using 026/029 Hollerith code. It has builtin light/dark checking, and Read Alert/Card Alert protection.



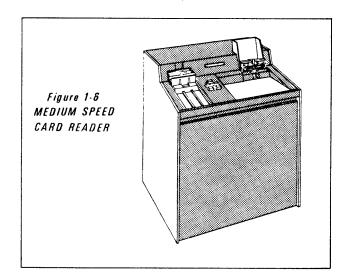
MEDIUM SPEED LINE PRINTER

This Medium Speed Line Printer prints the full 63 character ANSI set, with 136 column lines, at 600 lines per minute. Either 6 lines or 8 lines per inch vertical spacing can be chosen.



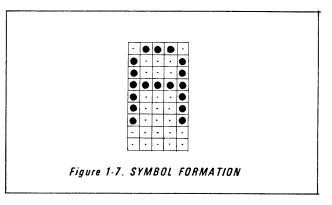
MEDIUM SPEED CARD READER

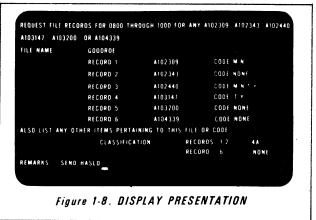
The Medium Speed Card Reader is a stand-alone unit that reads at 500 cards per minute. Either 026 or 029 Hollerith coded cards can be read, at the operators selection. Error checking features are included for reliable operation.



DATA PRESENTATION

The Display features symbols that are 3/32 inch wide by 3/16 inch tall, using a 5 by 9 dot matrix. A symbol is formed by brightening certain dots in the matrix. Figure 1-7 shows a matrix formation of the letter A. Symbols include the alphabet in uppercase, Arabic numerals, punctuation marks, and several special symbols. Figure 1-8 shows an actual CRT display.





The Line Printers both use the same character set composed of capital letters and ANSI standard symbols. Shown in Figure 1-9 is an actual sample of the printing.

```
ABCDEFGHIJKLMNOPORSTUVWXYZ0123456789_!"$.&*./[\]^#$!()+-::<=>?@
```

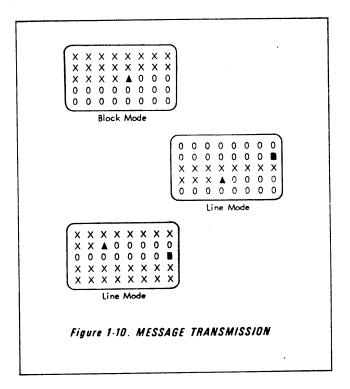
OPERATIONAL DESCRIPTION

In normal use, the operator composes an inquiry message using the Keyboard and watching the message appear on the Display. A blinking underline, called a cursor, shows where the next symbol will be displayed. Initially, the cursor appears at the upper left corner of the display. Pressing a symbol key puts that symbol at the cursor position, and moves the cursor one position to the right. When the end of a line is reached, the cursor resets to the beginning of the next line down. At the end of the bottom line, the cursor returns to the upper left corner of the display.

Either complete displays or segments of a display can be chosen as the transmitted message. The placement of the ETX symbol always shows the end of the message data (End of Text). The start of the message data is determined by operator selection of Block Mode or Line Mode. In Block Mode, the starting point is always the upper left corner of the display. All symbols between the left end of the top line and the ETX symbol are transmitted data. In Line Mode, the Line Index symbol () is displayed at the right hand end of the screen. All symbols between Line Index and ETX are transmitted data. Line Index is automatically displayed at the top right hand corner of the screen when Line Mode is selected. The F7 key moves

the Line Index down one line each time it is depressed. The first character of the line below the Line Index line is the first message character. If the ETX symbol is placed before Line Index, character transmission "wraps around" from bottom to top, and ends at ETX.

To change between Block Mode and Line Mode, another AUTOLOAD is performed to select the mode. Refer to Section 2, On Line Operations, for this procedure.



Keyboard data is automatically displayed. However, data from the Card Reader is not displayed. Data from the Central Processor is not displayed unless it is specifically addressed to the Display.

For printing data from the computer, the operator first selects either 6Line Per Inch or 8 Line Per Inch format during the AUTOLOAD procedure. Normal printing is then accomplished using the procedures of the computer system.

For card reading to the computer, either 026 Hollerith or 029 Hollerith coding is selected during the AUTOLOAD procedure. Card reading is then done using the computer System procedures.

If any operation is to be stopped or changed, depressing the F 0 key will send an Interrupt signal to the computer. The new operation is then selected using the System procedures.

TERMINAL CAPABILITIES

The Remote Terminal can perform a multitude of tasks, using the stored control—ware routines. This stored controlware is configured to make the Remote Terminal resemble the versatile 200 USER Terminals, able to use existing programs and languages at the larger data processing centers. External BCD, Internal BCD, and ANSI code repertoires are supported, interchangeably. The operator can also select either 2 wire or 4 wire Half Duplex communication.

The following operations can be performed:

OFF LINE --

Card Reader to Printer
Display/Keyboard to Printer

ON LINE --

To Central Processor Unit from: Card Reader Display/Keyboard

From Central Processor Unit to: Printer Display

section 2____operation

The operator controls most of the Remote Terminal Job processing. Tasks of the operator are simple, such as turning on power to the units, assuring the machines are in normal operating conditions and loaded with paper or cards, and keying the proper instructions into the controller. For best operation, any machine faults (out of paper, stacker full, etc.) should be immediately corrected.

This section describes the operation of each device, and how to set up the controller for some of the common processes.

CONTROLLER OPERATION

The controller is run by means of the Terminal Control Console and the Keyboard. The Terminal Control Console contains control switches, indicators, and a digital display.

The Keyboard contains an alphanumeric key set, a digital key set, and a set of control function keys. A common power supply operates all units in the Controller.

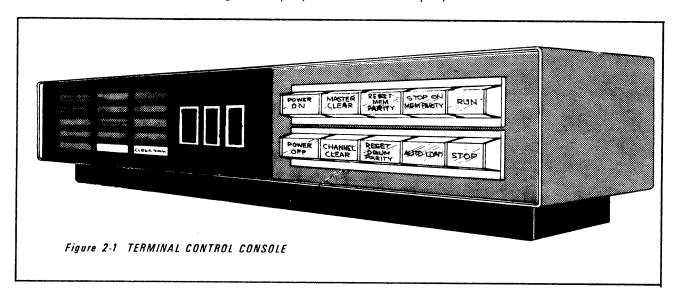
TERMINAL CONTROL CONSOLE

The Terminal Control Console contains the switches to run the controller and the indicators to monitor controller progress.

Figure 2-1 shows the Terminal Control Console.

Figure 2-2 and table 2-1 explain the switches, and figure 2-3 and table 2-2 explain the indicators.

The Digital Display Readout at the center of the Terminal Control Console is a maintenance feature. During normal operation, these displayed numbers are all zero, indicating no errors. If a failure occurs, indicators at the left locate the fault to a device, and the Digital Display Readout pinpoints the problem within the device. Refer Section 4, Terminal Control Console Error Display.



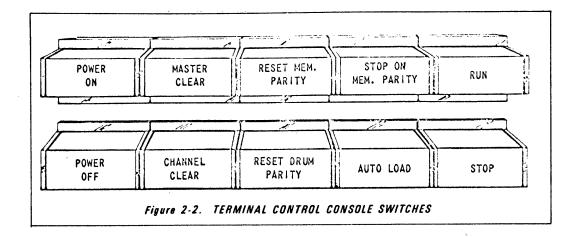


TABLE 2-1. TERMINAL CON	trol console switches
SWITCH	FUNCTION
POWER ON	Turns on power to Controller, Display, Terminal Control Console, and Low Speed Card Reader. Momentary action, holds set. Lens lighted when power is on.
POWER OFF	Turns off power to above equipment. No Light.
MASTER CLEAR	Stops Controller operation, and clears all addressable registers and their controls.
CHANNEL CLEAR	Clears all peripheral channels.
RUN	Starts the Controller. Lens lights when controller is running.
STOP	Stops the execution of a Controller program.
STOP ON MEMORY PARITY FAULT	Stops the Controller when a parity error is detected. Lens lights when switch is depressed.
RESET MEMORY PARITY FAULT SWITCH	Clears the MEMORY PARITY ERROR indicator.
AUTOLOAD	Initiates Controller operation. Enables operator selection features.
RESET DRUM PARITY	Clears the DRUM PARITY ERROR indicator.

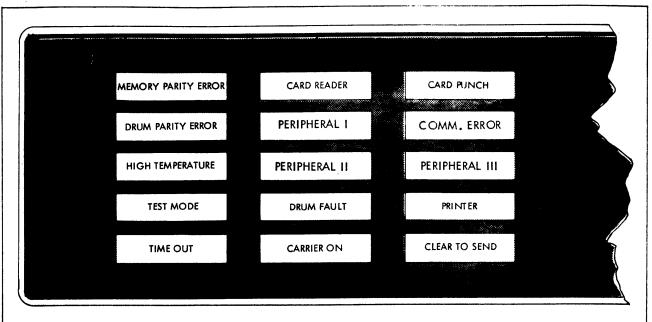
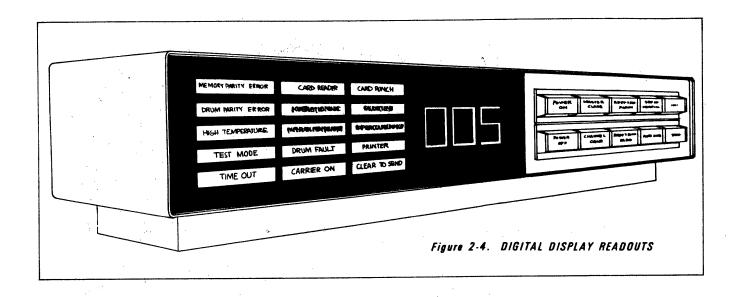


Figure 2-3. TERMINAL CONTROL CONSOLE INDICATORS

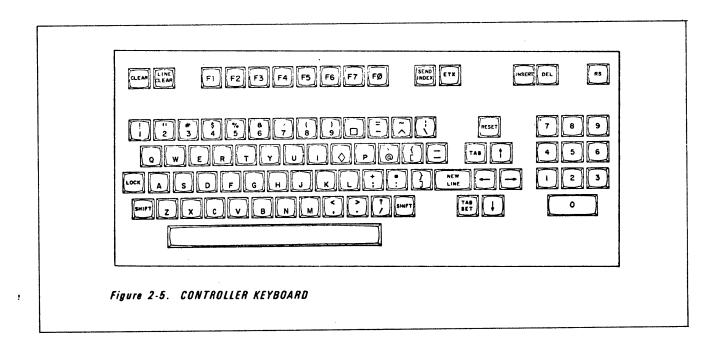
TABLE 2-2. TERMINAL CO	ontrol console indicators
INDICATOR	MEANING
MEMORY PARITY ERROR	Parity error detected in a stored data word.
DRUM PARITY ERROR	Parity error detected in a stored data word.
TEST MODE	The TEST MODE switch in controller is ON, for maintenance.
TIME OUT	A program or controller malfunction, and execution has stopped.
CLEAR TO SEND	The terminal has received a Class-To-Send signal from the data set, and is sending data to computer.
CARRIER ON	Data Set is sending Carrier On signal to terminal. Lights when terminal is received ing data.
TEMPERATURE WARNING	Lights when air temperature of Controller reaches 105° 5° (40.5°C 2.8°C). Equipment turns off automatically when temperature reaches 120°F 5°F (49°C 2.8°C).
DRUM FAULT	Failure in Controller rotating memory.
CARD READER	Lights when fault occurs during card reading.
PRINTER	Lights when fault occurs during printing.
CARD PUNCH	Not used in this terminal.
PERIPHERAL I	Lights when illegal data is detected.
PERIPHERAL II	Not used in this terminal.
PERIPHERAL III	Not used in this terminal.
COMM. ERROR	Lights when error in communication protocol is detected.



KEYBOARD

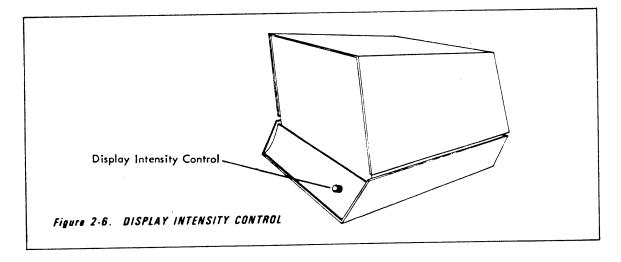
The controller keyboard is an 81-key ANSI (American National Standards Institute) encoded keyboard. The 2-key roll-over feature eliminates garbled data when 2 keys are pressed at the same time. The first key

pressed is used for data, down to thousandths of a second time difference between keys. The keyboard layout is shown in figure 2-5, and the keys are explained in table 2-3 and later text.



