AUERBACH DATA COMMUNICATIONS REPORTS

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AUERBACH Data Communications Reports

Printed in U.S.A.

COMMUNICATIONS TERMINAL EQUIPMENT

(Continued)

AUERBACH
DATA
COMMUNICATIONS
REPORTS

FRIDEN TELEDATA LINE

.1 GENERAL

.11 Identity: . . . . . Teledata Tape Transmitter-Receiver, Models 7, 7A, 7B, 8, 8A, and 8B.

.12 Manufacturer: . . . . . Friden, Inc.
San Leandro, California.

.13 Basic Function: . . . . . reads data from punched paper tape and transmits it over narrow-band or voice-band lines (some models);
receives data from narrow-band or voice-band lines (some models) and punches it into paper tape.

.15 Description

The Friden Teledata line consists of a number of paper tape transmitter-receivers designed to transmit coded information punched into standard 5, 6, 7, or 8-level tape at speeds up to 7.9 characters per second. When a standard telegraph-grade line is used, no special subset or interface unit is necessary, and full-duplex operation is possible. For transmission over voice-band lines (Model 8A only), a special Friden Interface Unit and a Bell System 103A or 103F Data Set (or equivalent) are required, and operation is limited to the half-duplex mode (transmit or receive, but not both at the same time).

The main characteristics of the models currently comprising the Teledata line are summarized in Table I.

Error checking is accomplished by sending one or two parity bits with each character, depending on the model (see Table I), and checking this parity when received data is punched. The second parity bit, when used, is formed from three levels of the coded character; this method limits the number of data bits per character to 5 or 6, depending on the model. Parity errors or an inoperative transmission line causes a halt in transmission and causes indicator lamps to be lit. Retransmission requires operator intervention.

TABLE I. FRIDEN TELEDATA GENERAL CHARACTERISTICS

Model	Tape Levels	Tape Width, inches	Transmission Cycle, bit periods	Data Bits per Transmission Cycle	Parity Bits per Transmission Cycle	Transmission Speed, char/sec*
7	8	1.000	9.42	6	1	7.9
7A	6	0.875	9.42	6	1	7.9
7B	5	0.6875	9.42	5	2	7.9
8	8	1.000	10.42	6	2	7.1
8A	8	1.000	10.42	6	2	7.1
8B	6	0.875	10.42	6	2	7.1

*These speeds are based on transmission over a 100-wpm (75-bits/sec) telegraph line or a voice-band line. The transmission speed over a 45-bits/sec or 56-bits/sec telegraph line is proportionately lower.

.16 First Delivery: . . . . . April, 1958.

.17 Availability: . . . . . 60 days.

.2 CONFIGURATION

A Friden Teledata terminal consists of a punched paper tape reader and punch and the necessary control electronics. The facilities of the various models are summarized in Table I. All models can be connected to 45, 56, or 75-bits-per-second telegraph-grade lines and require no data set for this type of connection. Interchangeable gears are provided to alter the speed for operation at the different rates.

Model 8A can be connected to a voice-band line via the appropriate Interface Unit and data set; see Paragraph .72 for the data set required.

.3 INPUT

Input medium: . . . . . standard fully punched 5/8, 11/16, or 1-inch tape, depending on model; see Table I.

Input code: . . . . . any 5, 6, 7, or 8-level code, depending on model, which conforms to the parity bit formation rules. Codes containing less than the maximum number of levels for a particular model can be used, and the parity bits will be supplied automatically. See Table I.

Quantity of data: . . . . . variable.

Rated input speed: . . . . . depends on grade of transmission line to be used; see Paragraph .71.

Effective speed: . . . . . somewhat less than rated speed, and depends on the block length.

.32 Manual Input: . . . . . no provision.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration: . . . . . 1 to N data characters; there are no special control characters.

.36 Operating Procedure

(1) Mount tape and check switch positions.

(2) Establish connection with remote point; switch to data mode if voice-band lines are used.

(3) Turn Power switch on and operate Read switch.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.41 Output to Punched Tape

Tape size: . . . . . standard 5/8, 11/16, or 1-inch tape depending on model; see Table I.

Tape code: . . . . . a binary image of the received data is punched; parity bits can be deleted.

Rated punching speed: . . . . . depends on model and grade of transmission line; see Paragraph .71.

Effective speed: . . . . . somewhat less than rated speed, and depends on block length.

Format control: . . . . . none.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors:	no checking.
.52 Data Transmission Errors	
Type of checking:	one or two parity bits are transmitted with each character, depending on model; see Table I. when receiving data, the parity is mechanically accumulated as the punches are activated.
Error indication:	light and device halt.
Correction procedure:	manual intervention.
.53 Data Recording Errors:	see Paragraph .52, above.
.55 Line Malfunctions	
Detection:	open lines are detected.
Action:	transmission is halted and a lamp is lighted.

.6 CONDITION INDICATORS

Input device available:	none.
Input device busy:	none.
Remote receiver ready:	none.
Remote receiver busy:	none.
Power on:	visible switch.
Improper data entry:	none.
Transmission error:	lamp.
Recording error:	lamp.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed —	
Friden 7, 7A, or 7B:	7.9, 6.0, or 4.8 char/sec over voice-grade or 75-bits/sec telegraph-grade line, 56-bits/sec telegraph-grade line, or 45-bits/sec telegraph-grade line, respectively.
Friden 8, 8A, or 8B:	7.1, 5.4, or 4.3 char/sec over voice-grade or 75-bits/sec telegraph-grade line, 56-bits/sec telegraph-grade line, or 45-bits/sec telegraph-grade line, respectively.
Transmission method:	serial by bit.
Transmission code:	same as input code plus start and stop bits.
Transmission mode:	half-duplex or full-duplex.
Order of bit transmission:	low-order bit of each character is transmitted first.
Synchronization:	start and stop bits are transmitted with each character (asynchronous).

.72 Connection to Communications Lines

Communications Line	Data Set*
Common-carrier leased telegraph-grade lines (up to 75 bits/sec):	none required.

.72 Connection to Communications Lines (Contd.)

Communications Line	Data Set*
Common-carrier leased voice-band line (75 bits/sec):	Bell System Data Set 103F or Western Union 75 Baud Data Modem.**
Public switched telephone network (75 bits/sec):	Bell System Data-Phone Data Set 103A.**

*In some cases, equivalent data sets can be used; see Sections 4620 and 4640 for a current list of modems available from independent manufacturers of telephone equipment.

**Only Model 8A can be connected to a voice-band line. This connection also requires use of the proper Friden Interface Unit.

.73 Transmission Control

Call initiation:	manual dialing or signaling.
Call reception:	operator must establish communication and then switch to data mode if transmission is via voice-band lines.
Functional operations:	none.

.74 Multistation Operation: . . . . . no provision.

.8 PHYSICAL SPECIFICATIONS

Component:	Teledata Models 7, 7A, 7B, 8, 8A, 8B
Width (inches)	23
Depth (inches)	16.25
Height (inches)	17
Weight (pounds)	120
Power (KW)	?
Voltage	115
Frequency (Hz)	60
Phases	1
Temperature Range (°F.)	?
Humidity Range (%)	?
Heat (BTU/hr.)	?

*Does not include channel-deriving (tone) equipment.

.9 PRICE DATA

Component or Feature	Monthly Rental, $	Purchase Price, $	Yearly Maintenance, $
Teledata Model 7, 7A, or 7B	100.75	3100	155-200
Teledata Model 8, 8A, or 8B	100.75	3100	155-200
103A or 103F Interface Unit	4.70	145	30

*Maintenance charge varies with distance, on a zone basis, from the nearest Friden Service Office.

FRIDEN 7100 CONVERSATIONAL TERMINAL

.1 GENERAL

.11 Identity: . . . . . Model 7100 Conversational Terminal.

.12 Manufacturer: . . . . . Friden, Inc.
Division of Singer Corporation
97 Humboldt Street
Rochester, New York 14609

.13 Basic Function: . . . . . two-way typed-message communication at 10 or 12.2 char/sec over narrow-band or voice-band communications facilities.

.15 Description

The Friden 7100 Conversational Terminal is designed to provide half-duplex typed message data communications at up to 10 or 12.2 characters per second. It can operate over a privately-owned or leased common-carrier narrow-band or voice-band line, or the public telephone network.

The 7100 can communicate with other 7100 terminals or with a remote computer; it can also be operated locally as a conventional electric typewriter.

A 52-key keyboard is provided with switches at the right of the keyboard for Power on/off, Break, Control and Color modes; see Figure 1.

The 7100 employs the USASCII transmission code presented in Table I. The complete 128-character USASCII character set can be transmitted or received. Control characters are transmitted by placing the 7100 in the Control mode and depressing the appropriate key. (Control characters are engraved on the front edge of the key, upper- and lower-case symbols, on the top.) This action transmits the appropriate control character and prints the corresponding upper-case symbol displayed on the key-top. Received control characters are either ignored or, the corresponding upper-case symbol is printed in red depending on the position of the color mode switch.

The 7100 generates even parity for each character transmitted. Parity checking on received data is optional; a red upper-case M is printed in place of an incorrectly received character. A Break feature is provided; space characters are transmitted for as long as the Break switch is depressed. The 7100 does not respond to a received brake code.

The Color Mode Switch provides two printing modes: (1) prints all transmitted characters in red and received characters in black (up position) or (2) prints both received and transmitted characters in black and printing the upper-case symbol corresponding to received control characters in red (down position).

The Mechanical Nonprint option (switch selectable) prevents printing transmitted or received data when placed in the Nonprint position.

.16 First Delivery: . . . . . November 1967.

.17 Availability: . . . . . 3 months.

.2 CONFIGURATION

The Friden 7100 Conversational Terminal consists of a manual input keyboard, a printer, and control logic including a communications interface. A data set is required to connect the 7100 to a communications line.

.3 INPUT

.31 Prepared Input: . . . . . no provision.

.32 Manual Input

Method of entry: . . . . . via 52-key keyboard.
Quantity of data: . . . . . variable.

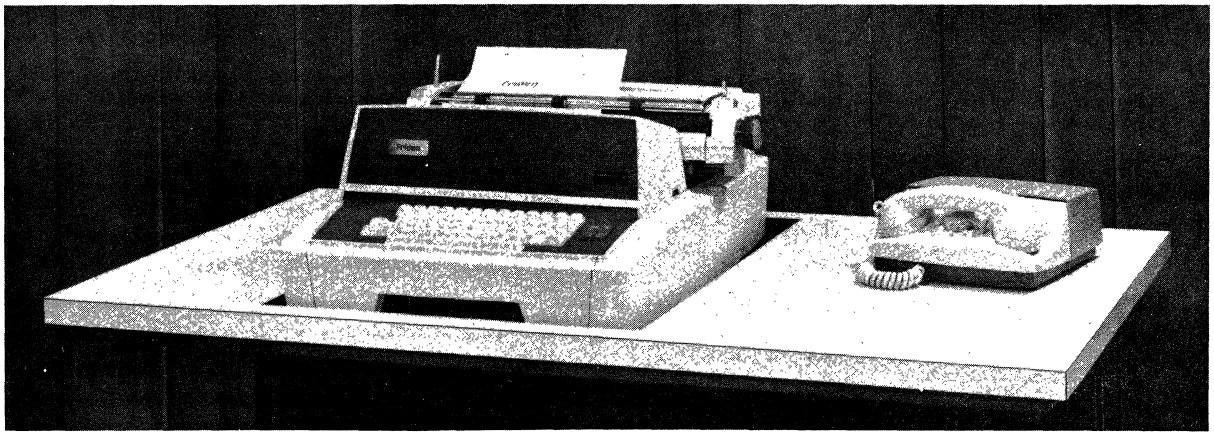


Figure 1. Friden 7100 Conversational Terminal.

.32 Manual Input (Contd.)

Character set: . . . . . 128 distinct character codes including numerics, upper- and lower-case alphabetics, special characters, and control characters; see Table I.

Comments: . . . . . control mode permits generating control characters from keyboard.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration: . . . . . 1 to N characters with control characters interspersed; control characters are keyed by depressing the Control Mode switch and the appropriate key.

.36 Operating Procedure

(1) Switch power on.

(2) Establish connection by dialing or manually signaling.