KEY GROUP/SYMBOLS	PURPOSE
Alphanumeric Keys (48)	Entering data messages to the controller.
Edit and Control Keys (12)	Emering dold mesiages to me controller.
CLEAR	Clears entire message. Entry point returns to top line, left end.
LINE CLEAR	Clears only the present line. Entry point returns to beginning of line. Allows changing one line.
SEND INDEX	Not used on this terminal.
ETX	End of Text. Sends completed message to Buffer Controller.
INSERT	Not used on this terminal.
DEL	Not used on this terminal.
RS	Not used on this terminal.
Function Keys (8)	
Fì	Selects On Line operation.
F2	In Off Line operation selects Card Reader to Line Printer transfer.
F3	Not used on this terminal.
F4	Selects Off Line operation.
F5	For maintenance purposes. In Off Line operation, selects memory to Line Printer transfer.
F6	In On Line operation, selects Display to Line Printer transfer.
F7	In On Line operation, Line Mode, moves the active white field down one line. At bottom line, F7 returns white field to top line.
F0	Allows operator to stop on On Line print or card read sequence. Keyboard is enabled after completion of current data transfer. For Off Line maintenance, FO selects access to the drum memory via the maintenance console.

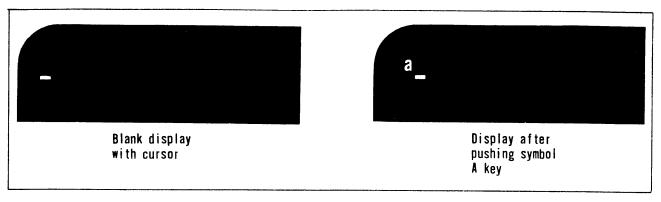
TABLE 2-3. KEY	YBOARD KEYS (CONT)
KEY GROUP/SYMBOLS	PURPOSE
TAB	Not used on this terminal.
TAB SET	Not used on this terminal.
LINE UP ()	For changes. Next symbol is entered at same spacing, one line up. Old symbol is replaced by new symbol entered.
Line Down (i)	Same as (†), but new symbol is entered one line down.
Shift Left (←)	Same as backspace on a typewriter. Entry shifts left space by space.
Shift Right ()	Same as space forward on a typewriter. Entry shifts right space by space.
Control Keys	
Space Bar	Same as typewriter. Enters a blank space.
SHIFT (2 Keys)	Sets uppercase when depressed.
LOCK	Locks the SHIFT key to uppercase. Releases when SHIFT key is again depressed.
Numeric Keys (0 9)	Enters control codes to operate terminal.



DISPLAY OPERATION

the only Display Operator control is the intensity knob on the lower right corner of the cabinet face. Turning this knob clockwise brightens the display. The following explanation of cursor movement, format control, transmission control, and extra features will help understanding display/keyboard operation.

CURSOR MOVEMENT



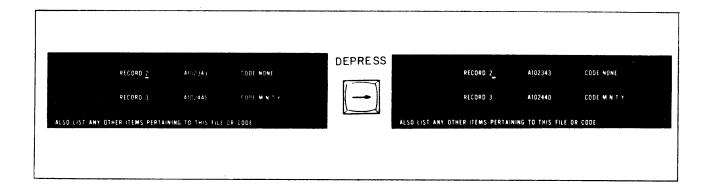
Cursor is a blinking underline dash

(_____) that indicates the position of the next symbol to be displayed. Depressing a symbol key on the keyboard erases the cursor and enters the symbol where the cursor used to be. The cursor moves to the next symbol position.

For each operation of a symbol or space bar on the keyboard, the cursor

advances one space to the right. If the cursor is at the end of a line, it automatically moves to the first position of the next line.

When the cursor reaches the end of the bottom line, it automatically moves to the first position of the top line. Another symbol entered will replace the existing symbol at that position.



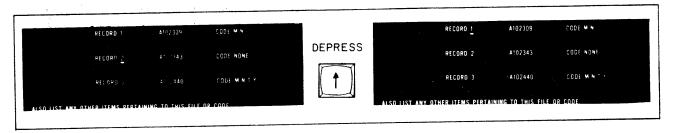
The cursor control keys are used to position the cursor. SKIP (\longrightarrow) moves the cursor one space to the right, each time

it is depressed. At the end of the line, the cursor will shift to the next line, and keep on moving to the right.



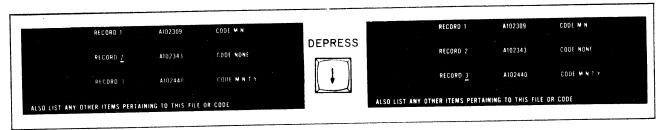
Backspace (-) moves the cursor to the left one space, for each depression.

At the beginning of the line, it stops.



Cursor Up (†) raises the cursor up one line, without changing its horizontal

position. The cursor stops at the top line.

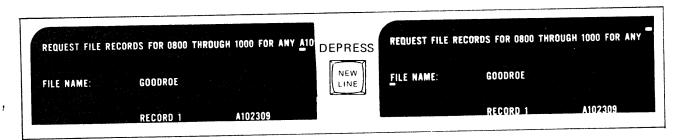


Cursor Down (\downarrow) moves the cursor down one line, until the bottom line is reached.

Then the cursor jumps to the top line.

FORMAT CONTROL

Keys that control the display layout are the NEW LINE, RESET, LINE CLEAR, and CLEAR Keys.



NEW LINE

The NEW LINE Key corresponds to the typewriter Carriage Return. The New Line symbol is displayed as (—), and shows the end of a line. Entry of this symbol from the keyboard (or from the central processor) will clear any symbols remaining to the right

of the NEW LINE symbol. The cursor advances to the beginning of the next line, as shown previously.

By positioning the cursor, NEW LINE can be used to erase symbols. The cursor may have to be re-positioned afterwards.

LINE CLEAR

LINE CLEAR works like the NEW LINE function, except that the cursor does not

advance. All symbols on the line to the right of the cursor are erased.

RESET

This key returns the cursor to the top left corner of the raster. No symbols are

erased. Entry begins at the first symbol position, replacing existing top line symbols.

CLEAR

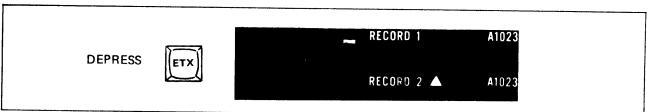
This key is used to erase the entire display. It resets the cursor to the upper left

symbol position.

TRANSMISSION CONTROL

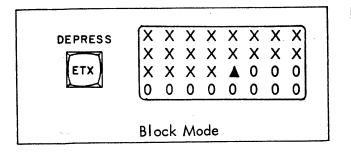
The ETX key transfers Display data to the computer, in both Block and Line Modes. In Block Mode, the upper left corner of the display raster is the beginning of the message. The ETX symbol is placed after the last mes-

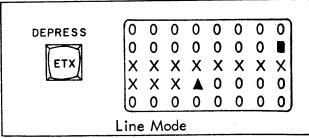
sage symbol. After ETX, the cursor returns to the upper left corner of the display. ETX never clears the display; the CLEAR key or the computer clear command removes the display.

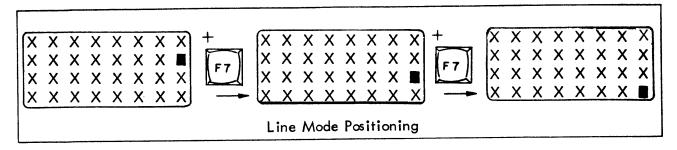


In Line Mode, the Line Index symbol () shows the start of the message. All symbols between Line Index and ETX are transmitted in the message. The F7 key

is used to position the Line Index symbol. Each depression of the F7 key moves Line Index down one line.







TERMINAL POWER SUPPLY

This supply furnishes all power used by the Controller. The logic chassis memory Micro Drum, and Terminal Control Console are run from this power supply. Figure 2-7 shows the Terminal Power Supply control panel, and table 2-4 explains control function.

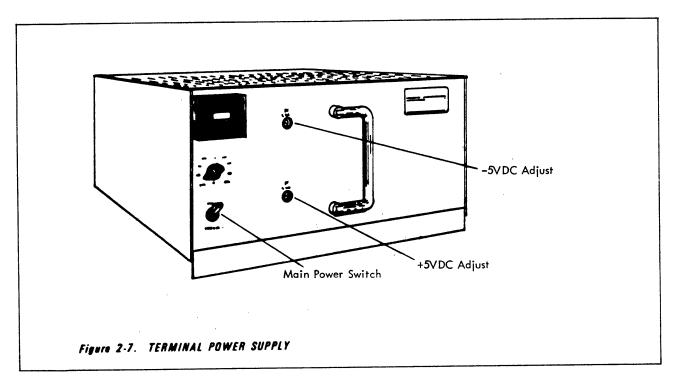
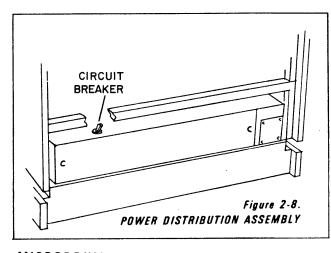


TABLE 2-4. POWER SUPPLY CONTROLS/INDICATORS

CONTROL/INDICATOR	TYPE	FUNCTION
MAIN POWER	Circuit Breaker, 3 pole	ON applies AC power to power supply, turns on controller. OFF turns off controller.
- 5 VDC	Potentiometer, Large Knob	Adjusts - 5 volt output of supply . Turning knob clockwise moves meter needle to right .
+ 5 VDC	Potentiometer, Small Knob	Adjusts + 5 volt output of supply - Turning knob clockwise moves meter needle to right.
(Output)	Meter	Measures voltage outputs selected by meter switch. Labelled in percent above and below desired voltage.
(Meter Select)	Switch, Rotary	

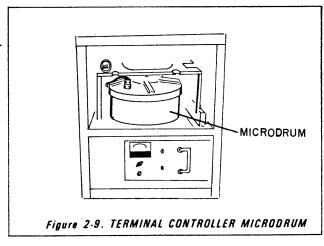


CONTROLLER POWER

Primary power for the Controller is fed through a Main Power circuit breaker on the power disptribution assembly. Power is distributed to the Terminal Power Supply, Terminal Control Console, and the Micro Drum memory. A time meter on the power distribution assembly shows total hours of terminal operation. Figure 2-8 shows the location of the power distribution assembly.

MICRODRUM

This is a rotating magnetic memory that is used to store controlware routines and data. The Controller calls in the desired controlware from the drum to the Core Memory and executes that program. Data is stored on the cylindrical magnetic surface of the rotating drum. Several read/write heads define tracks where data is located and the Controller can address a specific head and a specific location within that track. There are no operator controls for this device. Figure 2-9 shows the Microdrum.



CONTROLLER CLEANING

The exterior surfaces of the Controller cabinets and the cabinet air filters should be cleaned periodically. Air filters must be inspected at least once a month, and cleaned if necessary. To clean the cabinet surfaces, first depress POWER OFF, then wash with mild soap and water. Keep the soft cloth barely moist to avoid dripping water into the keyboard, switches, etc. Use window spray to clean the Display face.

There is one air filter at the bottom of the Power Cabinet and there are two filters under the Controller Cabinet. With POWER OFF, pull each filter forward out of the cabinet. Wash each filter with soap and water, rinse, and allow it to air dry. Push the filters back into the cabinets, and depress POWER ON.

CAUTION

Never use cleaners that contain ammonia or bleaches. Those ingredients will discolor the surfaces.

LINE PRINTER STATION OPERATION

Operator controls for the Line Printer are mounted on the upper right-hand part of the Line Printer cabinet. This control panel is shown in figure 2-10 and explained in table 2-5.

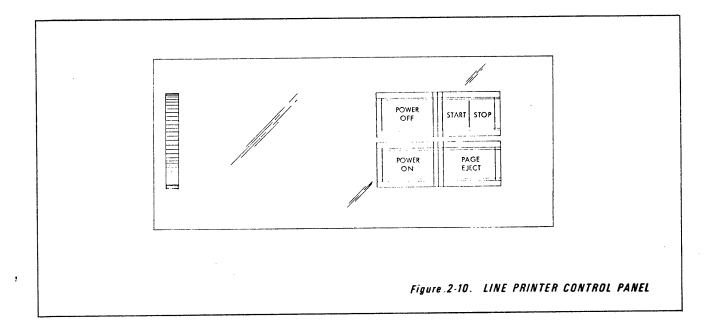
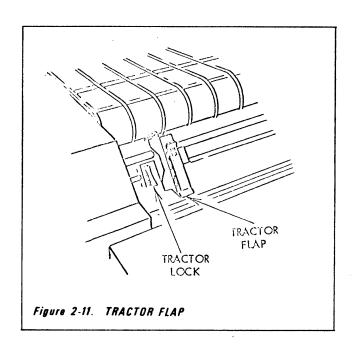


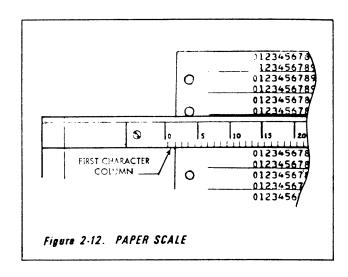
TABLE 2-5. LINE PRINTER CONTROL FUNCTIONS				
POWER ON	Switch/indicator momentary	Pressed, turns on AC power to the printer. Lights when ON.		
POWER OFF	Switch, momentary	Pressed, turns power OFF.		
ST OP/START	Switch/indicator momentary	Press once, START lights if printer is ready. Press again, STOP lights, printing stops at the completion of the operation STOP will also light if printer is not ready due to: a. Out of paper. Print head failure (hammer fuse blown).		
		c. Interlock switch open.		
PAGE EJECT	Switch, momentary	Pressed moves paper to top of next form. Does not work when START is lighted.		
Character Phasing	Thumbwheel	Adjusts vertical coverages of printed line. Centers character over print hammer. Range is half a character, up or down.		