(3) Key in message.

(4) Terminate connection.

.37 Entry of Time and Data: . . . . . no provision.

.4 OUTPUT

.44 Output to Printer

Output medium: . . . . . friction-fed roll paper or pin-fed (optional) fan-fold forms up to 14 inches wide (13.5-inch writing width).

Character set: . . . . . 91 printable characters; see Table I.

Rated printing speed: . . . . . 10 or 12.2 chars/sec.

Effective speed: . . . . . less than rated speed due to carriage return/line feed and control characters.

Format control: . . . . . controlled by control codes in incoming data or manually by operator. Controls include carriage return/line feed, case shift (includes Control mode) and Color mode (ribbon shift).

Comments: . . . . . horizontal spacing is 10 chars/inch; vertical spacing is 6 lines/inch; color mode permits printing transmitted characters in red, received characters in black or just upper-case symbols in red for corresponding control characters.

(Contd.)

TABLE I: USASCII TRANSMISSION CODE*

b7 → / b6 → / b5 →					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
Bits b4	b3	b2	b1	Row ↓ / Column →	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P		p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	¦
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

* Non-printable characters or symbols include control characters contained in columns 0 and 1, and the symbols SP, @, -, and DEL.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors: . . . . . no provision for checking except through visual verification of input data when typed.

.52 Data Transmission Errors

Type of checking: . . . . . optional character parity.
Error indication: . . . . . red upper case M is printed in place of character received in error.
Correction procedure: . . . . . operator intervention.

.6 CONDITION INDICATORS: . . . . . visible switches for Power on/off and Color mode.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed: . . . . . 10 or 12.2 chars/sec.
Transmission method: . . . . . serial by bit.
Transmission code: . . . . . 7-level USASCII with 8th bit added for even character parity; a total of 11 or 11 bits are transmitted for each character, including start and stop bits.
Transmission mode: . . . . . half-duplex; full-duplex is required for Break feature.
Order of bit transmission: . . . . . low-order bit (b1) is transmitted first.
Synchronization: . . . . . start/stop; one start bit and one or two stop bits bracket each character transmitted.

.72 Connection to Communications Lines

Communications Lines	Data Set***
Bell System leased line Type 1006 Data Channel:	Bell System Data Set 103F.
Western Union Class D Data Channel:	Western Union 180 Baud Data Modem.
Bell System leased line Type 3002 Data Channel:	Bell System Data Set 103F.
Public telephone network:	Bell System Data-Phone Data Set 103A2.

.73 Transmission Control

Call initiation: . . . . . manual dialing or signaling.
Call reception: . . . . . capable of automatic answering.
Functional operations: . . . . . carriage return/line feed; all USASCII control characters are received and can either be printed as the corresponding upper-case symbol or ignored.

.74 Multistation Operation: . . . . . no provision.

.8 PHYSICAL SPECIFICATIONS

Component	Model 7100 Conversational Terminal
Width (inches)	18
Depth (inches)	22
Height (inches)	10
Weight (pounds)	90
Power (KVA)	0.2
Voltage	115 ± 15V
Frequency (cps)	60
Phases	1
Temperature Range (°F)	+35 to +115
Humidity Range (%)	5 to 95
Heat (BTU/hr)	?

.9 PRICE DATA

Component or Feature	Monthly Rental,* $	Purchase Price,** $
Model 7100 Conversational Terminal	90	3200
Model 7100 desk	6	200
Mechanical Nonprint	1.25	25
Receive parity check	2.50	50

* Monthly rental is structured on a one-year lease; maintenance is included in the rental cost.

** A yearly maintenance contract priced at $160 is available for purchased equipment.

*** In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

FRIDEN MODEL 7102 COMMUNICATIONS TERMINAL

.1 GENERAL

.11 Identity: . . . . . Model 7102 Communications Terminal.

.12 Manufacturer: . . . . . Friden, Inc.
Division of Singer Corporation
97 Humboldt Street
Rochester, New York 14609

.13 Basic Function: . . . . . transmission and reception of data over a narrow-band or voice-band line at 12.2 characters per second; provides data input and output capabilities via typewriter, edge-punched card/paper tape reader and punch.

.15 Description

The Friden Model 7102 Communications Terminal incorporates an individual punched paper tape reader and tape punch as integral units; these units are positioned at the left side of the Flexowriter typewriter. The basic paper tape reader and punch can be replaced by an edge-punched card/tape reader and punch at additional cost.

The Model 7102 can communicate with another Model 7102, a Model 7100, or a remote computer system over a narrow-band or voice-band communications facility at up to 10 or 12.2 (optional) characters per second. Transmission is half-duplex asynchronous.

The Model 7102 can operate in any one of six transmit modes or three receive modes as illustrated in the following table:

Function	Mode								
	Transmit						Receive		
Print		X		X	X	X	X		X
Punch			X	X	X			X	X
Read	X	X	X	X					
Key					X	X			

In addition, data can be transcribed from edge-punched cards to paper tape or vice versa when the optional edge-punched card reader and punch is incorporated, data can also be entered from the keyboard and printed and/or punched without transmission.

The basic reader and punch accept 1-inch wide paper tape; the optional edge-punched card/paper-tape reader and punch also accept 3-inch by 7-inch edge-punched cards. The reader and punch can operate up to 12.2 characters per second. The readers sense data mechanically.

The Model 7102 generates even parity for each USASCII character transmitted from the keyboard; parity is not generated for data entered from the reader. Parity checking on received data is optional; a red upper-case M is printed and/or a delete code (punch in all channels) is punched in place of an incorrectly received character. A manual override switch permits punching any 8-level non-USASCII codes and printing and/or punching USASCII codes not containing a parity bit.

A Break feature is provided; space characters are transmitted for as long as the Break switch is depressed. The Model 7102 responds to a received break signal only when operating in the full-duplex mode. The received break signal, consisting of a 200 millisecond signal (space) interrupts the transmission from the reader but not the keyboard.

A 53-key keyboard is supplemented with switches located to the left and right of the keyboard for Tape Feed (punch), Start Read, Stop Read, Break, Control, Color mode and Power on/off.

The Model 7102 employs the USASCII transmission code; see Report 6271, Table I. The complete 128-character USASCII character set can be transmitted or received. Control

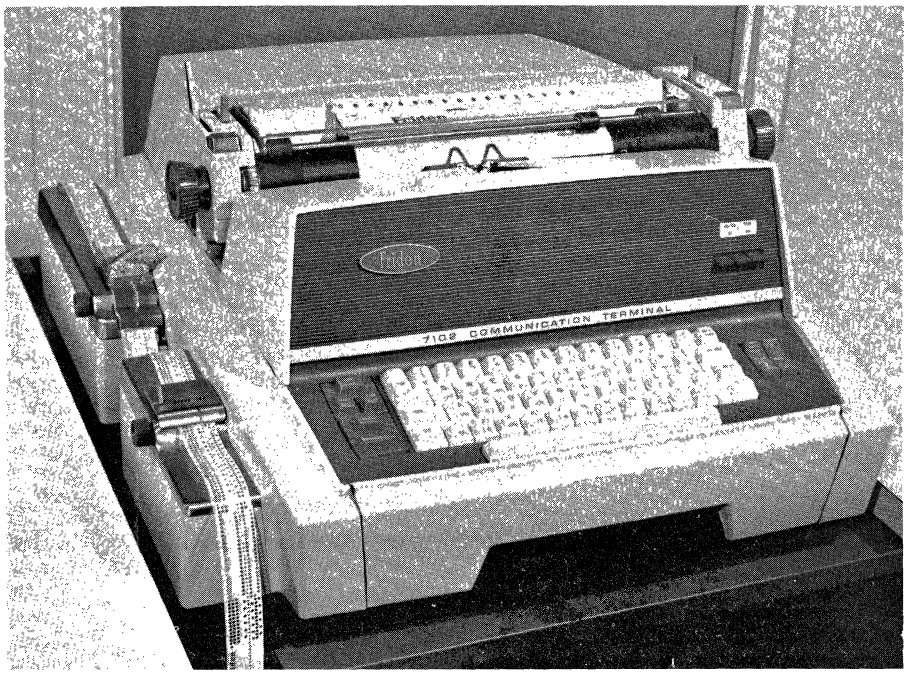


Figure 1. The Friden 7102 Communications Terminal

.15 Description (Contd.)

characters are transmitted by placing the 7102 in the Control mode and depressing the appropriate key. (Control characters are engraved on the front edge of the key; the associated graphic symbols are engraved on the top.) This action transmits the appropriate control character and prints the corresponding graphic symbol displayed on the key-top.

The Color mode switch provides three printing modes:

- Xmit-Recv—prints all transmitted characters in red and received characters in black; the choice of colors for transmitted and received data is optionally reversible. The corresponding graphic symbol (as engraved on individual key-tops) is printed in red for transmitted control codes only.

- Color Off—prints both transmitted and received characters in black; the corresponding graphic symbol is printed in red for transmitted control codes. Received control codes are not printed.

- Char Recog. — prints both transmitted and received characters in black; the corresponding graphic symbol is printed in red for both transmitted and received control codes. In this mode a graphic representation of 128 USASCII characters, except for carriage return, is printed. Horizontal tabulation and backspace are inhibited in this mode. A red "I" is printed in place of horizontal tabulation; a red "H" is printed in place of backspace operation. Line feed, null, and delete codes are optionally inhibited.

The Print Inhibit option (manually controlled by a lever on the right side of the Model 7102) prevents printing transmitted or received data when placed in the Print Inhibit position.

Reader control keys provide for starting, stepping one character position at a time, and stopping reader operation.

The Tape Feed key permits feeding tape; null codes are automatically punched when operating with the basic paper tape punch. When the edge-punched card/paper tape punch is incorporated, edge-punched cards are advanced to the initial punching position and sprocket holes only are punched. As an option, the delete code (a punch in all channels) can be punched on depression of the Tape Feed switch. This option is available for both the basic and optional punch.

(Contd.)

.15 Description (Contd.)

The three panel switches located immediately above and to the right of the keyboard provide reader, punch, and printer control functions.

A reader code-sensitivity control (All switch), when placed in the Select (up) position, establishes reader sensitivity to stop, delete, and null codes. The stop (DC4) code will stop the reader action; Tape Feed (DEL) and null (NUL) codes are ignored and are neither punched nor transmitted. When reader non-sensitivity is selected (down position) the reader is insensitive to control codes except the NUL code, which causes the reader to stop. All codes are transmitted and punched (if the punch is operating).

The punch control is a momentary on-off switch. Depressing the Punch switch activates the punch; depressing the Punch switch a second time deactivates the punch.

The printer control is also a momentary switch. Depressing the Print switch once establishes the normal print mode. In this mode, data entered from the reader or keyboard, or received from the communications line, is printed. Depressing the Print switch a second time functionally separates the printer and keyboard from the reader, punch, and communications line. In this mode, the printer and keyboard perform as a conventional typewriter while concurrent operations are performed, such as punching data received from the reader or from the communications line or transmitting and/or punching data entered from the reader. The Print On indicator, when lighted, indicates the normal print mode.

The optional Automatic Device Control feature permits automatic selection of the reader, punch, or printer under command of the designated standard (S) or alternate (A) control codes in the following table:

Status	Device					
	Reader		Punch		Printer	
	S	A	S	A	S	A
On	DC2	DC1	DC1	DC2	SI	SI
Off	DC4	DC3	DC3	DC4	SO	SO

Note: "S" indicates standard control code; "A" indicates alternate control code.

Control codes can be interspersed with manual operations such that a device can be activated by a control code and manually deactivated by the device switch. The All switch must be in the Select position for the Automatic Device Control feature to be operative. Control codes can be entered via the reader or the communications facility; codes entered via the reader are not transmitted. Control codes entered from the keyboard when in Control mode are transmitted and/or punched, but can not cause operation of the designated device.

Reader operation halts when a stop code is read from tape or cards, when a 200-millisecond break signal is received (full-duplex mode only) from the remote terminal or computer, or when manually stopped. Reader operation is initiated by receiving a start code from the remote terminal or computer or by manual means.

.16 First Delivery: . . . . . July 1968.

.17 Availability: . . . . . 2 months.