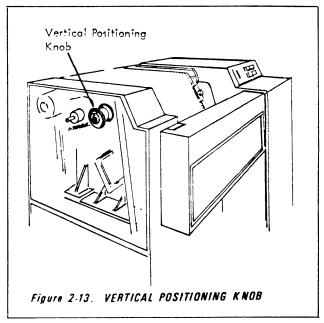
PAPER LOADING PROCEDURE

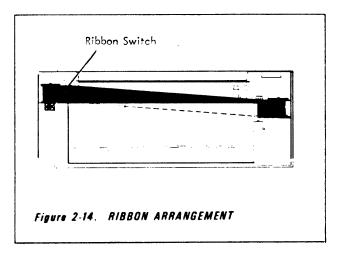
- (a) Press POWER ON switch. POWER ON lights.
- (b) Press PAGE EJECT switch. Printer sets to "top of form" position.
- (c) Unlatch the drum arm panel and swing it all the way out.
- (d) Raise tractor flaps. See figure 2-11.
- (e) Loosen each tractor lock by raising the small lever or by unscrewing the large thumbscrews.



- (f) Insert forms on the tractor pins and close tractor flaps. Be sure paper is straight, with the correct holes on the proper tractor pins.
- (g) Swing the drum arm panel closed and latched. Adjust the left to right paper position with the paper scale on the drum arm panel. See figure 2-12. The small marks on the paper scale show the left edge of the printed character. The longer marks show the center of every fifth character. Figure 2-12 shows a programmed 12-space indent from the paper edge, with the first printing in the 14th character column. The paper and tractors can be moved side to side to set the printing margin.
- (h) Close or tighten the left hand tractor lock. Pull the right hand tractor sideways to stretch the paper tight. Lock the right hand tractor with the paper tight.
- (i) Open the left side cabinet door to get to the Vertical Positioning Knob, shown in figure 2-13. By turning this knob, the paper is moved up or down to line up printing with forms lines. The edge of the plastic drum arm cover shows the base of the printed characters. Line up this edge with the forms lines. Close the cabinet side door.
- (j) Be sure the drum arm panel is securely latched. Press the START/STOP switch on the control panel, and see that START lights up. Depress PAGE EJECT if top of Forms is desired.
- (k) Start printing. Adjust the character phasing wheel for best printing. If the printer stops during this adjustment, the wheel has turned too far; rotate it back toward the center to restart printing.



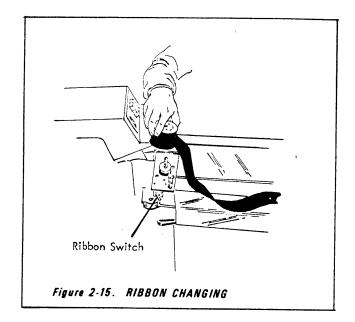




RIBBON CHANGING

The Line Printer ribbon works just like a typewriter ribbon. However, this ribbon is 2 inches wide and runs across the print hammers at an angle. An automatic switch in the printer keeps reversing the ribbon travel, giving more ribbon use.

- (a) Press the START/STOP switch to stop the machine.
- (b) When the printer has stopped, unlatch the drum arm panel and swing it all the way open.
- (c) Turn the Ribbon switch to OFF. This stops the ribbon transport motor.
- (d) Lift the two ribbon spools directly up and out of the machine.
- (e) If most of the printing has been on one side of the page, try switching the spools (left spool to right spindle). The less used part of the ribbon may still be usable.



- (f) If the ribbon is used up, install a new ribbon. Unwind the remaining ribbon from the near-empty spool, and use that spool for the new ribbon.
- (g) After the ribbon is in place, turn the Ribbon switch to ON, close the drum arm panel, and push the START/STOP switch.

300 CPM CARD READER OPERATION

Or erator controls on the 300 CPM Card Reader allow punched cards to be run for Off-Line jobs, or read into the Terminal Controller in the On-Line mode. Controls are shown in figure 2-16, and explained in table 2-6. For any Card Reader operation, power must be ON and the cards must be properly loaded. During the operation, more cards can be added to the input hopper,

when there are more than 200 cards left in the hopper. If the card weight is removed when there is less than the weight of 200 cards in the input hopper, the cards may be damaged by bad feeding. The input hopper and output stacker each hold up to 600 cards. Cards may be removed from the output stacker during operation, but only when there are less than 250 cards in the stacker. If the quantity is more than 250 cards, the operation must run to the automatic limit of 600 cards in the output stacker.

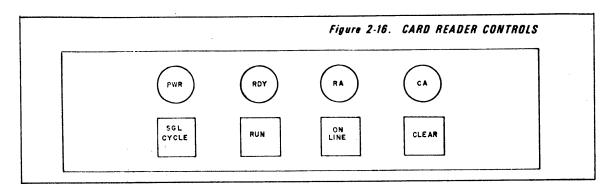


TABLE 2-6	. CARD READER CONTRO	L FUNCTIONS
CONTROL/INDICATOR	SWITCH/INDICATOR	FUNCTION
ON-OFF	Rocker Switch/ Circuit Breaker	ON position turns on AC power to power supplies, fans, and lights PWR indicator. OFF turns off power.
PWR	Indicator, green	Lights when AC power is ON.
ON LINE	Switch/indicator	Lights when pushed once, placing Card Reader under Terminal program control. This disables the RUN and SGL CYCLE switches. Pushed again, the light goes out, and cards can be cycled without passing data to ter- minal. RUN and SGL CYCLE switches now can be used.
RUN	Switch/Indicator	Push once, the RUN light goes on, and the reader continuously feeds cards. Push again, the feeding stops, and the RUN light goes out. Only works when not ON LINE.
SGL CYCLE (Single Cycle)	Switch, momentary	Each time pushed, one card will feed through the reader. Only works when on ON LINE.
CLEAR	Switch, momentary	Clears all alerts and error conditions.
RDY	Indicator, green	Lights whenever the ON LINE switch is activated, PWR is lit, and CA and RA are dark.
CA (Card Alert)	Indicator, red	Lights to show a Jam, Stacker Full, or Hopper Empty condition.

CONTROL /INDICATOR	SWITCH IN IDICATOR	
ONTROL/INDICATOR	SWITCH/INDICATOR	FUNCTION
RA (Read Alert)	Indicator, red	Lights to show a dark check or light check error.
D (Dark Check)	Indicator, red (Inside cabinet, on circuit card)	Lights to show a dark check error.
L (Light Check)	Indicator, red (Inside cabinet, on circuit card)	Lights to show a check error.

CARD LOADING PROCEDURE

- (a) Turn the power switch to ON. PWR will light, CA will light, and possibly ON LINE will light, if ON LINE had been pushed before.
- (b) Fan the stack of cards from both ends to break up any sticking between cards. Align the stack by jogging them on the cabinet plate.

OFF-LINE CARD FEEDING

When the OFF LINE indicator is not lit, cards can be fed continuously from input hopper to output stacker, without passing data to the Terminal Controller. This is a maintenance feature, making certain that cards feed through the machine properly. After loading cards follow these steps:

- (a) Be sure ON LINE is not lit. If it is, push the button again. The RDY light will not come on.
- (b) Press the CLEAR button. This sets up the machine for operation.

- (c) Remove the card weight from the input hopper.
- (d) Load the stack of cards into the hopper, with the printed side down, and the row nine edge toward the rear of the machine. A maximum of 600 cards can be loaded at the start.
- (e) Insert the card weight on top of the stack.
- (c) Press the SGL CYCLE switch to feed through one card. This checks the feeding, without risking damage to the whole stack of cards.
- (d) Press the RUN button, and cards will feed continuously at 300 cards per minute. Feeding continues until:
 - (1) The last card leaves the input hopper, or
 - the output stacker contains 600 cards, or
 - (3) a card jam occurs, or
 - (4) the RUN switch is pushed again, and RUN light goes out.

ON LINE OPERATION

To read card data under control of the Computer, turn power ON, load cards, press CLEAR button, and depress the ON LINE switch. RDY wil light, and the Card Reader is then available to the Terminal Controller. Refer to the On Line Operations procedures later in this section. On-Line card reading is done using the steps required by the central processor system.

CORRECTING A READ ALERT

The Card Reader uses a light/dark check to assure the reading photocells are operating. Before reading each card, all photocells are checked for a dark (no punched hole) signal. After reading the card the cells are checked for a light (hole) condition. If any cell fails these checks, RA lights and the card feeding stops. Inside the reader cabinet, either L (light check) or D (dark check) indicators show which check failed. Cleaning the card path may remove the trouble. If cleaning does not help, these failures can only be corrected by qualified maintenance people.

CLEARING CARD JAM

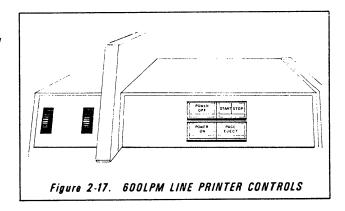
Card jamming can be caused by a bad card, excessive humidity, or a card reader misalignment. To clear the card jam, follow these steps:

- (a) Turn power switch to OFF. Also unplug the AC power cable at the rear of the reader cabinet.
- (b) Raise the cabinet top cover.
- (c) Lift the hinged read head plate.
- (d) Remove any stray pieces of card from the card path.
- (e) Check drive rollers for any bits of card.

- Remove any card pieces from drive rollers with a soft, non-metal tool (tooth-pick, rubber-tip hairpin, etc.).
- (f) Be sure that feeding throat gap is not clogged.
- (g) Wipe card path area with a clean, lint free cloth.
- (h) Lower read head, and be sure that it is firmly latched.
- (i) Lower cabinet top cover.
- (i) Connect AC power cable and turn ON power.

600 LPM LINE PRINTER STATION OPERATION

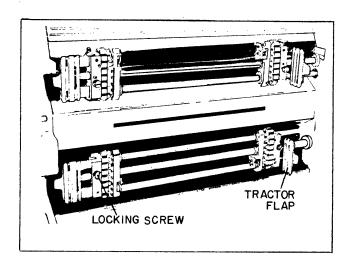
Operator controls for the Line Printer are mounted on the upper right-hand part of the cabinet. Two thumbwheels are located inside the plexiglass cover, and the switch/indicator controls are located on an external control panel. These controls are shown in figure 2-17 and explained in Table 2-7.



CONTROL	SWITCH/INDICATOR	FUNCTION
POWER ON	Pushbutton Switch/ Indicator	Lights when depressed, applying AC power to printer.
POWER OFF	Pushbutton Switch	When depressed, removes AC power to the printer, POWER ON indicator goes out.
START/STOP	Pushbutton Switch/ Indicator, alternate action.	Places printer in STOP or START condition as indicated. START makes the printer ready for use. STOP halts printing.
PAGE EJECT	Pushbutton Swtich	When depressed, advances paper to Top of Forms pos- ition.
Horizontal Paper	Thumbwheel (Left-hand)	Moves the paper transport right or left for centering print on paper. Turning Upwards moves print left on the paper; downwards moves print right on the paper.
Character Phasing	Thumbwheel (Right-hand)	Centers character over print hammer. If top of character is not printing, turn wheel downwards. If bottom of character is not printing, turn wheel upwards. Range is one half of a character.

LOADING PROCEDURE

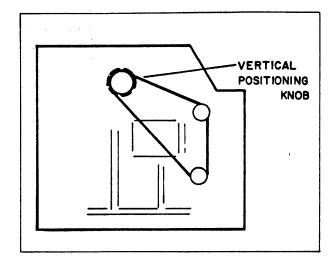
- (a) Press POWER ON switch. POWER ON must be lit.
- (b) Select Printer STOP mode. STOP lights.
- (c) Unlatch the drum arm panel and swing it all the way out.
- (d) Raise all four tractor flaps.
- (e) Loosen all tractor locking screws.



- (f) Set upper left and lower left tractors at the desired position, preferably in one of the grooved rings. Lock these two tractors in position.
- (g) Insert forms holes on all tractor lugs. Select forms position to place hammer bank behind first print line at Top of Forms.
- (h) Close all tractor flaps.
- (i) Pull right hand tractors to the right to tighten paper and lock in position.
- (i) Open side door on the left hand side of of the cabinet.
- (k) Pull out the Vertical Positioning knob, and turn it to advance the paper.
- (1) Open the cabinet top back door and route the forms through the paper guides and rollers.
- (m) Push the Vertical Positioning knob back in.
- (n) Close all doors and latch the drum arm panel.
- (o) Select START mode and depress PAGE EJECT for Top of Forms, if desired.
- (p) Initiate printing (refer to Card to Print operation, this section).
- (q) Make final character phasing, vertical positioning and horizontal positioning adjustments.