.2 CONFIGURATION

The basic Friden 7102 Communications Terminal consists of a manual input keyboard, a printer, an individual paper tape reader and punch, and control logic including a communications interface. An optional edge-punched card reader and punch, which can read and punch both edge-punched cards and paper tape can be substituted for the basic tape-only reader and punch. A data set is required to connect the 7102 to a communications line; see Paragraph .72.

.3 INPUT

.31 Prepared Input

Basic Paper Tape Reader and optional Edge-Punched Card/Paper Tape Reader —

Input medium:	fully punched 1-inch, 8-level paper tape; 3- by 7-inch edge-punched cards.
Input code:	any 8-level code; the device is code insensitive.
Quantity of data:	any size block length.
Character set:	128 characters.
Rated input speed:	12.2 char/sec.
Effective speed:	somewhat less than transmission speed, depending on block length.
Comments:	holes are sensed mechanically; parity is not checked; basic 7102 reader does not handle edge-punched cards; reader can be started or halted by control codes when the Automatic Device Control option is incorporated.

.32 Manual Input

Method of entry:	via 53-key keyboard.
Quantity of data:	variable.
Character set:	128 distinct character codes including numerics, upper- and lower-case alphabetics, special characters, and control characters; see Paragraph .32 Report 6271.
Comments:	Control mode permits generating 32 control code characters and 4 non-printing graphic symbols from keyboard.

.33 Fixed Input: no provision.

.34 Transaction Code Input: no provision.

.35 Message Configuration: 1 to N characters with control characters interspersed; control characters are keyed by depressing the Control Mode switch and the appropriate key.

.36 Operating Procedure

(1) Establish connection with remote terminal by manual dialing or signaling; on a dedicated line, a permanent connection can be maintained;

(2) Insure that the called terminal is ready;

(3) Depress the data set Data button;

(4) Transmit data from the reader or the keyboard;

(5) Terminate the connection.

The Model 7102 can be operated automatically (once the connection is established) under control of the remote computer. The Automatic Device Control must be incorporated for automatic operation.

A reader transmission can be interrupted by a received break signal when operating in the full-duplex mode.

.37 Entry of Time and Date: no provision.

.4 OUTPUT

.41 Output to Punched Tape

Basic Paper Tape Punch and optional Edge-Punched Card and Paper Tape Punch —

Tape size:	1-inch paper tape; 3- by 7-inch edge-punched cards.

(Contd.)

.41 Output to Punched Tape (Contd.)

Tape code:	7-level USASCII code plus an even parity bit (8-level) when punching from keyboard; punch is code insensitive and will punch any 8-level code.
Rated punching speed:	12.2 char/sec.
Effective speed:	somewhat less than transmission speed depending on block length.
Format control:	none.
Comments:	basic 7102 punch does not handle edge-punched cards; punch can be started or halted by control codes when the Automatic Device Control option is incorporated.

.44 Output to Printer

Output medium:	friction-fed roll paper or pin-feed (optional) fanfold forms up to 14 inches wide (13.5-inch writing width).
Character set:	89 printable characters; see Paragraph 6271.44.
Rated printing speed:	12.2 chars/sec.
Effective speed:	less than rated speed due to carriage return/line feed horizontal tab, backspace, and case shift operations.
Format control:	controlled by control codes in incoming data or manually by operator. Controls include carriage return/line feed, horizontal tab, back-space, case shift and ribbon color.
Comments:	horizontal spacing is 10 chars/inch; vertical spacing is 6 lines/inch; color ribbon shift incorporated, see Color Mode Control, Paragraph .15. Vertical Spacer forms handler can be attached to the printing carriage to accommodate sprocketed, continuous forms of different widths; printer can be started or halted by control codes when the Automatic Device Control option is incorporated.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors:	no provision for checking except for visual verification of input data when printed.

.52 Data Transmission Errors

Type of checking:	optional character parity on received data.
Error indication:	red upper case "M" is printed and/or delete code is punched in place of character received in error.
Correction procedure:	operator intervention.
Comments:	manual override switch permits punching any 8-level non-USASCII codes and printing and/or punching non-parity USASCII codes.

.53 Data Recording Errors:	no provision for checking recorded data except for visual verification of input data when printed.
.55 Line Malfunctions:	no provisions for detection other than through operator recognizing halted operation; transmission must be coordinated between sending and and receiving operators.
.6 CONDITION INDICATORS:	printer and punch status indicator lamps only; switches provide visual indication of setting.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	10 or 12.2 char/sec.
Transmission method:	serial by bit.
Transmission code:	7-level USASCII with 8th bit added for even parity; a total of 10 or 11 bits are transmitted for each character, including start and stop bits.
Transmission mode:	half-duplex; full-duplex is required for Break feature.
Order of bit transmission:	low-order bit (b1) is transmitted first.
Synchronization:	start/stop; one start bit and one or two stop bits bracket each character transmitted.

.72 Connection to Communications Lines

Communications Lines	Data Set*
Bell System leased line —	
Type 1006 Data Channel:	Bell System Data Set 103F.
Type 3002 Data Channel:	Bell System Data Set 103F.
Western Union Class D Data Channel:	Western Union 180 Baud Data Modem.
Public telephone network:	Bell System Data-Phone Data Set 103A2.

*In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

.73 Transmission Control

Call initiation:	manual dialing or signaling.
Call reception:	capable of automatic answering.
Functional operations:	carriage return/line feed, case shift, horizontal tab, backspace, etc.

.74 Multistation Operation: . . . . . no provision.

.8 PHYSICAL SPECIFICATIONS

Component	Model 7102 Communications Terminal*
Width (inches)	20.5
Depth (inches)	22
Height (inches)	10
Weight (pounds)	110
Power (KVA)	0.2
Voltage	115 ± 15V
Frequency (cps)	60
Phases	1
Temperature Range (°F.)	+35 to +115
Humidity Range (%)	5 to 95
Heat (BTU/hr)	?

*Model 7102 desk size is 51.25 inches wide by 27.5 inches deep by 28.5 inches high.

(Contd.)

.9 PRICE DATA

Component or Feature	Monthly Rental,* $	Purchase Price,** $
Model 7102 Communications Terminal (includes paper tape reader and punch)	140	4750
Model 7102 Desk	7.50	240
Edge-Punched Card Reader and Edge-Punched Card Punch	10.00	200
Print Inhibit	1.25	25
Automatic Device Control	7.50	150
Receive parity check	2.50	50
Pin Feed Platen	3.85	110
Vertical Spacer	3.50	100

*Monthly rental is structured on a one-year lease; maintenance is included in the rental.

**A yearly maintenance contract price at $237.50 is available for purchased equipment.

GE DATANET 600/601

.1 GENERAL

.11 Identity: . . . . . GE DATANET-600.
GE DATANET-601.

.12 Manufacturer: . . . . . General Electric Company
Computer Department
Phoenix, Arizona.

.13 Basic Function: . . . . . read data from punched paper tape and transmit it over a voice-band line;
receive data from a voice-band line and punch it into paper tape.

.15 Description

The GE DATANET-600 is a punched tape terminal which operates over a voice-band, half-duplex, common-carrier transmission line and consists of two separate components:

- A controller, which contains circuitry for control, synchronization, error detection, and bit/character serial/parallel conversion.
- A combination reader/punch, which provides paper tape input/output to the controller.

The DATANET-600 will transmit 5-, 6-, or 7-level codes at 50 characters per second. An 8-level code can be handled, but whenever the 8th level is punched, the transmission rate is reduced by half. Generally, the 8th level is used infrequently (for control codes), so the effective transmission rate for 8-level codes will be close to 50 characters per second.

The DATANET-600 operates in a half-duplex mode, alternately sending and receiving data. A full-character redundancy checking system is used, in which every character is sent twice. The second version of each character transmitted contains the inverse bit pattern of the first version transmitted. As the data is being received, each character is checked. At the end of a block, if all characters have been received correctly, a data character or tone is transmitted from the receiving station. If an error has been detected, no response is made.

A DATANET-600 can communicate with:

- Another DATANET-600.
- A GE-200 Series computer system, via a DATANET-15 Data Transmission Controller and a DATANET-601 at the computer site.
- A DATANET-30 Data Communication Processor.
- A GE-400 Series computer system, via a DATANET-20 Data Transmission Controller, a single-channel controller for controlling the exchange of data between a GE-400 Series computer system and communications lines.

The DATANET-601 is similar to the DATANET-600 but contains the additional circuitry necessary to allow it to signal a DATANET-15 that servicing is required and to exchange data with the DATANET-15. The 601 can be disconnected from the DATANET-15 and used as a DATANET-600. The DATANET-15 is a multiline controller for controlling the exchange of data between a GE-200 Series computer and communications lines. A DATANET-601 is required at the computer site to handle code conversion when a remote DATANET-600 is communicating with the computer. A paper tape copy of all received data can be made by the DATANET-601, if desired.

.15 Description (Contd.)

The DATANET-600 is capable of unattended operation. In this mode, a called terminal will not transmit or punch data until it has received a valid data code. This prevents unintentional operation if a number is called by mistake.

The DATANET-600 Controller can be switched to operate in an off-line mode, in which the reader and punch can operate in conjunction with each other to perform duplication and editing. The duplication function can be used to duplicate tapes or to combine several tapes into one tape. The edit function can be used to punch a new, error-free tape from tapes which contain bad blocks (incomplete blocks because of detected errors); the new tape contains only the good (error-free) data blocks.

.16 First Delivery: . . . . . ?

.17 Availability: . . . . . no longer in production.

.2 CONFIGURATION

A DATANET-600 or -601 terminal consists of two components housed in separate cabinets: a controller and a combination reader/punch. The terminal is connected to a voice-band communications line via an appropriate data set, as specified in Paragraph .72.

.3 INPUT

.31 Prepared Input

Input medium:	fully-punched 11/16-, 7/8-, or 1-inch, 5-, 6-, 7-, or 8-level Mylar or oiled paper tape.
Input code:	any 5-, 6-, 7-, or 8-level code; a separate plug-in module is used for each different code.
Quantity of data:	variable.
Rated input speed:	50 char/sec.
Effective speed:	somewhat less than rated speed, depending on block length. when transmitting an 8-level code, speed is cut in half for each character that has the 8th level punched.

.32 Manual Input: . . . . . no provision.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration: . . . . . data characters are followed by end-of-block code.

.36 Operating Procedure

(1) Establish connection by manual dialing.

(2) Set switches for receive/transmit.

(3) Switch to data mode and start transmission.

.37 Entry of Time and Date: . . . . . no provision.

(Contd.)

.4 OUTPUT

.41 Output to Punched Tape

Tape size:	11/16-, 7/8-, or 1-inch, 5-, 6-, 7-, or 8-level oiled paper tape. (Mylar tape is not recommended.)
Tape code:	same as input code; a separate plug-in module is required for each different code.
Rated punching speed:	50 char/sec.
Effective speed:	somewhat less than rated speed, depending on block length; when receiving an 8-level code, speed is cut in half for each character containing an 8th-level punch.
Format control:	tapes can be duplicated off-line, with deletion of error blocks.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors:	no detection facilities.

.52 Data Transmission Errors

Type of checking:	each character and its inverse are transmitted sequentially, and the two codes are compared at the receiver.
Error indication:	blank spaces on the output tape and failure to return an acknowledgement signal following end-of-block.
Correction procedure:	automatic backspacing of tape and retransmission of entire block; if errors persist, retransmissions will continue until operator intervenes.

.53 Data Recording Errors:	no detection facilities.
.55 Line Malfunctions:	no detection facilities; line failure will be regarded as an error, with continuous retransmissions until operator intervenes.

.6 CONDITION INDICATORS

Input device available:	none.
Input device busy:	none.
Remote receiver ready:	none.
Remote receiver busy:	none.
Power on:	lamp.
Improper data entry:	none.
Transmission error:	none.
Recording error:	none.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	50 char/sec (850 bits/sec) for 5-, 6-, or 7-level tapes. 25 char/sec (850 bits/sec) for 8-level tapes for each character containing an 8th-level punch.
Transmission method:	serial by bit.

.71 Basic Characteristics (Contd.)

Transmission code:	a total of 17 bits are transmitted for each character (a code containing a punch in the 8th level requires 34 bits).
Transmission mode:	half-duplex.
Order of bit transmission:	?
Synchronization:	start/stop.