CHANGING THE RIBBON

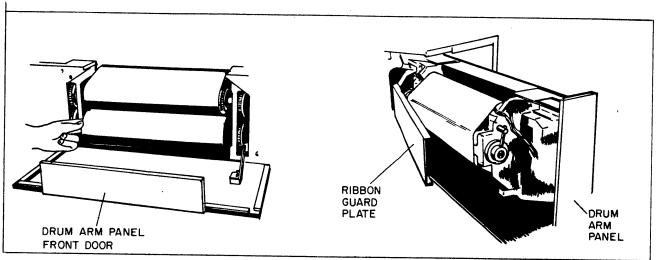
The ribbon is a 15 inch wide, 25 yard long "towel type" ribbon that completely spans the hammer bank. Ribbon travel is

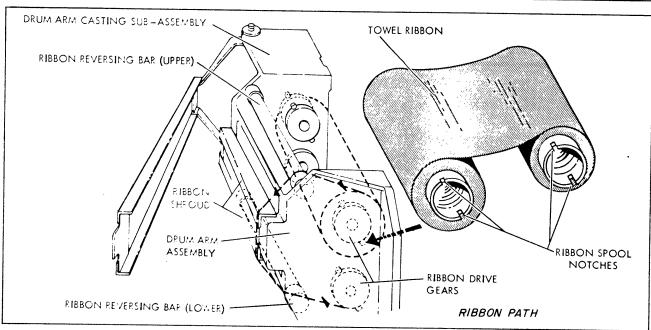


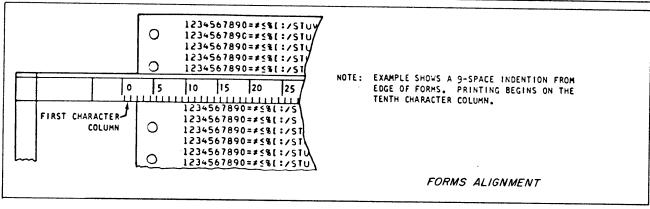
from the supply roll, past the hammer bank to the take up roll. With each replacement ribbon package are included a pair of plastic gloves and detailed instructions. Instructions are also given below.

- (a) Depress POWER OFF switch.
- (b) Open front door on drum arm panel.
- (c) Swing drum arm panel partly open. Be careful not to damage the cabinet with the drum arm panel front door.
- (d) At the inside surface of the drum arm panel, swing out the ribbon guard plate.
- (e) Remove the full ribbon roll by compressing the spring loaded end holder and lifting it free.
- (f) Relocate the empty roll tube to the take up position.
- (g) Insert the new full roll in the supply position.
- (h) Unroll the two feet of ribbon and pass it over the two guide bars to the take up roll.

- (i) Secure the ribbon with two or three turns around the takeup roll.
- (j) Close the ribbon guard plate, drum arm panel fron door, and drum arm panel.

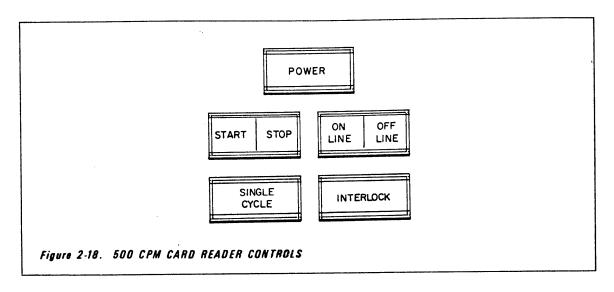






500 CPM CARD READER OPERATION

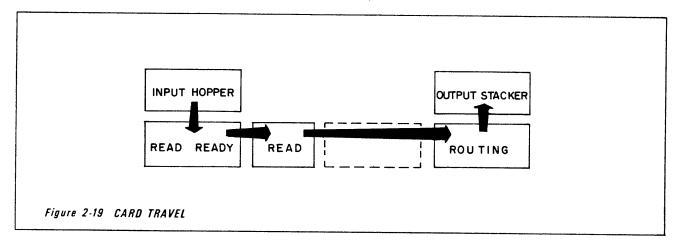
This stand—alone unit has the On Line/ Off Line modes of operation, and extensive self testing maintenance aids. The operator controls and indicators are shown in figure 2–18 and explained in table 2–8.



VAME		
POWER	Switch/Indicator alternate action	When depressed, indicator lights and power is applied to the unit. Second depression extinguishes the indicator and removes power.
START/STOP	Switch/Indicator, alternate action	Selects start or stop mode. START enables card reading. STOP disables card reading.
OFF LINE/ ON LINE	Switch/Indicator, alternate action	Selects either On Line mode for reading card data, or Off Line mode for maintenance.
SINGLE CYCLE	Switch, momentary	When in Off Line mode, each depression feeds one card through the reader. No data is read.
INTERLOCK	Indicator	Lights when cabinet doors are open or other interlocks are not closed.
DARK CHECK (Maintenance Panel)	Indi cators , Red/Green alternate display	Green lit, no errors. Red lit, dark check failed.
CLEAR (Maintenance Panel)	Switch, pushbutton	Depressed, extinguishes red DARK CHECK indicator.

For card reading, POWER must be on (lit) and the cards must be properly loaded. The input hopper can contain 1200 cards. During operation, more cards can be added, but at least 100 cards must remain in the hopper before the CARD Weight is removed. This minimum is sufficient weight for proper feeding. The Output Stacker can hold 1300 cards. During operation, cards can be

removed from the stacker, but at least 100 cards must remain for proper stacking. Card feeding stops automatically when the input hopper is empty, or the output stacker is full. When these conditions occur, STOP lights on the reader control panel, and CARD READER lights on the Terminal Control Console. Card Travel is shown in figure 2–19.



CLEARING CARD JAM

If a card jam occurs in the Card Reader, follow procedures below.

CAUTION

If cards are jammed, DO NOT SINGLE CYCLE the machine.

Damage to the reader may result.

- 1. Select OFF LINE mode.
- 2. Open top read door.
- Inspect the card path stations for torn, bent, or multiple cards.
 Raise the access flaps and remove these cards.
- At the maintenance panel, turn OFF the MOTOR POWER switch. Be sure the motor has stopped.

- 5. If the jam occurs at the input hopper remove the card deck and card weight. Pull the card back through the input hopper, in the opposite direction of card travel. If the card tears apart, rotate the transport hand wheel and remove any remaining card pieces out through the ready station.
- 6. If a jam occurs along the remainder of the card path, rotate the hand wheel to dislodge pieces caught at rollers. When cleaning near rubber rollers, use a nonmetallic pick to avoid damaging the roller surface.
- 7. Verify that all bits of card material have been removed from the card path.

- 8. Lower all station flaps.
- 9. Turn the MOTOR POWER switch back to on.
- 10. Close all cabinet doors.
- Load a test deck of unimportant cards. (If the machine alignments have been disrupted by the card

DARK CHECK

This internal quality control check verifies that the read station is operating properly. Twelve photo transistors are located under the row positions of a punched card. The read lamp illuminates each phototransistor that is not covered by card material. When there is no card in the read station all phototransistors are checked for an illuminated signal. When the column of phototransistors is covered by the leading edge of the card, each signal is checked for a dark condition. If any phototransistors are not operating properly, the DARK CHECK red light is lit and the STOP switch indicator lights.

CIFANING

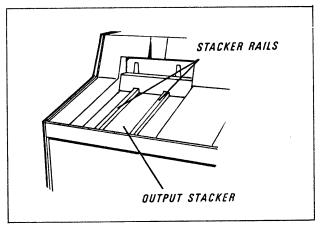
Every 40 operating hours, the card path should be cleaned as follows:

- 1. Select Off Line and STOP modes.
- 2. At the maintenance panel, turn MOTOR POWER switch to OFF.
- 3. Open top rear door.
- 4. Raise all station access flaps.
- 5. Using a paint brush or a similar soft brush, remove all card dust a and dirt from the card path. Start at the input hopper, and finish at the output stacker.

- jam, or if there are pieces left in the card path, these test cards may not survive).
- 12. Depress the SINGLE CYCLE switch to feed one card from hopper to stacker. If the card feeds properly, try several more cards. If it jams, go through this whole procedure again.

These alerts are also given if the read lamp burns out. The read lamp and phototransistor replacement are actions to be performed only by a qualified maintenance person. One possible operator corrective action is to clean the read station area thoroughly on the chance that foreign material is covering one phototransistor. Refer to the cleaning procedure explained in the following paragraphs. To clear the DARK CHECK alerts, depress the CLEAR button below the DARK CHECK lights.

- 6. Using a vacuum cleaner, vacuum the entire card path.
- 7. With a clean cloth, wipe the card path to get the last of the dirt and dust. Also wipe the stacker rails.



- 8. Using a toothpick, or other nonmetallic pick, clean out any foreign matter from the step on the picker knife in the input hopper.
- 9. Close the station access flaps, and cabinet top rear door.
- 10. Turn the MOTOR POWER switch back to ON.
- 11. Close the front door.
- 12. Return the card reader to operation.

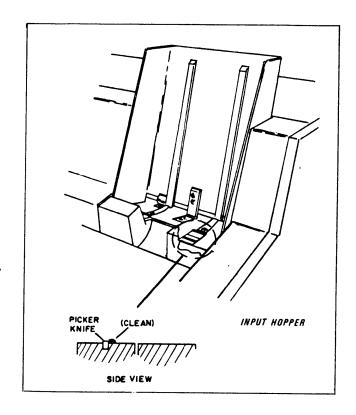


Controlware resident in the Terminal can perform basic transfers without using the Central Processor (Off Line). Display to Printer, and Card Reader to Printer transfers are easily performed.

DISPLAY TO PRINTER

The following steps will transfer displayed data to the printer for permanent record.

- 1. Perform Line Printer Loading Procedures previously listed in this section.
- 2. At the Terminal Control Console, depress the AUTOLOAD switch.
- 3. At the Keyboard, depress the F1 key. This places the Terminal in the On Line mode, but the computer will not be used.



- 4. At the Keyboard, depress the CLEAR key. The On Line system is now ready.
- 5. Display data to be printed.
- 6. Ready the Printer with the START and PAGE EJECT switches.
- 7. Depress the Keyboard F6 Key. Printout begins.

CARD READER TO PRINTER

The following steps will transfer Card Reader data to the Line Printer for readable copy.

- Perform Line Printer Loading Procedures previously listed in this section.
- 2. At the Terminal Control Console, depress the AUTOLOAD switch.
- 3. Depress the Keyboard F4 Key, selecting Off Line mode.
- 4. Depress the Keyboard CLEAR key.
- 5. Depress the Keyboard F2 key.
- 6. Load Cards into the Card Reader.
- 7. Depress the Card Reader CLEAR or START switch.
- Select the Card Reader ON LINE mode. Card to print transfer begins.

ON LINE OPERATIONS

The On Line controlware is enabled to handle communications with the Central Processor. The various operating choices are selected before this communications begins. The procedure is listed below.

 Depress Terminal Control Console AUTO LOAD switch.

- 2. Depress the F1 key. This re-starts the On-Line software.
- 3. The following interaction takes place between the Terminal and Operator to select operating parameters.
 - a. Displays: 200UT OPTIONSY = YES N = NO
 - b. Depressing N Key will select standard options, which are:

2 wire communication

Block Mode

026 Hollerith Code

Ext. BCD communication code

8 Lines Per Inch Print

160 Site Address

- c. Depressing Y Key, the following choices are offered:
 - (1) Displays: 2-WIRE = 1,4 WIRE = 2
 - (2) Key in 1 or 2.
 - (3) Displays: BLOCK MODE = 1, LINE MODE = 2_____
 - (4) Key in 1 or 2.
 - (5) Displays: 026 = 1, 029 = 2____
 - (6) Key in 1 or 2 for Hollerith code.
 - (7) Displays: CODE EXT BCD = 1, INT BCD = 2, ASCII = 3_____
 - (8) Key in 1 or 2 or 3.

- (9) Displays: PRINT 6 LPI = 1, 8 LPI = 2
- (10) Key in 1 or 2 for Line Printer Vertical spacing, Lines Per Inch.
- (11) Displays: SELECT SITE ADDRESS 160-177
- (12) Key in chosen site address, any number from 160 through 177.
- 4. Displays: SYSTEM LOADED-DEPRESS CLEAR KEY TO CONTINUE-CK = XXXX
- 5. The four digit number following CK is a Checksum. This number is a Control Data identifier for standard controlware. Depress the CLEAR key. At this point, the Terminal waits for a message from the Central Computer. When a message is received, CARRIER ON lights and a Read message is transmitted. CLEAR TO SEND lights when the Terminal is transmitting.

General Instructions.

First, AUTOLOAD, then depress the F1 key for On-Line. Choose the parameters and depress the CLEAR key. Log in with the central computer. Load cards, select Card Reader Off Line mode, depress the Card Reader CLEAR or START switch, then select the Card Reader On Line mode. Send the "Read" command to the central computer. Card Reading begins. For Printing, load paper, select Start mode, and depress PAGE EJECT. Then send the "Print" command to the central computer. Printout begins. The cards must be loaded and print forms aligned before requesting the read or print.

Further instructions are beyond the scope of this book. Refer to the publications covering your particular Central Computer Communications system for further information.

section 3

programming

This Remote Batch Terminal contains resident controlware routines conforming to the 200 USER Terminal Link Control procedures. This allows the Remote Batch Terminal to communicate with any central processor that employs 200 USER Terminal Link Control, Such as the Control Data 6000 and 3000 series computers. The terminal operates with most modems conforming to EIA Standard RS-232-C, and is compatible with AT&T synchronous 200 series data sets. Data rate is dependent only on the speed of the peripheral devices, and can range from 2000 to 9600 bits per second. Operation is half duplex, meaning that the terminal can transmit or receive, but not both at the same time. Communication codes are operator selected for External BCD, Internal BCD, and ANSI.

This section outlines function description, word format, message format, types of messages, code repertoire, and message processing. Unless noted otherwise, all examples are given in External BCD coding.