.72 Connection to Communications Lines

Communications Line	Data Set*
Public switched telephone network:	Bell System Data-Phone Data Set 202C.
Common-carrier leased voice-band line:	Bell System Data Set 202D, or Western Union 1200 Baud Data Modem.

.73 Transmission Control

Call initiation:	manual dialing.
Call reception:	capable of unattended operation.
Functional operations:	none.

.74 Multistation Operation: no provision.

.8 PHYSICAL SPECIFICATIONS

Component:	DATANET-600 or -601 Controller	Reader/Punch
Width (inches)	26	10.5
Depth (inches)	18	12
Height (inches)	9	5
Weight (pounds)	54	20
Power (KW)	0.14 max	
Voltage	115	
Frequency (cps)	60	
Phases	1	
Temperature range (°F.)	65 to 95	
Humidity Range (%)	20 to 80	
Heat (BTU/hr.)	478 (approx.)	

.9 PRICE DATA

Component or Feature	Monthly Rental, $	Purchase Price, $	Monthly Maintenance, $
DATANET-600 (includes controller and reader/punch)	275	8,250	?
DATANET-601 (includes controller and reader/punch)	300	9,000	?

* In some cases, equivalent data sets can be used; check with the local common-carrier communications consultant.

REPORT UPDATE

GE INTRODUCES COMPONENT CHANGES IN DATANET-760 SUBSYSTEM

GE has introduced significant changes in the DATANET-760 Subsystem. Basically, the DTU 760 Display Terminal Unit has been replaced by the Display Monitor Unit (DMU 761) and the Electronic Keyboard (EKB 761); see Figure 1.

The new, 14-inch DMU 761 Display Unit provides the same display as the DTU 760 Display Unit. The DTU 760 Display Unit is no longer in production and is available on an "as returned" basis only. A number of new components now supplement the DATANET-760 Subsystem to extend the overall versatility and efficiency of the subsystem.

Two new Data Line Controllers, the DLC 761 and DLC 766, provide full-duplex operation with respective transmission rates of 1200 bits per second (120 characters per second) and 2000 or 2400 bits per second (250 or 300 characters per second). The DLC 761 operates asynchronously; each character is composed of 10 bits, which include parity and unity start and stop bits. The DLC 766 operates synchronously; a total of 8 bits, which includes parity, is transmitted for each character, and four sync characters precede each message.

Two Basic Controller Units (BCU 760 and 761) provide basic control logic for keyboard entry control, character generation, and timing. The BCU 761 is employed when the Function Key Group option is incorporated. The BCU is included as an integral component of the Display Controller Units (DCU 760).

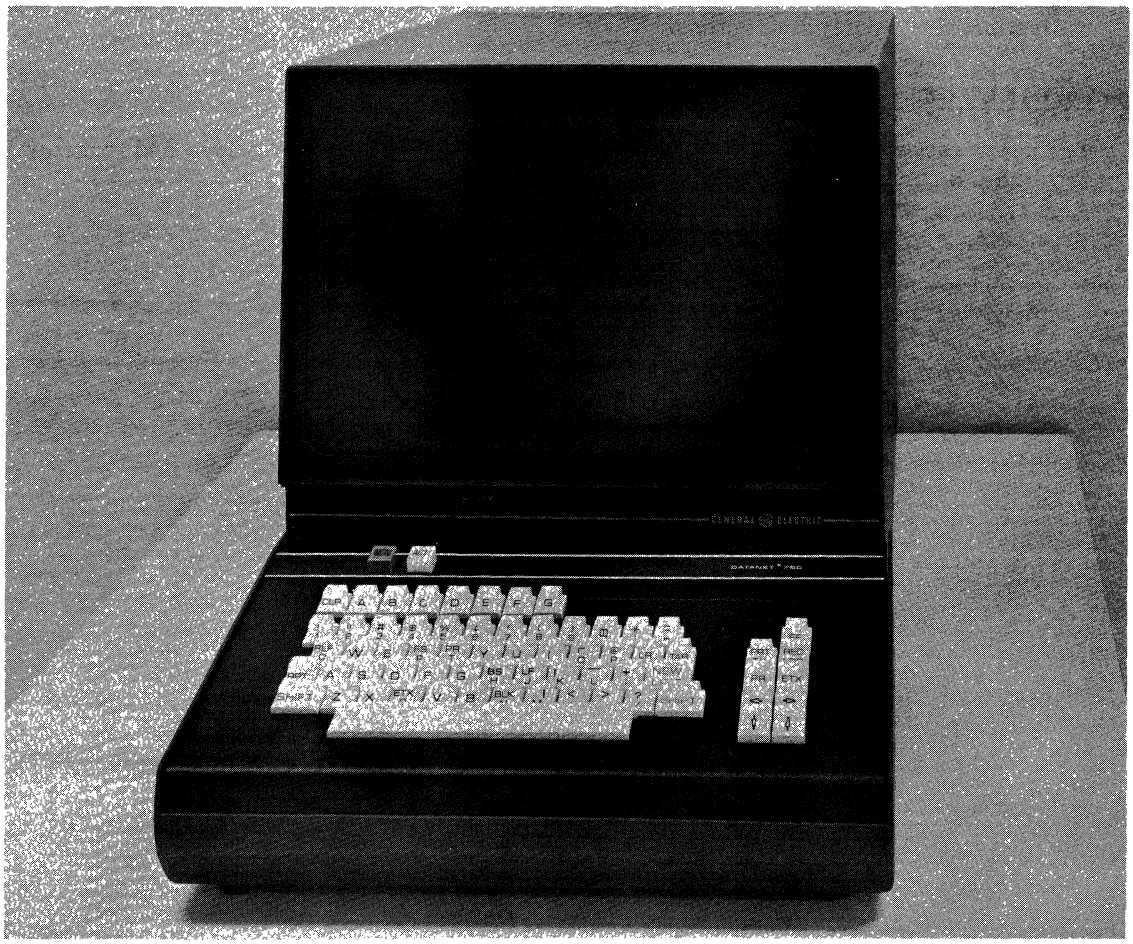


Figure 1. New GE DATANET-760 Subsystem

The Function Key Group is now available as a standard option providing 8 or 16 additional keys for the display and transmission of special symbols.

Up to four or more 14-inch or 23-inch (DMU 765 23-inch Read Only Display Unit) display-only monitors can be connected to each Display Unit for repeating a display at several locations. On special request, a DATANET-760 Subsystem can be interfaced with closed-circuit television. Read-only, two- or three-color monitors are also available on request.

The configuration rules for incorporating printers in a 760 Subsystem have been changed. Each Page Printer Controller (PPC 760) can accommodate only one Teletype Model 33 or 35 Receive-Only Page Printer. Up to four Printer Controllers can be connected to a Display Controller. The Teletype Page Printers can now be obtained from GE; however, prices have not been established to date.

NEW PARTY LINE OPTION EXPANDS SIZE OF DATANET-760 SUBSYSTEM

Each keyboard/display or read-only display unit can be located up to 5000 cable feet from the Display Controller by incorporating two Line Repeater Units (LRU 760). Each Line Repeater Unit extends the basic 1000-foot separation by 2000 feet. A Keyboard Video Amplifier (KVA 760) must be included in each Repeater Unit. When the Party Line Junction option (PLJ 760) is incorporated in the Line Repeater Unit, up to four additional keyboard/display or read-only display units can be connected to the Line Repeater Unit. The Party Line Junction option requires a Party Line Monitor (PLM 760) for each terminal unit connected to the Line Repeater Unit. The Party Line option alerts each of the party line operators to his own incoming message or alerts the operator when the party line is not busy. The 760 Subsystem can be expanded to provide a maximum combination of 288 keyboard/display and read-only display units with full utilization of the party line options.

DATANET-760 PRICES CHANGED

The price data on page 6321:12 has been updated to reflect current prices and features included with the GE DATANET-760 Subsystem.

GE DATANET—760 KEYBOARD/DISPLAY SUBSYSTEM

.1 GENERAL

.11 Identity: ..... DATANET-760 Keyboard/Display Subsystem.

.12 Manufacturer: ..... General Electric Company
Information Systems Division
P.O. Box 129
Oklahoma City, Oklahoma.

.13 Basic Function: ..... visual display, via a cathode ray tube, of data transmitted between a DATANET-760 subsystem and a remote computer; data can be entered via a keyboard; printed output is optional.

.14 Basic Components

Name: ..... Display Terminal Unit.
Model number: ..... DTU760.
Function: ..... provides cathode ray tube and keyboard for display and entry of data.

Name: ..... Display Controller Unit.
Model number: ..... DCU760.
Function: ..... provides basic control logic for keyboard entry control, character generation, and timing.

Name: ..... Terminal Memory Unit.
Model number: ..... TMU760.
Function: ..... provides buffer storage and display logic for all units.

Name: ..... Page Print Controller.
Model number: ..... PPC760.
Function: ..... provides basic control logic for a Teletype Model 33 or 35 Receive-Only set.

Name: ..... Data Line Controller.
Model number: ..... DLC760 or DLC765.
Function: ..... provides interface for data set, message assembly and distribution, and error detection and retransmission.

.15 Description

The GE DATANET-760 Subsystem is designed to facilitate the rapid exchange of data between a computer system and one or more remote locations, under control of a stored program in the computer. Up to 32 cathode ray tube Display Terminal Units with data entry keyboards can be controlled by the Display Controller. Figure 1 shows the Display Terminal Unit.

Up to four Page Print Controllers can be included in a DATANET-760 Subsystem. Each Print Controller replaces one Display Terminal Unit and can drive one or more Teletype Model 33 or 35 (or equivalent) Receive-Only Printers. All printers connected to a single Print Controller receive and print the same data.

Each display or printer unit can be located up to 1000 cable-feet from the Display Controller. (This distance can be extended for the display units with Line Repeater Units, available on special request.) The Display Controller is connected to a remote computer via a common-carrier leased voice-band line or the public telephone network, appropriate data sets, and an appropriate communications controller at the computer. The DATANET-760 can also be connected directly to a computer I/O channel; this report, however, deals with the DATANET-760 Subsystem as used in a data communications environment.

Only one DATANET-760 Display/Keyboard Subsystem is normally connected to a single communications line.