FUNCTIONAL DESCRIPTION

The major purposes of the 200 USER Terminal Emulation controlware for this terminal are as follows:

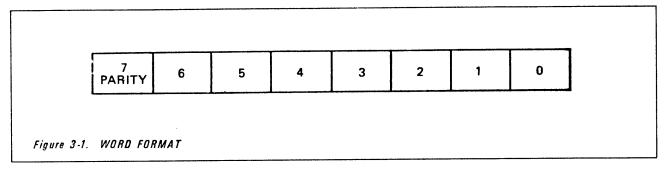
- (a) Interpret messages transmittedby the higher level processor;
- (b) transmit message in response to message received;
- (c) route output data to the correct device;
- (d) accumulate data from input devices;
- (e) transmit data to the higher level processor;
- (f) check and generate word and message parity;
- (g) check for correct controlcodes on messages received;
- (h) attach correct control codes to messages transmitted;
- (i) transmit error messages in response to errors detected.

WORD FORMAT

Communications between the central and remote sites are bit serial, word serial. Each word is 8 bits including one parity bit as shown in figure 3-1. A bit is transmitted and received as either a 1 0r 0. Bit 0 is received and transmitted first. The order of 1's in bit positions 0 through 6 determines the code represented by the word. These bits enable a total of 128 different codes.

The receiving routine uses the parity bit to determine correct receipt of the word. The transmitting routine counts the number of 1's in bits 0 through

6 of a generated word. If the number is even, it sends a 1 for bit 7 making the total number of 1's odd. If the number is odd, it sends a 0 for bit 7. Upon receipt, the receiving routine counts the number of 1's in all bit positions. If the number of 1's is odd, it accepts the word. If the number of 1's is even, it initiates an error sequence. Because generating and checking the parity bit is not a programming function but is controlled by the transmitting and receiving resident controlware, codes in this section do not include the parity bit unless otherwise indicated.

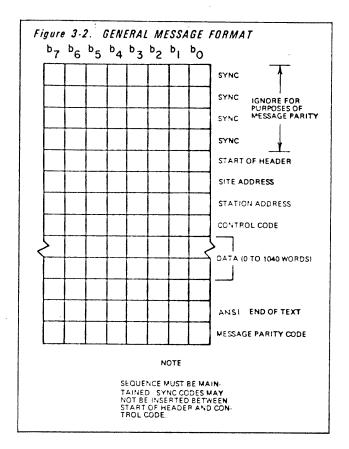


MESSAGE FORMAT

Messages received and sent by the terminal consist of codes in a defined sequence. Figure 3-2 shows the general message format. Any deviations from the established sequence can result in an aborted operation depending upon the point at which the deviation occurred.

Codes listed are a 7-bit length defined in octal.

Four sync codes (026) must precede all messages to assure synchronization recovery at the receive end. Sync codes are not considered for purposes of message parity regardless of their position in the message format.



The start of heading code (001) follows the sync codes. It informs the receiving device that the following two codes are addresses (site and station) and denotes the beginning of the message.

Codes 160 through 177 octal, when used in the site address position of the message format, specify the terminal receiving or transmitting the message.

Since more than one terminal may be sharing a common telephone line, each must be assigned a separate address. The site address is loaded into the routine by the operator when communication parameters are selected.

The station address was used for multistation terminals. This terminal is single station, so the station address is not necessary for that originial purpose. However, to stay compatible with existing formats, the 141 or 161 station address is used. The two codes are used to check for telephone line interruptions, as explained later under "Redundant Responses".

Transmission control codes
define the type of message being sent or
received. In the case of messages containing data, the control code also may
specify that data be cleared and/or
the cursor reset. Transmission control
codes are further defined under "Types
of Messages" later in this section.

Codes 040 through 137 designate the 62 symbols and space. In addition, when an escape code is sent by the data source, the single code following the escape code is interpreted as terminal control, for example, End Of Text or New Line. In a terminal-initiated message, the escape code is automatically generated when a key which performs a terminal control function is depressed.

Symbol codes and terminal control codes are further explained later in this section.

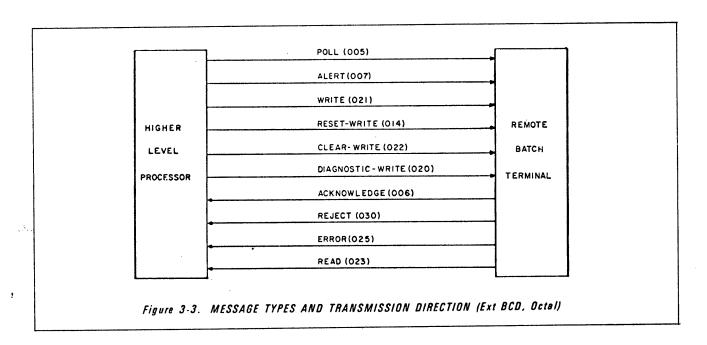
The ANSI end of text code (003) follows the message text or the trans-mission control code in messages without text. The code is automatically generated as defined by the message type and sequence.

The message parity code is the last word of any message. Message parity is applicable from the start of heading through the ANSI end of text,

excluding all sync codes. It ensures that an odd number of 1's have been transmitted in each bit position. With odd parity on each word and a final message parity code, vertical and longitudinal redundancy checking is provided. Bit 7, however, is parity only for the message parity word and is meaningless for the purpose of message parity.

TYPES OF MESSAGES

All messages conform to the general message format governed by the transmission control code of the sequence. Figure 3-3 shows the various messages, the controlling codes, and the transmission direction. The following discussions define each message type, its purpose, and its distinctive format.



POLL MESSAGE

Since the terminal is, generally, one of many sites involved in a remote communications system, the higher level processor must scan each site in the search for messages. The poll message achieves this function. It interrogates each site sequentially, using the respective site address. The site poll message uses station address 140 or 160. This starts a resident controlware scan of each device in the terminal, looking for a read request. The operator can generate

a read request from the keyboard by depressing the ETX key.

All other read requests are generated as responses to alert or write messages. If there is a read request active, the terminal transmits a read message to the higher level processor. If no read requests are present, the terminal sends a reject message.

The format for a site poll message is shown in table 3-1. A site address of 161 and a station address of 140 is assumed.

TABLE 3-1. SITE POLL MESSAGE FORMAT

CODE	7-BIT OCTAL				SA	MPLE			
DESCRIPTION	TRANSLATION	Р	24	25	24	23	22	21	20
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
SYNC	. 026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
START OF HEADING	001	0	0	0	0	0	0	0	1
SITE ADDRESS	161	1	1	1	1	0	0	0	1
STATION ADDRESS	140	1	1	1	0	0	0	0	0
POLL	005	1	0	0	0	0	1	0	1
ansi end of text	003	1	0	0	0	0	0	1	1
MESSAGE PARITY	151	1	1	1	0	1	0	0	1

ALERT MESSAGE

An alert message informs the terminal that the higher level processor has a write message for transmission. This alert message is used to see if the terminal is ready to receive the write message. Without the alert, the write message would be lost if the terminal were not ready.

The alert message returns an

acknowledge message to the higher level processor on the crt. The operator then presses the ETX key on the keyboard, generating a read message. The poll message following the alert message brings the read message back to the higher level processor. The read message shows the higher level processor that the terminal is ready for the write message. Table 3-2 shows the alert message format.

TABLE 3-2. ALERT MESSAGE FORMAT

CODE	7-BIT OCTAL				SA	MPLE			
DESCRIPTION	TRANSLATION	Ρ	26	25	24	23	22	21	20
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
START OF HEADER	001	0	0	0	0	0	0	0	1
SITE ADDRESS	161	1	1	1	1	0	0	0	1
STATION ADDRESS	141	0	1	1	0	0	0	0	1
ALERT	007	0	0	0	0	0	1	1	1
ANSI END OF TEXT	003	1	0	0	0	0	0	1	1
MESSAGE PARITY	152	1	1	1	0	1	0	1	0

ACKNOWLEDGE MESSAGE

The terminal transmits an acknowledge message in response to a write, reset-write, clear-write, or alert message. This informs the higher level processor that the message was received correctly, and is being processed. The acknowledge message format is shown in table 3-3.

TABLE 3-3. ACKNOWLEDGE MESSAGE FORMAT

CODE	7-BIT OCTAL				SA	MPLE			
DESCRIPTION	TRANSLATION	Р	26	2 ⁵	24	2 ³	22	21	20
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
START OF HEADER	001	0	0	0	0	0	0	0	1
SITE ADDRESS	161	1	1	1	1	0	0	0	1
STATION ADDRESS	141	0	1	1	0	0	0	0	1
ACKNOWLEDGE	006	1	0	0	0	0	1	1	0
ANSI END OF TEXT	003	1	0	0	0	0	0	1	1
MESSAGE PARITY	153	0	1	1	0	1	0	1	1

REJECT MESSAGE

The reject message is transmitted by the terminal when the terminal is polled, but has no read requests pending. The reject message is also used when the terminal is busy and unable to process a received command. The reject message format is shown in table 3-4. If the reject message were sent in response to a site poll message, the station address would be 140 or 160.

TABLE 3-4. REJECT MESSAGE FORMAT

CODE	7-BIT OCTAL				SA	MPLE			
DESCRIPTION	TRANSLATION	Р	26	25	24	23	22	21	20
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
SYNC	· 026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0.	1	1	0
START OF HEADING	001	0	0	0	0	0	0	0	1
SITE ADDRESS	161	1	1	1	1	0	0	0	1
STATION ADDRESS	141	0	1	1	0	0	0	0	1
REJECT	030	1	0	0	1	1	0	0	0
ANSI END OF TEXT	003	1	0	0	0.	0	0	1	1
MESSAGE PARITY	165	0	1	1	1	0	1	0	1

READ MESSAGE

A read message is a transmission of data from the remote terminal for processing at the central site. These messages may end with any one of the three end of text codes — E1, E2, or E3. The message may consist of data from an input station or may be a one word response set up as a result of an alert or write message.

In any event, the E code used specifies the station's status. A message ending with E1 indicates that the information is from the Keyboard and the station can now accept data for display purposes. Figure 3-5 specifies the meanings assigned to E codes in a read response for a printer or reader.

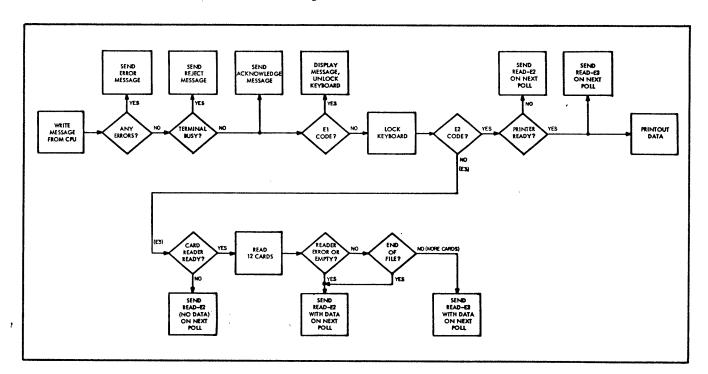


Figure 3-5. READ RESPONSES

The diagnostic-write message is the only one that receives a read response without going through the acknowledge-poll sequence. E codes are meaningless in this response since their source was the preceding diagnostic write; however, they are used to terminate the message.

The E codes as well as certain other function codes are preceded in the read message format by an escape code.

Escape is a flag code used to indicate that the following word has some controlling function. A read message from the keyboard would terminate as follows:

Data
Escape
E1
ANSI End of Text
Message Parity

Tables 3-5 and 3-6 show the proper format for two types of read messages. Table 3-5 shows the format for a read message containing data entered from the keyboard. Site and station addresses of 161 and 141, respectively, are assumed. Three data words are used

in the sample — numerals 1, 2, and 3. The start of text code preceded by an escape code also is used. Codes are listed in external BCD. Table 3-6 shows the format for automatic read messages assuming station address 141 and employing an E3 code for message termination.

TABLE 3-5. READ MESSAGE CONTAINING KEYBOAPD DATA

CODE	7-BIT OCTAL					MPLE			
DESCRIPTION	TRANSLATION	Р	26	2 ⁵	24	23.	22	21	20
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	, 0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
START OF HEADING	001	0	0	0	0	0	0	0	1
SITE ADDRESS	161	1	1	1	1	0	0	0	1
STATION ADDRESS	141	0	1	1	0	0	0	0	1
READ	023	0	0	0	1	0	0	1	1
Escape	076	0	0	1	1	1	1	1	0
Start of Text	042	1	0	1	0	0	0	1	0
1	101	1	1	0	0	0	0	0	1
2	102	1	1	0	0	0	0	1	0
3	103	0	1	0	0	0	0	1	1
Escape	076	0	0	1	1	1	1	1	0
End of Text (E1)	102	1	1	0	0	0	0	1	0
USASCII END OF TEXT	003	1	0	0	0	0	0	1	1
MESSAGE PARITY	136	0	1	0	1	1	1	1	0

TABLE 3-6. AUTOMATIC READ USING E3

CODE	7-BIT OCTAL				SA	MPLE	 :		
DESCRIPTION	TRANSLATION	Р	26	2 ⁵	24	23	22	21	20
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
START OF HEADING	001	0	0	0	0	0	0	0	1
SITE ADDRESS	161	1	1	1	1	0	0	0	1
STATION ADDRESS	143	1	1	1	0	0	0	1	1
READ	023	0	0	0	1	0	0	1	1
Escape	076	0	0	1	1	1	1	1	0
End of Text (E3)	041	1	0	1	0	0	0	0	1
ANSI END OF TEXT	003	1	0	0	0	0	0	1	1
MESSAGE PARITY	143	1	1	1	0	0	0	1	1

WRITE MESSAGE

Information from the central processing site for display or printing is sent in the form of write, reset-write, clear-write, or diagnostic-write messages. A write message designates that data entry must begin at the current cursor position. A reset-write message stipulates resetting the cursor to the beginning of page position (without affecting data already stored) and the message begins at that point. In addition to resetting the cursor, the clear-write message also clears previously received data. These write messages also are used to enable data transmissions during a card read sequence.