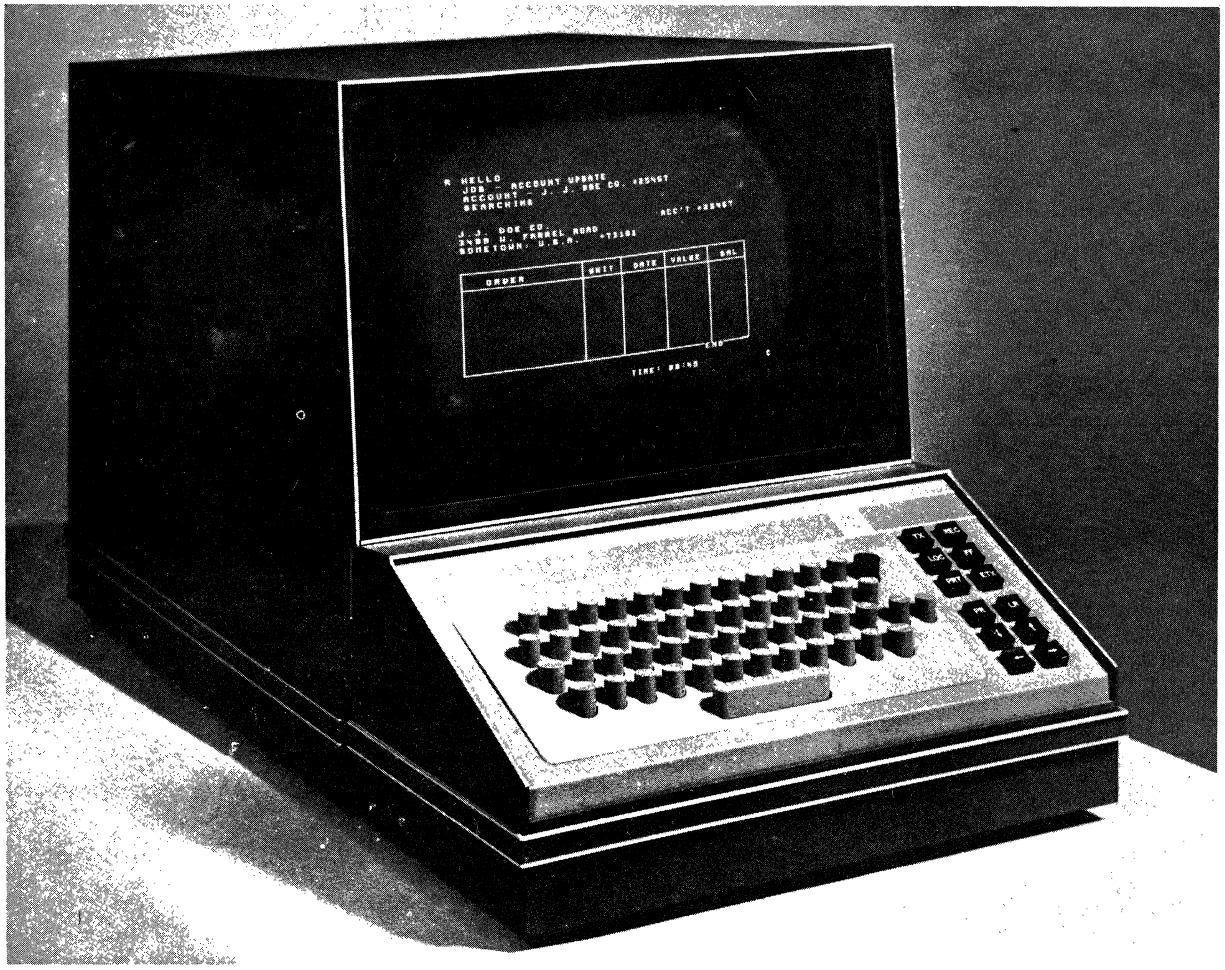


Figure 1: GE DATANET-760 Display Terminal Unit

.15 Description (Contd.)

Basic Operation

The GE DATANET-760 Subsystem operates in a half-duplex mode. Information is exchanged between the Subsystem and the remote computer by an alternating series of "transmission frames," each consisting of one or more messages to or from individual display or printer units. After receiving a transmission frame from the remote computer, or after a predetermined time has elapsed without receiving anything, the Display Controller automatically scans the units for messages to be sent, and initiates the sending of a transmission frame, which may contain messages from up to eight terminals. During periods when no information is to be transmitted, empty frames are transmitted. Normally, all data messages are acknowledged. The Display Controller will automatically retransmit a message if a negative acknowledgment is received. Full-duplex operation, which permits simultaneous transmission and reception, is available upon special request.

The 7-level ASCII transmission code is employed, with an eighth bit added for character parity. A DATANET-760 Subsystem can be obtained for transmission at 1,200, 2,000, or 2,400 bits per second. The corresponding character rates are 120, 250, and 300 characters per second. Start/Stop synchronization is employed at 1,200 bits per second; a total of 10 bits, including start and stop bits, are transmitted for each character. Synchronous transmission is used at 2,000 or 2,400 bits per second; sync characters are transmitted prior to each transmission frame.

(Contd.)

Components

A DATANET-760 Display/Keyboard Subsystem consists of:

- One Display Controller,
- Up to 32 Display Terminal Units, and
- Up to 4 Page Print Controllers.

On special request, up to four or more 14-inch or 23-inch display-only monitors can be connected to each Display Unit for repeating a display at several locations.

The Display Controller contains one to four Terminal Memory Units (TMU), each containing 1,472 characters of delay-line storage. The storage of each TMU can be segmented to accommodate from 1 to 8 Display Terminal Units and Print Controllers. On special request, multiple Display Terminal Units can share one memory segment of a TMU on a shared-access, party-line basis. Paragraph .2 shows the display sizes when various numbers of units are connected. The Display Controller also contains the logic for character generation, display regeneration, parity checking, and control of multiple display stations and printers. The displayed characters are composed of one or more strokes.

The Display Terminal Unit consists of a rectangular cathode ray tube with a 14-inch diagonal and a maximum display field 8 inches wide by 6.3 inches high. A physically separate alphanumeric keyboard is a standard part of the Display Terminal. The keyboard module can be located up to four feet from the display module. On special request, the keyboard can be as far as 100 feet from the display module.

A Page Print Controller (PPC) is required for each independent group of printers incorporated in the Subsystem. The Print Controller utilizes one storage segment of a Terminal Memory Unit. GE supplies the PPC with an interface to accommodate a Teletype Model 33 or 35 Receive-Only Page Printer or equivalent. (The user must obtain the printers separately.) All data to be printed must be transmitted from the remote computer. If an operator desires a display to be printed, the displayed data is first sent to the computer, then back to the printer under control of the program stored in the remote computer. This technique enables the program stored in the remote computer to manipulate the printed format and to add stored data not displayed by the requesting station. The Page Print Controller formats the incoming data for line length and provides control functions that make it possible to tie together lengthy messages that require more than one frame for transmission. The display terminal is free to operate immediately after the print request has been transmitted.

Editing Facilities

Editing facilities available to the Display Terminal Unit operator include movement of the cursor forward or backward, up or down, to the beginning of a line, or to the first display position. The cursor is non-destructive; i.e., it does not erase the character displayed in the position the cursor occupies. In the basic keyboard, cursor movement is controlled by certain character keys in the up-shift condition. The optional Entry Marker Group provides a separate set of keys at the right of the keyboard which duplicate these functions. These keys are repeating keys; i.e., the indicated action is continued if the key is held depressed. An automatic tab function is included in the basic unit which positions the cursor at a vertical line in a table outline previously written on the display. A Repeat key in the basic keyboard, if held depressed simultaneously with a character key, enables the operator to make repetitive entries of characters or symbols.

A selected portion of the data displayed can be transmitted to the remote computer, beginning with any position in one line and continuing through to the end of a consecutive group of lines. The remainder of the display is not disturbed.

The cursor can be positioned directly to any display position by control codes contained in the incoming message. This eliminates the need for rewriting previously displayed data.

.15 Description (Contd.)

Error Checking and Correction

Character and longitudinal (optional) parity checking are performed on all data received by the DATANET-760 Subsystem from the remote computer; character parity bits and longitudinal check characters (optional) are generated and transferred with all data transmitted from the Subsystem. If the remote computer returns a negative acknowledgment, indicating that an error was detected at the computer site, the Display Controller automatically retransmits the message. The Display Controls also makes certain checks on the validity of message formats received from the computer. If errors are detected, the Display Controller transmits a negative response.

Programming Support

GE states that software is now available or is being planned to facilitate the use of the DATANET-760 Subsystem with any GE computer system.

.16 First Delivery:..... June 1966.

.17 Availability: ..... 5 months.

.2 CONFIGURATION

A GE DATANET-760 Keyboard/Display Subsystem is composed of these units:

- One Display Controller,
- Up to 32 Display Terminal Units, and
- Up to 4 Page Print Controllers.

Each Display Unit or Printer can be located up to 1,000 feet from the Display Controller. Extended distances are available on special request.

Up to four or more 14-inch or 23-inch display monitors can be connected to each Display Terminal Unit (DTU) for display only. The monitor's display is exactly the same as that of the DTU to which it is connected. The monitors are available on special request.

The Display Controller consists of the Display Controller Unit (DCU), one Data Line Controller (DLC), one to four Terminal Memory Units (TMU), and up to four Page Print Controllers (PPC). All of these components are housed in the cabinet provided with the Display Controller Unit. Each component physically consists of one or more logic boards; configuration changes can be easily made in the field.

A Terminal Memory Unit contains a delay-line memory with a total storage capacity of 1,472 characters. This memory can be segmented into two, four, or eight parts to accommodate up to eight Display Terminal Units or associated printers. The following table shows the allowable segmentation of each TMU and the resulting display size for each Display Unit.

Number of Memory Segments	Number of DTU's and Print Controllers*	Display Size		
		Number of Lines	Number of Char/Line	Total Number of Characters
1	1	26	46	1,196
2	2	16	46	736
4	4	8	46	368
8	8	4	46	184

*Maximum of four Print Controllers per subsystem.

All Display Units connected to the same TMU have the same display size. Units connected to different TMU's can have different display sizes.

Each Page Print Controller can accommodate one independent group of printers. Each printer within a group receives and prints the same data. See Paragraph .44.

(Contd.)

Two standard Data Line Controllers (DLC) are available. The DLC760 is for a data transmission rate of 1,200 bits per second (120 characters per second); the DLC765 is for a data transmission rate of 2,000 or 2,400 bits per second (250 or 300 characters per second). Table IV lists the characteristics of each DLC. A special controller for full-duplex operation is available on special request. See Paragraph .72 for the standard communications facilities that can be accommodated and the data set required.

.3 INPUT

.31 Prepared Input: . . . . . no provision.

.32 Manual Input

Display Terminal Unit —

Method of entry:	via 53-key keyboard, including 10 control keys.
Quantity of data:	up to 1,196, 736, 368, or 184 characters per display, depending on the number of displays per TMU; see Paragraph .2.
Character set:	digits, upper-case alphabetic letters, and 28 punctuation marks and special symbols; see Table I.
Comments:	4 additional command keys are provided on right side of keyboard; 8 cursor control keys (optional) which duplicate functions of certain keyboard keys are located on right side of keyboard. except for punctuation marks and special symbols, keyboard layout is the same as for a standard typewriter. a group of Function keys is available on special request; see Paragraph .34.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . a group of Function keys is available on special request; these keys provide additional symbols for display and transmission and are normally used for transaction-code input or similar identification.

.35 Message Configuration

Input to the remote computer and data to be displayed or printed are transmitted between the computer and the DATANET-760 Subsystem in alternate groups of messages called "transmission frames" (see Paragraph .7). A transmission frame sent by the computer consists of any number of computer messages followed by an EOT character. A transmission frame sent by the DATANET-760 consists of up to eight display messages followed by an EOT character. The exact number of display messages in a frame depends on the number of units connected to a TMU and the activity of the units (see Paragraph .73). During periods when no information is to be exchanged, a two-character quiescent frame is transmitted which consists of an SOH and an EOT character. When the DLC765 Data Line Controller is used for transmission at 2,000 or 2,400 bits per second, each data message is preceded by four sync characters.

The formats for all messages sent by the DATANET-760 are identical, and consist of the following characters: SOH, address of unit originating message, status character, FC1, FC2, STX, text, ETX, and LP. The FC1 and FC2 characters are reserved for Function codes; see Paragraph .34. There are five types of messages, which are distinguished by the status character; the five message types are listed in Table III. The LP character is the longitudinal parity check character. If the Longitudinal Parity Check option is not incorporated, the LP character transmitted is all ones.

The DATANET-760 Subsystem can recognize and respond to three types of messages sent from the remote computer; see Table III. The format for these messages is identical to that for display-originated messages except that the address character indicates the unit addressed and the FC1 and FC2 characters can be omitted.

TABLE I: GE DATANET-760 ASCII DATA TRANSMISSION CODE

			b7	0	0	0	0	1	1	1	1
			b6	0	0	1	1	0	0	1	1
			b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1								
0	0	0	0	NUL		SP	0	@	P		
0	0	0	1	SOH	RLF	!	1	A	Q		
0	0	1	0	STX	FS	"	2	B	R		
0	0	1	1	ETX		#	3	C	S		
0	1	0	0	EOT	PR	$	4	D	T		
0	1	0	1	ENQ	NAK	%	5	E	U		
0	1	1	0	ACK	SYN	&	6	F	V		
0	1	1	1			'	7	G	W		
1	0	0	0	BS		(	8	H	X		
1	0	0	1			)	9	I	Y		
1	0	1	0	LF	PRT	*	:	J	Z		
1	0	1	1			+	;	K	|		
1	1	0	0	FF		,	<	L	—		
1	1	0	1	CR		-	=	M	|		
1	1	1	0			.	>	N	BLINK		
1	1	1	1			/	?	O	⌐	BUSY	

- Character for Storage
- Combinations not used externally
- Commands (not stored)

* These symbols permit horizontal or vertical lines to be drawn for tables or charts.

Note — See Table II for definition of control characters.