The diagnostic-write message is

intended to test the transmission path to a designated station. The message resets the cursor but does not clear previous data. The terminal responds to the diagnostic write by transmitting a read message. This read contains the data originally received in the diagnostic write with one exception. All data codes containing a parity error are returned, in the read, as space codes. The read message terminates with the first E code or a second end of text.

Station addresses used in write messages to a station should alternate bit 4 between a 0 and a 1. For example, if the first write message to a station contained station address 161, the next write message to the same station should use an address of 141. This enables the

station to remember and report the accuracy of the write message (see "Redundant Responses").

Write messages have three basic functions - to display, read cards, or print. The E control code determines the function as follows:

Write E1 - data is displayed.

Write E2 - data is printed.

Write E3 - sets a Card Reader read request, so that the next poll message will receive a Read E3 message

The write message normally solicits a response from the terminal in the form of an acknowledge message. However, should the addressed station be busy at the time, a reject message

transmits instead. Any error conditions result in an error sequence described later. As stated before, a diagnostic write message obtains a read message response.

Tables 3-7 through 3-10 show the proper format for each of the four types of write messages. In each, a site address of 161 is assumed. The station address varies. Three data words are used in each sample program — numerals 1, 2, and 3. Codes are external BCD.

In addition to the above listed E codes, there are three other types of control codes that may appear in write messages. These are the end of line, new line, and compression codes.

TABLE 3-7. WRITE MESSAGE FORMAT

		i			C A I	MPLE			
CODE DESCRIPTION	7-BIT OCTAL TRANSLATION	Р	26	25		23		21	20
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	ו	0
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
START OF HEADING	001	0	0	0	0	0	0	0	1
SITE ADDRESS	161	1	1	1	1	0	0	0	1
STATION ADDRESS	141	0	1	1	0	0	0	0	1
WRITE	021	1	0	0	1	0	0	0	1
1	101	1	1	0	0	0	0	0	1
2	102	1	1	0	0	0	0	1	0
3	103	0	1	0	0	0	0	1	1
Escape	076	0	0	1	1	1	1	1	0
End of Text (E1)	102	1	1	G	0	0	0	1	0
ANSI END OF TEXT	003	1	0	0	0	0	0	1	1
MESSAGE PARITY	100	0	1	0	0	0	0	0	0

TABL	E 3-8. RESET-WRITE	MES	SA	GE	FOR	MA	T		
CODE DESCRIPTION	7-BIT OCTAL TRANSLATION	P	26	25	24	5AA 2 ³			20
SYNC SYNC SYNC SYNC SYNC START OF HEADER SITE ADDRESS STATION ADDRESS RESET-WRITE 1 2 3 Escape	026 026 026 026 001 161 141 014 101 102 103	0 0 0 0 0 1 0 1 1 0 0	0 0 0 0 0 1 1 0 1	0 0 0 0 0 1 1 0 0 0 0 1	1 1 1 0 0 0 0 0	0 0 0 0 0 0 1 0 0 0 1	1 1 1 0 0 0 1 0 0 0 0 1	1 1 1 0 0 0 0 0	0 0 0 1 1 1 0 1
End of Text (E2) ANSI END OF TEXT MESSAGE PARITY	076 040 003 077	0 1	0 0 0	1 0 1	0 0 1	0 0 1	0 0 1	0	0 0 1 1

CODE	E 3-9. CLEAR-WRITE	T					APLE	:	
CODE DESCRIPTION	7-BIT OCTAL	_	-6	55	5 2 ²				1 0
DESCRIPTION	TRANSLATION	P	2	2	2	2`	2	2	20
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	Õ
SYNC	026	0	0	0	1	0	i	i	Ô
SYNC	026	0	0	0	1	0	1	i	Õ
START OF HEADER	001	0	0	0	0	Ō	Ó	ò	1
SITE ADDRESS	161	1	1	1	1	0	ō	0	i
STATION ADDRESS	141	0	1	1	0	0	Ō	Õ	i
CLEAR-WRITE	022	1	0	0	1	0	Õ	1	ò
1	101	1	1	0	Ô	0	0	ò	ĭ
2	102	1	1	Ō	ō	0	0	ĭ	ò
3	103	0	1	Ō	Ō	Õ	0	i	ĭ
Escape	076	0	0	1	1	1	ì	i	ò
End of Text (E1)	102	i	1	ò	0	ò	ò	i	Ô
ANSI END OF TEXT	003	1	0	0	0	0	ŏ	i	ĭ
MESSAGE PARITY	103	0	ì	0	Ô	0	0	i	i

TABLE 3-10. DIAGNOSTIC-WRITE MESSAGE FORMAT									
					SA	MP	LE		
CCDE DESCRIPTION	7-BIT OCTAL TRANSLATION	Р	26	2 ⁵	·4	23	22	21	20
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
START OF HEADING	001	0	0	0	0	0	0	0	1
SITE ADDRESS	161	1	1	1	1	0	0	0	1
STATION ADDRESS	143	1	1	1	0	0	0	1	1
DIAGNOSTIC-WRITE	020	0	0	0	1	0	0	0	0
1	101	1	1	0	0	0	0	0	1
2	102	1	1	0	0	0	0	1	0
3	103	0	1	0	0	0	0	1	1
Escape	076	0	0	1	1	1	1	1	0
End of Text (E2)	040	0	0	1	0	0	0	0	0
ANSI END OF TEXT	003	1	0	0	0	0	0	1	1
MESSAGE PARITY	041	1	0	1	0	0	0	0	1

Only new line performs an operation on the display. New Line erases the remaining data to the right of the cursor and advances the cursor to the start of the next line. This avoids having to use individual blank space codes for the unused remainder of the line.

The end of line and compression codes have meaning only to the line printer. Those two code types are not recognized in the diagnostic write message, and are interpreted as symbol codes. The use of these codes in all other write messages is explained later under code repertoire.

ERROR MESSAGE

The terminal generates an error message as a response to a received message in error. The terminal's reaction to a word parity error depends upon the point in the message at which it is detected. The following is a breakdown of the general message format listing the terminal's response to a word parity error on each code. A word parity error in a diagnostic—write message, however, does not initiate an error message response. Instead, a parity error code is stored in memory and a space code is substituted in the read response.

Table 3-11 lists all error conditions with the exception of word parity which was previously discussed. In each case, the terminal generates an error message to indicate incorrect mes-

sage receipt. Table 3-12 shows the proper error message format using addresses of 161 for site and 141 for station.

TABLE 3-11. MESSAGE ERRORS

	TABLE 3-11. MESSAGE	RRORS
ERROR CONDITION	C AUSE	ACTION
Nonexistent Station	Station address selects a station that is phy- sically nonexistent or electrically not ready.	The Remote Terminal aborts the received message upon error detection.
Station 140 or 160 in a Message other than Poll.	Station address 140 or 160 received for Alert, Write, Reset Write, Clear Write or Diagnostic Write,	The Remote Terminal aborts the received message upon error detection.
Unrecognized Message Control Code	Message control code other than Poll, Alert Write, Reset Write Clear Write, or Diag- nostic Write,	The Remote Terminal aborts the received message upon error detection.
No E or STX Code	No E1, E2, or STX code in Write, Reset- Write, or Clear-Write message text.	The Remote Terminal aborts the received message upon error detection. Data is stored in memory, but the keyboard remains locked out and printout is prevented.
Message Parity Error	Incorrect message parity	The Remote Terminal aborts the received message upon error detection. Data is stored in memory, but the keyboard remains locked out and printout is prevented.
Carrier Drop	Modem Carrier On signal drops before EOT or message parity code is received.	The Remote Terminal aborts the received message upon error detection.

TABLE 3-12. ERROR MESSAGE FORMAT

CODE	7-BIT OCTAL				SAMPLE				
DESCRIPTION	TRANSLATION		26	2 ⁵	24	23	22	21	20
SYNC	026	0	0	0	1	0	1	1	0
SYNC .	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
SYNC	026	0	0	0	1	0	1	1	0
START OF HEADING	001	0	0	0	0	0	0	0	1
SITE ADDRESS	161	1	1	1	1	0	0	0	1
STATION ADDRESS	141	0	1	1	0	0	0	0	1
ERROR	025	0	0	0	1	0	1	0	1
ANSI END OF TEXT	003	1	0	0	0	0	0	1	1
MESSAGE PARITY	170	1	1	1	1	1	0	0	0

CODE REPERTOIRE

The American National Standards Institute (ANSI) Standard Code for Information Interchange has become a common code repertoire for data processing equipments. However, many central processors still operate with a binary-coded decimal (BCD) repertoire. The Remote Batch Terminal resident controlware is set up for the External BCD, Internal BCD, and

ANSI code repertoires. Because most modems conform to the ANSI standards, the External BCD and Internal BCD repertoires must conform to ANSI standards. The codes shown in the following tables meet these requirements.

The four basic groups of codes are the address, transmission control, symbol, and terminal control groups.

ADDRESSES

Addressing a message to a Remote Terminal requires a site address and a station address. The Remote Terminal, under its own program control, acts as a single station terminal. The station address is a requirement of the 200 USER format for multistation terminals. As mentioned previously, the station address is used as a check on communication line reliability. This use is explained in Section IV, under "Redundant Responses."

TABLE 3-13. ADDRESSES.

	ODE	SITE NUMBER	7-BIT OCTAL CODE	SITE NUMBE
160		1	170	9
161		2	171	10
162		3	172	11
163		4	173	12
164		5	174	13
165		6	175	14
166		7	176	15
167		8	1 <i>7</i> 7	16
140* 1	60*	STATION		
141* 1	61*	CODES		

^{*}These addresses may only be used in site poll messages and the reject response to the site poll.

TRANSMISSION CONTROL

Transmission control codes determine the type of message and also control transmission of each message. These codes are listed in table 3-14.

TABLE 3-14. TRANSMISSION CONTRO	L CODE REPERTOIRE
NAME	7-BIT OCTAL CODE
Start of Heading (SOH)	001
ANSI End of Text (ETX)	003
Poll (ENQ)	005
Acknowledge (ACK)	006
Alert (BEL)	007
Reset Write (FF)	014
Diagnostic Write (DC4)	020 EXT, BCD, INT, BCD
	024 ANSI
Write (DC1)	021
Clear Write (DC2)	022
Read (DC3)	023
Error (NAK)	025
Synchronization (SYN)	026
Reject (CAN)	030
Escape (ESC)	076 EXT BCD
	136 INT BCD
	033 ANSI

SYMBOL DATA

The symbol repertoire includes the alphabet in uppercase, Arabic numerals (0 through 9), punctuation marks, and special symbols. Table 3-15 presents the symbols in alphabetic and numerical order. The typewriter-produced symbols shown do not necessaryily reflect actual images reproduced by the display. Codes shown are the 7-bit codes on line between the modem and terminal (parity bit has not been included in this list). External BCD, Internal BCD or ANSI code is chosen during the AUTOLOAD of the On-Line controlware.

The array of holes on a punched card is interpreted as Hollerith coding. An example of a punched card is given in figure 3-6. In Hollerith, each column represents one word or character. The are 12 rows (channels) and each character has 12 hole positions. The numbers given in the Hollerith code have a corresponding row number on the punched card with the exception of row 11 and 12. Row 12 is the uppermost row, while row 11 is the next lower row. Two types of Hollerith coding are listed; either 026 or 029 code is chosen during the AUTOLOAD of the on-line controlware.

TABLE 3-15. SYMBOL CODE REPERTOIRE

No punch No punch Code	_				BCD				
No purch No purch Space Code	<u> </u>	 7	ANSI		Printer	lot		026	029
No Code Co	l			ASCII	CRT-				
**No purch No purch 2/0-20(16) Space 2/2 2/2	1			Code				Cord	Code
8-8-6 8-3 9-7 2/1-210-7 0-8-6 8-3 11-8-1 11-		Code	Code		Char.		1		
8-4	-	No punch	No punch	2/0-20	Space	60.	120 _p		No punch
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NOTE 1: The BCD Terminal is a 63-character device.

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	2	3	233223333333333333333333333333333333333
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	20	•	449-99999999999999999999999999999999999

TERMINAL CONTROL CODES

Any time an escape code is encountered in a message, the following code is assumed to have special significance. This escape code is generated by the terminal and does not have to appear on a punched card. Table 3-16 lists the entire control code repertoire. The interpretation applied to these codes by the various stations is described in the following paragraphs.

DISPLAY INSTRUCTIONS

These instruction codes control
the format and presentation of a display
message. Each instruction from the
central computer <u>must</u> be preceded by
the Escape Code. "Escape" refers to
getting out of the symbol code repertoire.
Without Escape, the control code would
be treated as a data word. Any codes
other than these instruction codes, that
are preceded by Escape, will be treated
as normal data. Display control codes
perform the functions listed below.

BACKSPACE

When received in a write message, the cursor will be moved back one position, without affecting displayed data.

NEW LINE

When transmitted by the terminal, this indicates the end of a current line of data. When received by the terminal, it clears remaining data on that line, and it moves the cursor to the start of the next line.

LINE SKIP

When received by the terminal, the cursor is advanced to the start of the next line, without affecting displayed data. Line skip is not transmitted by the terminal.

SKIP

Skip is not transmitted by the terminal, but when received, the cursor is moved to the next symbol position.

Existing data is not affected.

RESET

Moves the cursor back to the start of the top line, without erasing displayed data. This code cannot be transmitted by the terminal.

CLEAR

This code removes all data from memory and display, and resets the cursor to the start of the top line.

TABLE 3-16. TERMINAL CONTROL CODES (Octal)

INT BCD	ANSI	EXT	DISPLAY/	LINE PRINTER	CARD READER	CARD CODES 026 029
BCD		BCD	KEYBOARD		KLADLK	020 027
040	040	040	None	E2	E2	
041	041	041	None	E3	E3	
042	042	042	STX	None	None	
043	043	043	None	Compress 3 Spaces	None	1
044	044	044	None	Compress 4 Spaces	None	
045	045	045	None	Compress 5 Spaces	None	
046	046	046	None	Compress 6 Spaces	None	
047	047	047	None	Compress 7 Spaces	None	
050	050	050	None	Compress 8 Spaces	None	
051	051	051	None	Compress 9 Spaces	None	
052	052	052	None	Compress 10 Spaces	None	
053	053	053	None	Compress 11 Spaces	None	
054	054	054	None	Compress 12 Spaces	None	
055	055	055	None	Compress 13 Spaces	None	
056	056	056	None	Compress 14 Spaces	None	
057	057	05 <i>7</i>	None	Compress 15 Spaces	None	
120	060	060	None	Compress 16 Spaces	None	
121	061	061	None	Compress 17 Spaces	None	
122	062	062	None	Compress 18 Spaces	None	
123	063	063	None	Compress 19 Spaces	None	
124	064	064	None	Compress 20 Spaces	None	,
125	065	065	None	Compress 21 Spaces	None	
126	066	066	None	Compress 22 Spaces	None	,
127	067	067	None	Compress 23 Spaces	None	
130	070	070	None	Compress 24 Spaces	None	
131	071	071	None	Compress 25 Spaces	None	
132	072	072	· None	Compress 26 Spaces	None	
133	073	073	None	Compress 27 Spaces	None	
134	074	074	None	Compress 28 Spaces	None	
135	075	075	None	Compress 29 Spaces	None	,
136	076	076	None	Compress 30 Spaces	76	
136	033	076	Escape	Escape	Escape	
137	077	077	None	Compress 31 Spaces	None	
i	1	ı	i	5	•	, ,

TABLE 3-16. TERMINAL CONTROL CODES (OCTAL) (CONT)

INT BCD	ANSI	EXT BCD	DISPLAY/ KEYBOARD	LINE PRINTER	CARD READER	CARD CODES 026 029
101	012	101	New Line (LF)	New Line	None	
102	102	102	El	None	None	
103	103	103	None	Compress 3 Zeros	None	
104	104	104	None	Compress 4 Zeros	None	
105	105	105	None	Compress 5 Zeros	None	
106	106	106	None	Compress 6 Zeros	None	
107	107	107	None	Compress 7 Zeros	None	
110	110	110	None	Compress 8 Zeros	None	
111	111	111	None	Compress 9 Zeros	None	
100	112	11.2	None	Compress 10 Zeros	None	
113	113	113	None	Compress 11 Zeros	None ·	
114	114	114	None	Compress 12 Zeros	None	
115	115	115	None	Compress 13 Zeros	None	
116	116	116	None	Compress 14 Zeros	None	
117	117	117	None	Compress 15 Zeros	None	
060	100	120	None	End of Line	None	
062	122	122	Line Skip (ESC)		None	
063	123	123	Clear (CAN)		None	
064	124	124	Line Clear (EM)		None	
066	034	126	None		End of File (FS)	6-7-8-9 11-9-8-4
067	036	127	None		End of Record (RS)	7-8-9 11-9-8-6
071	131	131	Skip (US)		None	
072	132	132	Reset (FF)		None	
003	003	003	ETX	None	None	
004	004	004	EDT	None	None	

START OF TEXT

Used to define the beginning point of a message. When encountered in a write message to the display, the STX symbol (=) is entered at the cursor position.

LINE PRINTER INSTRUCTIONS

For the most part, instructions to the Line Printer consist of compression, end of line, and end of text codes. Each time a compression code is received, the Line Printer "prints" the specified number of zeros or spaces as listed in table 3-16. These codes must be preceded by an Escape code. Any code other than those listed, when preceded by Escape, results in no action. These wrong codes will be treated as normal data, or, if no symbol exists for that code, the PRINTER Error Light will light and error code X8X will be displayed. The Printer also recognizes formate control codes as defined in Section IV.

CARRIAGE RETURN

When the Line Printer receives a Carriage Return code, printing of the present line stops, and printing then resumes as determined by the Format Control code (see Section IV).

Defines the End of Text in a read message. When detected in a write message, the E1 symbol (Δ) is displayed at the cursor position. The cursor advances one position.

END OF LINE

As in Carriage Return, this code stops printout on the present line, and control is turned over to the Format Control code (see Section IV).

E2

Any data for printout must use E2 at the end of the message. In Off Line (Local) operation, a display to printer E2 code will terminate printout and perform a page eject. A reader to printer E2 will terminate printout and perform a line feed. In On Line operation, E2 merely terminates printing; page eject or line feed must be done with Format Control codes. In a one-word read response from the terminal, the E2 means the printer is Not Ready.

E3

The terminal transmits an E3 code in a one-word read response to indicate the printer is Ready. The data source should use the E3 (or E1) instruction in a write message to clear the printer Busy status after a print sequence.

CARD READER INSTRUCTIONS

Although the reader is an input device, it responds to certain commands.

All other instructions will be ignored.

These paragraphs list all legal instructions as well as all control codes the reader may send in a read response.

END OF FILE

Whenever the reader encounters a Hollerith Card with end of file code (6,7,8,9 rows) then the remaining data on the card is not stored, and the reader stops reading the current batch of data. An E3 code is inserted, and the batch is transmitted as the next read response. Another write message is required to continue the sequence.

END OF RECORD

If the reader detects an end of record code (7,8,9 rows) on a Hollerith card, then the remaining data on the card is not stored or transmitted. The sequence normally continues with the next card.

E2

The E2 code is sent as the end of text code by the terminal, when the reader is Not Ready. This code may be a one-word response message, or it may

come at the end of a batch of card data. Sending E2 signifies a hopper empty, stacker full, stacker jam, card jam, or an error condition that requires operator attention. The E2 (or E1) code may be sent by the data source to release the reader after a read operation.

E3

When cards are to be read, the write message received at the terminal must end with E3. When transmitted by the terminal in a read message, it means the reader is Ready, and able to read cards.

section 4_____ programming aids

This section summarizes information of the previous sections, and gives greater detail of the more unusual characteristics of this terminal.

possible responses returned by the terminal. Station addresses shown are 141, but would actually alternate between 141 and 161. The station address in the response must be the same as the one in the data source message. (See Redundant Responses.)

MESSAGE RESPONSES

All Remote Terminal messages are in response to data source messages. Table 4-1 lists messages sent by the data source and

TABLE 4-1. MESSAGE RESPONSES

MESSAGE DATA S		RESPONSE REMOTE T		
MESSAGE TYPE	STATION ADDRESS	MESSAGE TYPE	STATION ADDRESS	response Significance
Any message		No response		An error was detected before the station address in the message format.
Any messag e		Error		An error was detected in the data source mes-sage.
Site Poll	140	Reject	140	The Remote Ter- minal has no message ready for the data source.
Site Poll	141	Read	141	The text portion of the response contains data from the terminal.
Alert	141	Ack	141	The message was received correctly.
Write Reset Write, or Clear Write	141	Ack	141	The message was received correctly.

MESSAGES FOR PRINT

In order for a message to be printed, it is necessary that it terminate with an escape code followed by an E2 code.

An alert message may be used first to determine the terminal's operating status. The terminal responds with an acknowledge message. In response to the next poll, the terminal will issue a one-word read message.

The one-word read response will contain an escape code followed by either an E2 or E3 code. An E2 code states that the device is not ready (power off, out of paper, etc). The E3 code signifies that the station is ready to process a message.

A read request is also raised after each print message is received and processed. This allows the data source to continually monitor operating status during an extended printout. To end the sequence, the data source should send a one-word write message (terminating with escape followed by E1 or E3) to release the printer.

PRINT MESSAGE SEQUENCE

MESSAGE (FROM CPU)	MESSAGE (FROM TERMINAL)		
Write-El (request command)	Acknowledge		
Poll	Read E1 (Display command)		
Write-E2 (first data)	Acknowledge •		
,	Store data, Lock Keyboard		
Pol l	Read-E3		
	Begin printing		
Write-E2 (second data)	Acknowledge		
,	Store data •		
Poll	Reject - Still		
	printing first data		
	Storage full.		
Poll	Read-E3		
	Begin Printing second		
	data • Storage open •		
Write-E2 (third data)	Ack nowledge •		
	Store data		
	•		

Write E1 (request new command)

unlock Keyboard)

Read E 1 (new Display command)

Messages processed by the Line Printer differ somewhat from other messages. Any write, reset-write, or clearwrite containing an escape code, followed by an E2 code, allows transfer of the message to the printer. The Line Printer has line truncation, format control, and character compression features which are governed by control codes in the message.

LINE TRUNCATION

Print lines can be truncated through the use of an escape code followed by an end of line or carriage return code. These two codes enable the rest of the current print line to be filled with blanks.

Since the Line Printer does not perform truncation automatically after an end of line code, it must be programmed to do so.

FORMAT CONTROL

When the Line Printer is operating, the first data code of a line is recognized as a format control code and is not printed. The first code following an end of line or

carriage return control code is also interpreted as a format control code. The four format control codes are shown in table 4-2.

		TAI	BLE 4-2. FORMAT CONTRO)L
ANSI	INT BCD	EXT BCD	OCTAL CODE/ KEYBOARD	FUNCTION
040 112 101 120	060 100 101	120 112 101 060	00/0 , Space 12/ NEW LINE 01/ SHIFT , Space 60/ SEND INDEX , SHIFT	Single space (vertical) Double space (vertical) Page eject — advance to beginning of next form Suppress space — maintain current line (do not space)

Any codes other than those shown are interpreted as single spacing. All operations are performed before subsequent printout of data (preprint).

Proper use of the format control code prevents the possibility of over-print. For example, if the format control code beginning the first line is a suppress space, overprint is possible. The use of the suppress-space code also makes over-print possible within a message.

Table 4-3 shows the proper format to follow when composing a print message.

TABLE 4-3. DATA SOURCE PRINT MESSAGE FORMAT

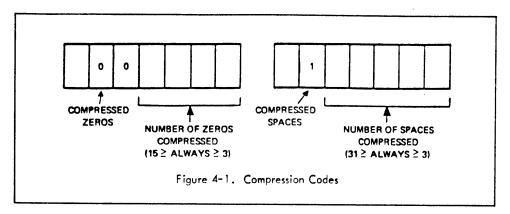
LINE	(EXT BCD)	FORMAT	DESCRIPTION
First Line	xxx	FMT	Any format control code in table 4-2 except suppress space.
	XXX	Data	Data and compression codes restricted to this area.
	xxx	Data	
	076	Escap e	
	120	EOL	Carriage return (101 EXT BCD) may also be used.
Succeed- ing Lines	xxx	FMT	Any format control code in table 4-2. Suppress space may be used to maintain same line.
	xxx	Data	Data and compression codes restricted to this area.
	xxx	Data	
	076	ESCAPE	·
	120	EOL	Carriage return may also be used.
Last Line	xxx	FMT	Any format control code in table 4-2. Suppress space may be used to maintain same line.
	xxx	Data	Data and compression codes restricted to this area.
	xxx	Data	
	076	ESCAPE	
	120	EOL	Carriage return may also be used.
	101	FMT	Page eject used to advance paper to beginning of next form for next message.
	076	ESCAPE	
	040	E2	End of print message.

Note — FMT is format control code: EOL is end of line code. EXT BCD used in this example.

CHARACTER COMPRESSION

The Line Printer allows data source compression of strings of zeros or spaces. This means that the data source need only send an escape code followed by one other code to enable printout of a specifified number of zeros or spaces in succession. This character compression oper-

ation cannot take place simultaneously with format control. Consequently, the first code for a line cannot be used for character compression in an effort to space and print out a string of zeros or spaces. The data compression codes are interpreted as shown in figure 4-1.



CARD READ SEQUENCE

When cards are loaded, and the reader started, the first 12 cards are read into core memory. Then the read command and ETX are keyed in and displayed. The central computer responds with a Write E3 (Read Cards) and the Terminal Acknowledges. The following Poll is answered with a Read E3 message containing data from the first 12 cards. While this data is being sent, the next 12 cards are read into a second buffer in core memory. The next Write E3 -Acknowledge - Poll - Read E3 sequence transmits the second 12 cards of data, while the third file of 12 cards is being read.