Reproduced from DATANET-760 Keyboard/Display Subsystem Manual, CPB-1308, published by General Electric Company.

.36 Operating Procedure

A Display Terminal Unit operates in one of four modes (Local, Transmit, Receive, or Print), as indicated by the mode indicator located in the left margin opposite the first display line. The Local mode is used to compose messages. The cursor (entry marker) identifies the next display position to be entered. Control keys are provided to space the cursor forward or backward one position at a time, move the cursor up or down one line at a time, move the cursor to the first character position of the same line, and position the cursor at the first displayable position. These control keys are located within the character keyboard layout in the basic keyboard and are operated in conjunction with a control shift key.

The optional Marker Control Group provides a set of control keys in addition to the standard control keys to provide the same functions. These keys are located on the right side of the keyboard and operate without the control shift key. When held depressed, the optional cursor control keys will repetitively advance or backspace the cursor, or move it up or down. The cursor continually blinks 3 to 5 times per second, which permits quick visual location by the operator.

(Contd.)

TABLE II: DEFINITIONS OF GE DATANET-760 CONTROL CHARACTERS

Control Character	Definition
NUL	Null. Used as a status character in message header to indicate the message contains text.
SOH	Start of Header.
STX	Start of Text.
ETX	End of Text.
EOT	End of Transmission.
ENQ	Enquiry. Used in conjunction with NAK as subsequently described.
ACK	Acknowledgment. Used as a status character to indicate that the last message for the specified terminal was received correctly.
BSY	Busy. Used as a DATANET-760 status character in the message header to indicate that the last message received was addressed to a Busy terminal. A terminal is Busy when it is under local control or has a message waiting to be transmitted.
PRT	Print. Used as a DATANET-760 status character to indicate that the message is to be printed. The computer then re-addresses the message to the PPC.
NAK	Negative Acknowledgment. Used as a status character in message header to indicate that the last message was received with a detectable error.
BS	Backspace marker one character. When the marker is at the left edge of the page, subsequent backspaces have no effect.
LF	Line Feed. Moves marker down one line. When the marker is on the bottom line, a line feed moves the marker to the top line without changing character position.
FF	Form Feed. Clears memory, erases display, and page returns marker to the top left character position.
CR	Carriage Return. Returns marker to the leftmost character position. When the marker is at the left edge of the page, subsequent carriage returns have no effect.
RLF	Reverse Line Feed. Moves marker up one line without changing character position. When marker is on top line, subsequent RLF's have no effect on the marker. Character position is never changed with this command.
FS	Forward Space marker one character. When the marker reaches the end of the line, another Forward Space causes generation of a Carriage Return — Line Feed.
PR	Page Return. Returns marker to top left character position without erasing display.
SYN	Synchronous Idle. Used in synchronous transmission to obtain character synchronization.
SP	Space. Stores and displays a "Space" character.
BLINK	Causes all characters between Blink character and the next space character (or end of line) to blink. When inserted in a message to a Page Print Controller, a single Blink character stops the printer at that point. A Double Blink code causes the PPC to generate a form feed (carriage return, line feed) sequence and then stop printing.

TABLE III: SUMMARY OF MESSAGE TYPES

Type of Message	Status Character	Text	
		From Display	From Computer
Information	NUL	1 to 1,196 data characters*	1 to 1,196 data characters plus cursor movement commands*
Positive Acknowledgment	ACK	none	cursor movement commands*
Negative Acknowledgment	NAK	none	ENQ plus cursor movement commands
Busy	BSY	none	—
Print	PRT	1 to 1,196 data characters*	**

* Maximum number of data characters in message is determined by the maximum display size of the sending or receiving Terminal Display Unit; see Paragraph .2.

** A message from the computer which is to be printed is formatted as an Information message addressed to a printer.

.36 Operating Procedure (Contd.)

To transmit a message to the remote computer, the operator:

- Composes the message by keying in the data, using the cursor control keys to aid in positioning the data;
- Moves the cursor to anywhere in the last line to be transmitted and depresses the ETX key to enter the End of Transmission character (displayed as a C) in the right margin opposite the last line;
- Moves the cursor to the first character to be transmitted; and
- Depresses the TX key.

Transmission can be initiated in either the Local or Receive mode. All data between the cursor and the end of the line indicated by the ETX symbol is ready for transmission. Depression of the TX key places the Terminal Display Unit in the Transmit mode, as indicated by a "T" displayed in the mode indicator position. The message will be included in the next available transmission frame.

The keyboard is disabled until transmission is completed. The Terminal Unit is now free to receive a message from the remote computer. Normally, a positive or negative response is received. The keyboard is locked again if a negative response is received, and the mode indicator character will blink. The Display Control will automatically retransmit the message in the next available transmission frame. The Terminal Display Unit is automatically placed in the Receive mode after a successful transmission, and an "R" is displayed in the mode indicator character position. The operator can also change modes manually if required.

To print out a display, the operator depresses the PRT key, which puts the display in the Print mode and causes a "P" to be displayed in the mode indicator character position. The display message is transmitted to the remote computer. The remote computer selects a print terminal as determined by the stored program and sends the message back to the DATANET-760 for printing. The keyboard is locked until the transmission to the computer is completed. The Display Terminal is freed for other operations immediately following the transmission.

(Contd.)

The capability of the Display Unit to transmit selected portions of a message and the capability to include cursor positioning commands in the message from the computer allow a series of display messages and computer responses to be displayed simultaneously.

.37 Entry of Time and Date: . . . . . no provisions.

.4 OUTPUT

.44 Output to Printer

Up to 4 independent groups of Teletype Model 33 or 35 Receive-Only Printers can be used in a DATANET-760 Subsystem for printed output at 10 char/sec. Each group of RO Printers requires a Page Printer Controller (PPC). All printers in a group receive and print the same data. The Teletype units are fully described in Reports 6804 and 6805. The output interface of the PPC is EIA RS232A. The output code is as shown in Table I with the addition of a start bit and two stop bits to correspond to the 11-unit code used by the Teletype Model 33 and 35 equipment. The output transfer rate is 10 characters per second (110 bits per second). The user must obtain the Teletype or equivalent printers separately.

.46 Output to Visual Display Device

Display Terminal Unit —

Output medium:	cathode ray tube; displays white characters against gray background.
Character set:	digits 0-9, upper case letters A-Z, and 28 punctuation and special symbols; see Table I. Four of the special symbols permit drawing vertical and horizontal lines.
Character size:	nominally 0.12 inch wide and 0.16 inch high.
Display size:	display field for a 26-line unit is 8.0 inches wide by 6.3 inches high; the display field of a 16-, 8-, or 4-line unit is proportionately shorter in height, and is centered on the face of the tube; the diagonal of the rectangular tube is 14 inches.
Characters per line:	46.
Lines per display:	26, 16, 8, or 4 depending on the number of displays per TMU; see Paragraph .2.
Characters per display:	1,196, 736, 368, or 184, depending on the number of displays per TMU; see Paragraph .2.
Buffer capacity:	1,472 characters per Terminal Memory Unit; maximum of 5,888 characters per DATANET-760 Subsystem.
Format control:	each space in the display occupies one position of buffer storage; cursor is nondestructive and blinks continually 3 to 5 times a second to aid operator visibility; control keys allow cursor to be advanced or backspaced, moved up or down, positioned at the beginning of the next line, or positioned at the first display position; cursor can be positioned by the operator when composing a message or by control codes in a received message; the entire message can be erased by the operator or by a control code in the received message; single characters are corrected or changed by positioning the cursor and depressing the correct character key; special symbols allow drawing of horizontal and vertical lines; cursor can be tabbed to the next position after a vertical line.
Rated output speed:	150, 250, or 300 char/sec (1,200, 2,000, or 2,400 bits/sec respectively).

.46 Output to Visual Display Device (Contd.)

Effective output speed:	highly variable; depends on activity of display terminals, number of format control characters in the display message, turnaround time, etc. The activity of the terminals affects the blocking of messages into transmission frames.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors:	no provision for checking other than visual verification of the display. Errors are corrected by repositioning the cursor and rekeying the data.

.52 Data Transmission Errors

Type of checking:	character parity; longitudinal parity (optional); status character validity check; various checks on format and control characters.
Error indication:	a negative acknowledgment message is transmitted, the mode indicator on the display blinks, and the keyboard remains locked during retransmission.
Correction procedure:	automatic retransmission by DATANET-760, as programmed by computer at remote site (usually retransmission).
.53 Data Recording Errors:	no provision for checking other than visual verification of displayed or printed data

.55 Line Malfunctions

Detection:	no data received from remote computer within 4 seconds after transmission from DATANET-760.
Action:	Controller reinitiates a transmission frame; see Paragraph .7.
.6 CONDITION INDICATORS:	the mode indicator character is displayed in the left margin opposite the first display line. An "R", "L", "T", or "P" is displayed to indicate Receive, Local, Transmit, or Print mode, respectively. The mode indicator blinks if a negative response, which indicates an error, is received. A wide array of controls allows the operator to adjust the brightness and contrast of the display, the vertical size of the characters, and the horizontal and vertical synchronization.

.7 DATA TRANSMISSION

A DATANET-760 Subsystem can operate the public telephone network or over a dedicated line. A connection is normally maintained between the Subsystem and the remote computer for an extended period of time. Groups of messages called "transmission frames" are normally transmitted continually in alternate directions between the Subsystem and the remote computer.

The Data Line Controller contains a timer which is started after every transmission from the DATANET-760. If a transmission is not received from the remote computer within 4 seconds, the DATANET-760 will reinitiate a transmission frame. The remote computer can defeat the time out and prevent the DATANET-760 from transmitting by appropriate signals to the data set. All messages from Display Units are held pending until acknowledged. See Paragraph .35 for a discussion of the message and transmission frame formats.

.71 Basic Characteristics:	see Table IV.

(Contd.)

TABLE IV: DATANET—760 BASIC TRANSMISSION CHARACTERISTICS

Characteristic	DLC 760 and DCL 761 Data Line Controllers	DLC 765 and DLC 766 Data Line Controllers
Rated transmission speed bits/sec	1,200 (120 char/sec)	2,000 or 2,400 (250 or 300 char/sec)
Transmission method	Serial by bit	Serial by bit
Transmission code	ASCII, see Table II; a total of 10 bits are transmitted for each character, including start and stop bits	ASCII, see Table II; a total of 6 bits are transmitted for each character
Transmission mode	Half-duplex (DLC 760); full-duplex (DLC 761)	Half-duplex (DLC 765); full-duplex (DLC 766)
Order of bit transmission	Low-order bit first, parity bit last	Low-order bit first, parity bit last
Synchronization	Start/stop	Synchronous; 4 sync characters precede each message

.72 Connection to Communications Lines

Communications Line or Service	Data Set*
Public telephone network, operating at the following speeds —	
1,200 bits/sec:	Bell System Data-Phone Data Set 202C.
2,000 bits/sec:	Bell System Data-Phone Data Set 201A.
Common-carrier leased voice-band line operating at the following speeds —	
1,200 bits/sec:	Bell System Data Set 202C or 202D, or Western Union 1200 Baud Data Modem.
2,000 bits/sec:	Bell System Data Set 201A.
2,400 bits/sec:	Bell System Data Set 201B or Western Union 2400 Baud Data Set.

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

.73 Transmission Control

In half-duplex operation the Display Controller Unit initiates the sending of a transmission frame after each transmission frame received from the computer, or after the timer in the Data Line Controller has timed out. The Display Units and printers connected to a Terminal Memory Unit (TMU) are numbered sequentially, and all TMU's are also numbered sequentially. When initiating a transmission frame, the units are scanned in descending sequence by Memory Unit and by Display Unit for messages awaiting transmission. If a waiting message of any type is detected, that message and all messages from lower-numbered units connected to the same TMU are grouped and sent as one transmission frame. A similar procedure is followed in full-duplex operation except that the units are scanned continuously for transmit requests and there is no message framing.

.74 Multistation Operation

Polling:	automatic poll after each message received from remote computer; see Paragraph .73.
Addressing:	individual Display Units cannot communicate directly with one another; such communication could be provided on a store-and-forward basis by appropriate programming of the remote computer, utilizing the individual addressability of the terminal units.