If the Card Reader goes Not Ready (card jam, out of cards, etc.), while a memory buffer is being filled, then that data is sent with a Read E2 message. In the case of a card jam, it is necessary to re-read the entire card deck, to make certain the core memory buffers are filled properly.

CARD F	CARD READ MESSAGE SEQUENCE					
MESSAGE (FROM CPU)	RESPONSE (FROM TERMINAL)					
Write-E1 Poll Write-E3 Poll Write-E3 Poll Write-E3 Poll Write-E1	Acknowledge Read-E1 (Display command) Acknowledge Locks Keyboard Read-E3 (12 cards data) (Store next 12 cards data) Acknowledge Read-E3 (12 cards data) (Store next 12 cards data)					

REDUNDANT RESPONSES

Normally the terminal responds to each write message with an acknowledge reject, or error message. The type of response issued tells the data source that:

Telephone channel errors normally occur in bursts which result in unintelligible communications. A situation such as this could leave the data source in doubt as to the status of the write message. With proper programming, the terminal is capable of providing this status and alleviating the consequences of telephone channel error bursts.

A restriction should be placed on the use of station addresses when programming write messages. Alternate use of the two addresses for a station (see table 3-13) in each successive write mes-

- (1) Either the write message was received correctly or incorrectly.
- (2) If correctly received, the terminal either was not ready at the time and could not process the write, or ready and the write message was processed.

sage to a particular station is imperative. In addition, the first message in a sequence must utilize one of the addresses in the left-hand column (160 to 177) in table 3-13. If the write message is correctly received, the terminal returns the same address in its response. Incorrect receipt results in a response with the alternate address. The following list shows the station address situation for both correct and incorrect receipt of write messages. Normally the data source retransmits a write message if it is received incorrectly. Message 5 indicates this procedure.

	Transmitted Message	Station Address	Response Message	Station Address
Message 1	Write	161	Acknowledge	161
Message 2	Write	141	Acknowledge	141
Message 2 Message 3	Write	161	Acknowledge	161
	Write	141	Error	161
Message 4 Message 5	Write	141	Acknowledge	141

If the data source fails to receive a response correctly, another message (station poll, or alert) may be transmitted in an effort to determine the status of the preceding write message. This new message may use either of the station addresses. If the original write message is received correctly, the response to the second transmission supplies the original station address.

In the following list, the acknowledge message response to the write message marked with an asterisk (*) is assumed to have been destroyed by a telephone channel error burst. By transmitting a poll message, the data source receives a reject message response (assuming no read requests) containing the station address used by the preceding write. This station address tells the data source that the previous write message was received and processed correctly and retransmission is not necessary.

If the write message has been received incorrectly, the error message response (assuming the response is enabled) contains the alernate station address as shown by the following list.

	Transmitted Address	Station Address	Response Message	Station Address
Message 1	Write	161	Acknowledge	161
Message 2	Write	141	Acknowledge	141
Message 3	Write	161	Acknowledge*	161
Message 4	Poll	141 or 161	Reject	161
Message 5	Write	141	Acknowledge	141

Assuming a telephone channel error burst destroys this error response, the data source transmits a poll message to determine the status. An alternate address

in the reject message response informs the data source of the error condition in the previous write. Retransmission of the write message is the normal procedure

	Transmitted Message	Station Address	Response Message	Station Address
Message 1	Write	161	Acknowledge	161
Message 2	Write	141	Acknowledge	141
Message 3	Write	161	Error	141
Message 4	Poll	141 or 161	Reject	141
Message 5	Write	161	Acknowledge	161

TERMINAL CONTROL CONSOLE ERROR DISPLAY

The resident controlware includes limited self-diagnosis, with problems called out via the Terminal Control Console indicators. These faults that can be corrected by the operator are called out in the following table. If the listed actions do not cure the

fault, call the authorized Customer Engineer (CE). In the case of Communications Errors, the Terminal automatically re-tries to get a good message. If the communication line is lost completely, the operator must re-establish the line.

TABLE 4-4. ERROR DISPLAYS

DEVICE INDICATED	ERROR CODE	FAULT	OPERATOR CORRECTIVE ACTION
PRINTER	XX2	Not Ready (Stopped).	Check for X1X, X2X, X4X conditions. Correct the fault, then restart.
	XX4	Sync Error.	Automatic recovery, but that print line may be lost. Re-run job.
	XX8	Paper Runaway.	Restart job.
	XIX	Paper Fault (empty or torn).	Replace paper.
	X2X	Drum Arm Panel not latched.	Close Panel securely.
	X4X	Hammer Fuse blown or Power Supply Fault.	Call Customer Engineer.
	X8X	Illegal Character Code.	(1) Restart job. (2) Check central computer data for missing Escape code, or wrong character code.
CARD READER			
(LOW SPEED)	XX2	Not Ready.	Check for conditions below.
	XX4	Strobe Count Error.	Call Customer Engineer if this persists.
	XIX	Dark Check Failed.	(1) Clean card path. (2) Restart. (3) Call CE.
	X2X	Light Check Failed.	(1) Clean card path. (2) Restart. (3) Call CE.
	3XX	Card Jam at Read Head.	Clear Card jam.
	4XX	Hopper Empty or Stacker Full.	Load or unload cards.
	8XX	Card Jam at Hopper.	Clear card jam.

TABLE 4-4. ERROR DISPLAYS (CONT)

DEVICE INDICATED	ERROR CODE	FAULT	OPERATOR CORRECTIVE ACTION
CARD READER (MEDIUM	V//3	Cluth Fault.	Coll CE.
SPEED)	XX1 XX2	Not Ready (Stopped).	Depress START, then correct other faults displayed.
	XX4	Column Count Error. (Card Slipped).	(1) Restart. (2) Clean Card Path.
•	XX8	Skew Error or Skew Test	Clean Card Path.
	XIX	Dark Check Failed.	Clean Card Path.
	X2X	Light Check Failed.	Clean Card Path.
	X4X	0° Switch Fault.	Call CE.
	X8X	321° Switch Fault.	Call CE.
	1XX	Card Jam at Read Station or Exit station.	Clear Card Jam.
	2XX	Motor Off (due to Open Interlock, or control failure).	Clear the error. Restart.
	4XX	Stacker Full or Hopper Empty•	Load or unload cards.
	8XX	Card Feed Failed.	(1) Restart. (2) Clean Card Path, especially Picker Knives.
PERIPHERAL I	001	Illegal Hollerith Card	(1) Inspect the last 24 cards for an illegal Hollerith punched code. Correct that card.
			(2) Re-Autoload and go back On-Line. (3) Re-read the last 24 cards.
501114	XXI	Head Select Fault.	Call CE.
DRUM FAULT	XX2	Power Supply Fault.	Call CE.
and/or DRUM	XX4	_	Call CE.
PARITY ERROR	XIX		Restart. Call CE.

TABLE 4-4. ERROR DISPLAYS (CONT)

DEVICE INDICATED	ERROR CODE	FAULT	OPERATOR CORRECTIVE ACTION
COMM. ERROR	XX1	2 Sync Codes not received.	Automatic Recovery.
(Communi-	XX2	Too Many Control Codes.	Automatic Recovery.
cations Error)	XX4	Start of Header not received.	Automatic Recovery.
	XX8	Unidentified Site Address.	Verify that correct address was entered at Autoload.
	XIX	Unidentified Station	Automatic Recovery.
	X2X	Unidentified Control	Automatic Recovery.
	X4X	Escape Code not Received.	Automatic Recovery.
	X8X	Input Characters Exceeded 1041 Max Total	Automatic Recovery.
	ıxx	End of Transmission not Received.	Automatic Recovery.
	2XX	Message Parity Error.	Automatic Recovery.
	4XX	Carrier on Error.	Automatic Recovery.
•	8XX	Line Synchronization Lost.	Automatic Recovery.
Note: X inc ERRC	dicates th OR and 12	at digit could be any number. 4 indicates three errors: 1XX,	
MEMORY PARIT	Y		Call CE.
DRUM PARITY ERROR.	•		Call CE.
HIGH TEMPERATURE.			Clean Power Cabinet and Controller Cabinet air filters.
TEST MODE.			Indicates maintenance personnel working.
		1	Call CE.

The COMM. ERROR light and Error Code will flash three times each time an error occurs. Then the light and Error Code are turned off. Each individual type of communication Error is handled

this way. If the COMM. ERROR light is frequently flashing, the communications line is probably very poor. The line should be re-established with a different circuit routing.

CONTROLWARE INSTALLATION

After the Terminal has been installed and placed in operation by maintenance personnel, later changes or enhancements to the resident controlware can be installed by the operator. The controlware routines are packaged in a deck of punched cards that can be loaded into the Card Reader and read into the Terminal Controller.* As long as no catastrophe has occurred to the equipment and original controlware, the installation can be done at any time. During this installation, the Terminal is not available to the Central Computer.

The procedure requires relocating a circuit card within the Microdrum assembly. This card relocation allows the new controlware to be entered into the Microdrum memory. After the controlware installation is completed, the card is returned to its original location to preserve contents of the Microdrum memory.

One note of caution is in order. During the time that the Microdrum circuit card is out of its normal operating location, the Microdrum memory is vulnerable to erasure if AC power is removed. The Microdrum memory contains the routine needed to operate the Card Reader and load the controlware installation card deck. A power failure or depressing the Terminal Control Console POWER OFF switch during this vulnerable time could erase the routine needed for controlware installation. If the Microdrum memory is erased, qualified maintenance people must be called to re-start the Terminal. Therefore, it is recommended that this installation not be performed if there is a good chance of having even a momentary power failure. If the erasure does occur, attempt the installation anyway; little time will be lost trying it.

- 1. Remove Terminal Controller Power Cabinet rear panel.
- 2. With a screwdriver or coin, turn the Microdrum drawer lock screws counterclockwise, and gently roll out the drawer.
- 3. Mounted on the inside of the drawer panel is the circuit card chassis. Three horizontal rows of circuit cards are lettered A (top), B (Middle), and C (bottom). The card locations are numbered 1 through 10, from left to right. Gently pull out the card in location B7 (middle row, seventh from left). Re-mount the card in location C7, (bottom row, seventh from left, directly below the slot it was removed from). Slide the card into the C7 card guides, and push it firmly all the way back in. Leave the Microdrum drawer extended.
- 4. At the Terminal Control Console, depress the MASTER CLEAR, CHANNEL CLEAR, and AUTOLOAD switches, in that sequence.
- 5. Load the Controlware Installation card deck into the Card Reader input hopper, and place the card weight on top of the deck.
- 6. If the Card Reader ON LINE indicator is lit:
 - Depress the Low Speed Card Reader ON LINE switch to extinguish the ON LINE indicator, or;
 - Depress the Medium Speed Card Reader ON LINE/OFF LINE switch to light OFF LINE.

The procedures is as follows;

^{*} NOTE: The controlware card deck is packaged with a pink top card showing the Control Data part number. The following punched card has the name and level information printed at the top. Column

⁷⁶ is Hollerith punched to show the letter code of the controlware level. All communication concerning this controlware must refer to this level letter and part number.

- 7. a. Depress the Low Speed Card Reader CLEAR switch, or:
 - b. Depress the Medium Speed Card Reader START/STOP switch to light START.
- 8. a. Depress the Low Speed Card Reader ON LINE switch to light ON LINE, or:
 - b. Depress the Medium Speed Card Reader ON LINE/OFF LINE switch to light ON LINE.
- 9. Cards begin feeding and the controlware is installed in the Microdrum memory. When the Terminal Control Console digital display shows 099, the loading is complete. Any other numbers displayed will stop the card feeding. Some error numbers and recovery steps are listed below.
 - 008 Microdrum error. Reassemble the card deck and repeat steps 4 th-rough 8. If this error occurs again, the last card out of the read station has an error.
 - O22 Card out of sequence or missing.
 Column 2 of each card contains its binary number in the deck sequence.
 2° is in row 9, and 2" is in row 12.
 The number sequence starts over after each End of Record card; EOR cards are punched 11-6-8-9 in column 1 only. The last card out of the read station should be the erroneous card. If a card is missing, a new deck must be obtained. Repeat steps 4 through 8.
 - 027 Deck does not start with End of File (EOF = 11-4-8-9, col. 1) card, followed immediately by an End of

Record card (EOF = 11-6-8-9, col 1). If missing, these cards may be punched locally and added to the deck. Repeat steps 4 through 8.

Other error displays are possible, and reflect a bad card deck. A new card deck should be obtained. The Terminal may or may not be usable, depending on where the card deck error occured in the controlware. Proceed with the following steps to protect the Microdrum memory while waiting for the new card deck.

- 10. At the Terminal Control Console depress the MASTER CLEAR switch, then the CHANNEL CLEAR switch.
- 11. Back at the Microdrum card chassis, remove the card from its temporary C7 position. Install this card in the original B7 position, directly above C7. The Microdrum memory contents are now protected again.
- 12. Slide the Microdrum drawer back into the cabinet. At the first slide stop, press in the locking button on each slider rail. The drawer will now roll all the way back into the cabinet.
- 13. Turn the drawer locks clockwise to secure the drawer in the cabinet. Use a coin or screwdriver as in step 2.
- 14. Replace the Power Cabinet rear panel.
- 15. At the Terminal Control Console, depress the AUTOLOAD switch. The Terminal is now ready for use.

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