.8 PHYSICAL SPECIFICATIONS

Component	Display Terminal Unit	Controller Cabinet*	Line Repeater Unit
Width (inches)	16	27.25	11.1
Depth (inches)	27	27.25	14
Height (inches)	17	62	11
Weight (pounds)	78 (appx.)	550 (appx.)	17 (maximum)
Power (KVA)	0.20	0.75	0.06
Voltage	115	115	115
Frequency (cps)	60	60	60
Phases	1	1	1
Temperature Range (°F)	40 to 100	65 to 85	-20 to +125
Humidity Range (%)	10 to 90	20 to 80	5 to 95

* Houses all components except Display Terminal Units and Printers.

.9 PRICE DATA

Component or Feature	Monthly Rental, $	Purchase Price, $	Monthly Maintenance, $
DMU 761 Display Monitor Unit (14-inch screen)	27.50	1,010	5
DTU 760 Display Terminal Unit*	55	2,020	10
DMU 765 Read-Only Display Unit (23-inch screen)	25	900	5
EKB 761 Electronic Keyboard	27.50	1,010	5
EMC 761 Entry Marker Control	10	375	2
FKG 761 Function Key Group (8 keys)	15	550	3
FKG 766 Function Key Group (16 keys)	20	735	4
DCU 760 Display Controller Unit	350	14,000	24
TMU 760 Terminal Memory Unit	110	4,600	8
BCU 760 Basic Controller Unit	NC	NC	NC
BCU 761 Basic Controller Unit	NC	NC	NC
PPC 760 Page Print Controller	50	2,100	4
Data Line Controllers —			
DLC 760 (half-duplex at 1200 bps)	105	4,200	8
DLC 761 (full-duplex at 1200 bps)	170	6,250	20
DLC 765 (half-duplex at 2000 or 2400 bps)	125	5,000	16
DLC 766 (full-duplex at 2400 bps)	190	7,950	26
LRU 760 Line Repeater Unit	15	550	3
KVA 760 Keyboard Video Amplifer	5	185	1
PLJ 760 Party Line Junction	5	185	1
PLM 761 Party Line Monitor	5	185	1
DTU 760 Options* —			
EMC 760 Entry Marker Control	10	375	2
FKG 760 Function Key Group (8 keys)	15	550	3
FKG 765 Function Key Group (16 keys)	20	735	4
PLM 760 Party Line Monitor	5	185	1

* The DTU 760 is no longer in production; it is available on an "as returned" basis only. The options shown are still available for existing units.

NC — No Charge.

GE DATANET-730 ACOUSTICALLY COUPLED TERMINAL

.1 GENERAL

.11	Identity:	General Electric DATANET-730 Acoustically Coupled Terminal (ACT).
.12	Manufacturer:	General Electric Company Information Systems Division P. O. Box 12313 Oklahoma City, Oklahoma 73112.
.13	Basic Function:	transmit and receive data over the public telephone network via an acoustic telephone coupler.

.14 Basic Components

Name:	Portable Keyboard Send-Receive Set.
Model number:	Model ACT-731 KSR.
Function:	transmits data from keyboard input; receives data and prints it.
Name:	Portable Automatic Send-Receive Set.
Model number:	Model ACT-733 ASR.
Function:	transmits data from punched paper tape or keyboard input; receives data and punches it into paper tape or prints it.
Name:	Mobile Automatic Send-Receive Set.
Model number:	Model ACT-735 ASR.
Function:	transmit data from punched paper tape or keyboard input; receives data and punches it into paper tape or prints it.

.15 Description

The GE DATANET family now includes a line of acoustically-coupled teletypewriter terminals under the name of DATANET-730. Three models of the DATANET-730 are presently available; all include the Teletype Model 33 ASR or KSR (depending on the DATANET-730 model) interfaced with a GE DigiNet Model TDM-114 Data Set and packaged as a mobile unit, see Figure 1, or as portable units in separate hand-carrying cases.

This report presents a summary of the DATANET-730, and includes only that information pertinent to the 730 configuration. Refer to Report 6804 for a detailed description of the Teletype Model 33 line.

The GE DATANET-730 is available in three models:

- Model ACT 731 - includes the Teletype Model 33 KSR and GE Model TDM-114 Data Set. Both units are packaged in separate hand-carrying cases.
- Model ACT 733 - includes the Teletype Model 33 ASR and GE Model TDM-114 Data Set. Both units are packaged in separate hand-carrying cases.
- Model ACT 735 - includes the Teletype Model 33 ASR and GE Model TDM-114 Data Set. Both units are functionally integrated into a mobile cabinet.

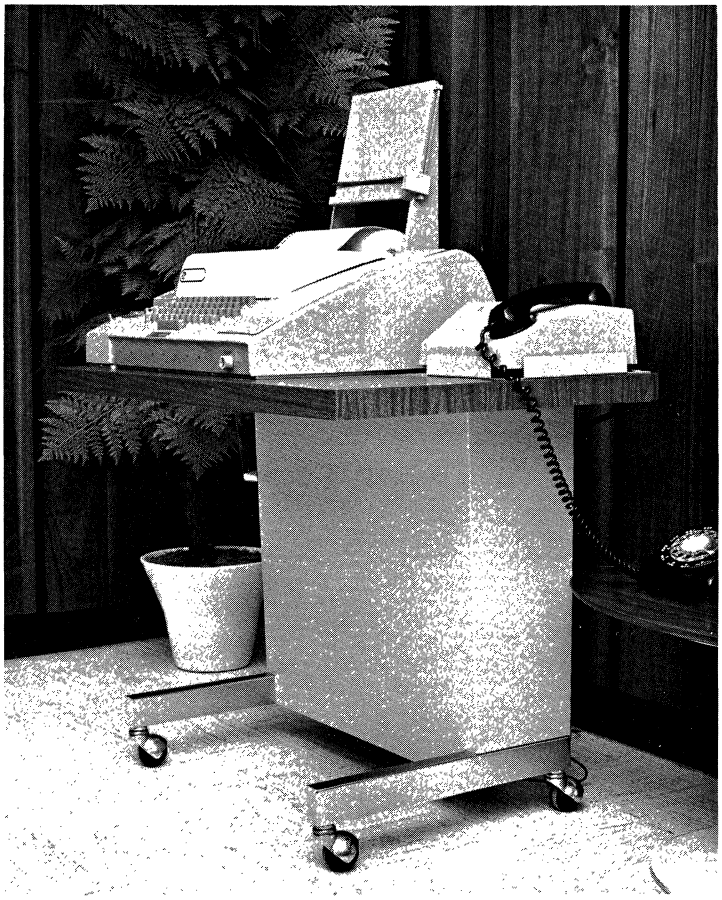


Figure 1. The GE DATANET-730 Model Act-735 Mobile Terminal, Connection to a Standard Desk-Telephone Set is Shown.

.15 Description (Contd.)

The differences between the Teletype equipment and the GE DATANET-730 include some keyboard key-top changes, the addition of the GE acoustically-coupled data set, and the special packaging provisions.

The DATANET-730 transmits at 10 characters per second (110 bits per second) and operates asynchronously in the half-duplex mode. The 7-level USASCII code with an 11-unit code structure is employed. Each character transmitted includes a parity bit, one start, and two stop bits. Even parity is generated and transmitted but no checking facilities are provided for received data other than operator surveillance.

The character set totals 96 characters including upper-case alphabetics, numerics, special characters and control codes; of these 96, 64 characters are printable.

The ASR models employ a punched paper type reader and a punched paper tape punch. Operation of these units can be initiated by the remote computer via special control codes. Both units employ 1-inch, 8-level paper tape.

The GE TDM-114 is a telephone coupler data set that acoustically couples the Model 33 Teletype unit to the public telephone network via a standard desk telephone set such as the Bell System Series 500 telephone set. To transmit data between the DATANET-730 and a remote computer, the operator places the call in the conventional manner, positions the telephone handset in the telephone-coupler cradle and activates the data terminal. The call is terminated by simply removing the handset from the cradle and "hanging-up" in the conventional manner. Table I presents the operational characteristics of the TDM-114 Data Set.

(Contd.)

TABLE I. GE DATANET-730 ACOUSTIC COUPLER TRANSMISSION CHARACTERISTICS*

Component	Mode	Method	Modulation	Timing	Code	Operating Mode	Speed
TDM-114 Data Set	Half-duplex or full-duplex	Serial by bit	Frequency Shift	Asynchronous	Any code; unrestricted code length	Originate only	Up to 300 bps

*The GE TDM-114 Data Set is compatible with the GE TDM-115 Data Set and the Bell System Data-Phone Data Set 103A2. GE also markets the TDM-114 and-115 Data Sets as separate units; see Section 4640: Telephone Coupler Data Sets.

.15 Description (Contd.)

In addition to its data transmission capabilities, the DATANET-730 can be used off-line to prepare paper tape or list paper tape data.

The Answer-Back feature of the standard Teletype Model 33 units is also present in the DATANET-730. The feature consists of a recorded message of up to 20 characters that is initiated by an ENQ code received from the remote computer or another DATANET-730 ACT.

An elapsed time meter is available as an option for the DATANET-730 terminals.

.16 First Delivery: . . . . . December 1968.

.17 Availability: . . . . . 3 to 4 days.

.8 PHYSICAL SPECIFICATIONS

Component	Model 731 ACT		Model 733 ACT		Model 735 ACT		
	KSR Unit*	TDM-114 Data Set*	ASR Unit*	TDM-114 Data Set*	ASR Unit	TDM-114 Data Set	Mobile Cabinet
Width (inches)	21.2	10.0	24.63	10.0	22.0	9.5	34.0
Depth (inches)	22.0	12.0	22.0	12.0	18.5	7.5	22.0
Height (inches)	14.0	4.62	14.0	4.62	8.4	4.0	27.0
Weight (lbs.)	70.0	8.5	82.0	8.5	125.0**		
Power (KW)	0.110	Supplied	0.110	Supplied	0.110	Supplied	—
Voltage	115	by	115	by	115	by	—
Frequency (Hz)	60	KSR	60	ASR	60	ASR	—
Phase	1	Unit	1	Unit	1	Unit	—
Temperature Range (°F)	40-120		40-120		40-120		—
Humidity Range (%)	0-90		0-90		0-90		—
Heat (BTU/Hr.)	409	?	682	?	682	?	

*Includes carrying case.
**Includes mobile cabinet.

.9 PRICE DATA

Component	Monthly Rental, $	Purchase Price, $	Monthly Maintenance, $
Model ACT-731 KSR*	N/A	2100	30
Model ACT-733 ASR*	N/A	2200	35
Model ACT-735 ASR**	110	2100	35

*Includes carrying cases.
**Includes mobile cabinet.
N/A - Not Applicable.

HONEYWELL 480 COMMUNICATIONS CONTROL UNIT

.1 GENERAL

.11 Identity: ..... 480 Communications Control Unit.

.12 Manufacturer: ..... Honeywell EDP Division
60 Walnut Street
Wellesley Hills, Mass.

.13 Basic Function: ..... provides a Honeywell 400 or 1400 computer system with the capability of communicating with various remote terminals over a voice-band line.

.15 Description

The Honeywell Model 480 Communications Control Unit controls the transfer of digital information over a single half-duplex voice-grade line (either leased, or the public switched network) between a Honeywell 400 or 1400 computer system and various terminal units, including:

- Another Honeywell 400 or 1400 computer system equipped with a 480 Communication Control Unit.
- A Honeywell 800 or 1800 computer system equipped with an 880 Communication Control Unit.
- A Honeywell Series 200 computer system equipped with either a 281-2D or 286 Communication Control.
- An IBM 1400 or 7000 Series computer system equipped with a 1009 Data Transmission Unit.
- An IBM System/360 computer system equipped with a 2701 Data Adapter Unit.
- An IBM 1013 Card Transmission Unit.
- An IBM 7701 or 7702 Magnetic Tape Transmission Unit.

The 480 operates at 250 or 300 characters per second and sends or receives a 4-of-8 transmission code. Utilizing a buffer capacity of 512 characters, the 480 supplies all control codes, establishes synchronization, automatically translates to and from the internal Honeywell 6-bit code, implements a character validity and longitudinal parity error detection scheme, and automatically retransmits erroneous messages.

As many as four 480's can be connected to the central processor of a Honeywell 400 or 1400 computer system. Each requires an input and an output trunk from the central processor. A hardware interrupt feature allows a separate data processing program to be run concurrently with the transfer of data over a communications line.

.2 CONFIGURATION

A 480 can be connected to a Honeywell 400 or 1400 Central Processor via one input and one output trunk of the central processor. A maximum of four 480 Communications Control Units can be connected to either processor. Connections to standard communications facilities are as specified in Paragraph .72.

.3 INPUT

All input to the 480 is from the associated H-400 or H-1400 computer system under control of the stored program. Input to the H-400 or H-1400 can be from the console keyboard, punched cards, punched paper tape, magnetic tape, or magnetic disc.

.35 Message Configuration: . . . . . data is transferred in blocks of from 1 to 512 characters under program control. Each message is preceded and followed by control characters automatically supplied by the control unit.

.36 Operating Procedure

(1) Operator establishes connection manually by dialing or signaling.

(2) The 480 is set to transmit or receive.

(3) The Start button is pressed and the telephone is switched to data mode.

.4 OUTPUT

All output from the 480 is to the associated H-400 or H-1400 computer system under control of the stored program. Output can be to printed copy (via either the line printer or the console typewriter), punched cards, punched paper tape, magnetic tape, or magnetic disc.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors

Type of checking: . . . . . no checking is performed on the data transferred from the attached computer system to the 480.

.52 Data Transmission Errors

Type of checking: . . . . . character validity and longitudinal parity.
Error indication: . . . . . an interrupt signal is generated and the processor branches to a specified location.
Correction procedure: . . . . . under control of the stored program; usually retransmission.

.53 Data Recording Errors

Type of checking: . . . . . no checking is performed on the data transferred from the 480 to the connected computer system.

.55 Line Malfunctions: . . . . . no checking.

.6 CONDITION INDICATORS

Component: . . . . . 480 Communications Control Unit

System available: . . . . . lamp.
Input device transmitting: . . . . . lamp.
Remote receiver ready: . . . . . lamp.
Remote receiver busy: . . . . . lamp.
Power on: . . . . . lamp.
Transmission error: . . . . . lamp.
Retransmission occurring: . . . . . lamp.

(Contd.)

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	250 or 300 char/sec over voice-band lines. These speeds correspond to 2,000 and 2,400 bits per second, respectively.
Transmission method:	serial by bit.
Transmission code:	4-of-8 (same as IBM 4-of-8 code used with 7702 Magnetic Tape Terminal; see Paragraph 6450.31).
Transmission mode:	half-duplex.
Order of bit transmission:	1, 2, 4, 8, R, O, X, N.
Synchronization:	synchronous; i.e., synchronization is maintained by the data signals.

.72 Connection to Communications Lines

Communications Line	Data Set*
Public switched telephone network at 2,000 bits/sec (250 char/sec):	Bell System Data-Phone Data Set 201A.
Common-carrier leased voice-band lines at the following speeds:	
2,000 bits/sec (250 char/sec):	Bell System Data Set 201A.
2,400 bits/sec (300 char/sec):	Bell System Data Set 201B, or Western Union 2400 Baud Data Modem.

.73 Transmission Control

Call initiation:	manual dialing or signaling.
Call reception:	operator must establish voice communication and then switch to data mode.
Functional operations:	no direct control, but incoming data can be used to control operations through appropriate programming.

.74 Multistation Operation: no provision.

.8 PHYSICAL SPECIFICATIONS

Component:	480 Communications Control Unit
Width (inches)	35
Depth (inches)	30
Height (inches)	66
Weight (pounds)	800
Power (KW)	1.0
Voltage	208
Frequency (cps)	60
Phases	3
Temperature range (°F.)	70-74
Humidity Range (%)	?
Heat (BTU/hr.)	?

*In some cases, equivalent data sets can be used; see your local common-carrier communications consultant.

.9 PRICE DATA

Component or Feature	Monthly Rental, $	Purchase Price, $	Monthly Maintenance, $
480 Communications Control Unit	790	35,550	79.00

HONEYWELL 481 SINGLE-CHANNEL COMMUNICATIONS CONTROL

.1 GENERAL

.11 Identity: . . . . . 481 Single-Channel Communications Control.

.12 Manufacturer: . . . . . Honeywell EDP Division
60 Walnut Street
Wellesley Hills, Mass.

.13 Basic Function: . . . . . provides a Honeywell 400 or 1400 computer system with the capability of communicating with various remote terminals over a narrow-band or voice-band line.

.14 Basic Components

Name: . . . . . Single-Channel Communications Control (SCCC).
Model number: . . . . . 481.
Function: . . . . . provides buffering to control data flow between the computer system and a communications line.

Name: . . . . . Communications Adapter Unit.
Model number: . . . . . 485-1R, -1T, -1H, -2R, -2T, or -2H.
Function: . . . . . provides the interface for a specific type of line.

.15 Description

The Model 481 Single-Channel Communications Control (SCCC) controls the transfer of digital information over a simplex or half-duplex narrow-band or voice-band line between a Honeywell 400 or 1400 central processor and a variety of terminal equipment. Generally, any standard teleprinter, paper tape reader or punch, etc., which can transmit or receive up to 105 characters per second with codes of up to 8 levels, can be employed as terminal equipment.

The 481 has a dual two-character buffer for input, which is used as a single four-character buffer during output. A hardware interrupt facility allows an independent data-processing program to be run concurrently with the data communications transfer. All control signals, error checking, and translation are implemented by the central processor program.

A Model 485 Communication Adapter Unit (CAU) is contained in the 481 and serves as the interface between the 481 and the line terminal. There are various types of CAU's, depending on the type of line to be serviced.

.2 CONFIGURATION

The 481 SCCC can be connected to a Honeywell 400 or 1400 central processor via one input and one output trunk of the central processor. A maximum of four 481 SCCC units can be connected to either processor. A 485 Communications Adapter Unit is required for attachment to a specific communication line. Six models of the 485 are currently available:

- 485-1R — permits connection to a telegraph-grade line for receive-only operation.
- 485-1T — permits connection to a telegraph-grade line for transmit-only operation.
- 485-1H — permits connection to a telegraph-grade line for half-duplex operation.

.2 CONFIGURATION (Contd.)

- 485-2R — permits connection to a voice-grade line for receive-only operation.
- 485-2T — permits connection to a voice-grade line for transmit-only operation.
- 485-2H — permits connection to a voice-grade line for half-duplex operation.

The connections to various communications facilities, and the data sets required, are specified in Paragraph .72.

.3 INPUT

All input to the 481 is from the associated H-400 or H-1400 computer system under control of the stored program. Input to the H-400 or H-1400 can be from the console keyboard, punched cards, punched paper tape, magnetic tape, or magnetic disc.

.35 Message Configuration: . . . . . data is transmitted in blocks of variable length. data characters are followed by an end-of-message or end-of-transmission character supplied by the stored program, when required by the remote terminal. minimum message length is four characters; maximum length is dependent on core storage availability and/or on program considerations.

.36 Operating Procedure

With 485-1 Communications Adapter —

Operation with this Adapter is entirely under program control; no operator action is required.

With 485-2 Communications Adapter —

(1) Operator establishes connection manually by dialing or signaling.

(2) The 481 is set to transmit or receive.

(3) The Start button is pressed and the telephone is switched to data mode.

.4 OUTPUT

All output from the 481 is to the associated H-400 or H-1400 computer system under control of the stored program. Output can be to printed copy (via either the line printer or the printer or the console typewriter), punched cards, punched paper tape, magnetic tape, or magnetic disc.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors: . . . . . no checking is performed on the data transferred from the attached computer system to the 481 SCCC.

(Contd.)

.52 Data Transmission Errors: . . . . . no automatic checking is performed on transmitted or received data, but various checks can be programmed, depending on coding and format restrictions of the remote terminal. If the 481 is receiving, the stored program can request retransmission; if the 481 is transmitting, the stored program can initiate retransmission.

.53 Data Recording Errors: . . . . . no automatic checking is performed on the data transferred from the 481 SCCC to the attached computer system.

.55 Line Malfunctions: . . . . . no automatic checking.

.6 CONDITION INDICATORS: . . . . . there are no condition indicators on the 481 SCCC, and there are no indicators on the attached computer system console which directly pertain to data communications.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed —
485-1 Communications Adapter: . . . . 6.0, 6.6, 7.5, or 10.0 char/sec on Telegraph-grade line.
485-2 Communications Adapter: . . . . 14.8 or 105 char/sec on voice-band line.

Transmission method: . . . . . serial by bit.

Transmission code: . . . . . any code up to 8 levels; specified when ordered.

Transmission mode: . . . . . simplex or half-duplex, depending on Adapter model; see Paragraph .2.

Order of bit transmission: . . . . . as specified when ordered.

Synchronization: . . . . . start and stop bits are transmitted with each character.

.72 Connection to Communications Lines

Communications Line	Data Set*
Common-carrier leased telegraph — grade lines (up to 75 bits/sec):	none required.
Common-carrier leased narrow-band Data Channels (up to 75 bits/sec):	Bell System Data Set 103F or Western Union 75 Baud Data Modem.
Bell System Schedule 3A Data Channel (150 bits/sec):	Bell System Data Set 103F.

* In some cases, equivalent data sets can be used; see your local common-carrier communications consultant.

.72 Connection to Communications Lines (Contd.)

Communications Line	Data Set*
Western Union Class D Data Channel (180 bits/sec):	Western Union 180 Baud Data Modem.
Common carrier leased voice-band lines at the following speeds:	
Up to 150 bits/sec:	Bell System Data Set 103F.
Up to 180 bits/sec:	Western Union 180 Baud Data Modem.
Up to 1,200 bits/sec:	Bell System Data Set 202C or 202D, or Western Union 1200 Baud Data Modem.
Public switched telephone network at the following speeds:	
Up to 150 bits/sec:	Bell System Data-Phone Data Set 103A.
Up to 1,200 bits/sec:	Bell System Data-Phone Data Set 202C.

.73 Transmission Control

Call initiation:	manual dialing or signaling on voice-band lines. programmed calling on telegraph-grade lines.
Call reception:	capable of unattended operation.
Functional operations:	no direct control, but incoming data can be used to control operations with appropriate programming.

.74 Multistation Operation: no provision other than the facilities offered by programming; it would depend on the remote terminals' ability to respond to messages, and would require program analysis of responses.

.8 PHYSICAL SPECIFICATIONS

Component:	481 SCC**
Width (inches)	20
Depth (inches)	30
Height (inches)	73
Weight (pounds)	400
Power (KW)	0.3
Voltage	208
Frequency (cps)	60
Phases	3
Temperature range (°F.)	70-74
Humidity Range (%)	?
Heat (BTU/hr.)	?

* In some cases, equivalent data sets can be used; see your local common-carrier communications consultant.

** This unit also contains the 485 Communications Adapter Unit.

(Contd.)

.9 PRICE DATA

Component or Feature	Monthly Rental, $	Purchase Price, $	Monthly Maintenance, $
481 Single-Channel Communications Controller	300	13,650	24.00
485 Communications Adapter Unit:			
485-1R	25	1,125	2.50
485-1T	25	1,125	2.50
485-1H	30	1,350	3.00
485-2R	30	1,350	3.00
485-2T	30	1,350	3.00
485-2H	40	1,800	4.00

HONEYWELL 281 SINGLE-CHANNEL COMMUNICATIONS CONTROL UNIT

.1 GENERAL

.11 Identity: ..... Type 281 Single-Channel Communications Control Unit.

.12 Manufacturer: ..... Honeywell EDP Division
60 Walnut Street
Wellesley Hills, Mass. 02181

.13 Basic Function: ..... different models provide a Honeywell Series 200 computer system with the capability of communicating with various remote terminals over a narrow-, voice-, or broad-band line.

.15 Description

The Type 281 Single-Channel Communications Control Unit enables the transmission and reception of messages over a common-carrier narrow-, voice-, or broad-band communications line. Many models of the 281 are available to accommodate 5- to 8-level data codes and transmission rates of up to 5100 characters per second. The 281 is a single-channel, half-duplex control that sends or receives either by single character or by message. For full-duplex or multiple-channel operation the Honeywell Type 286 Multi-channel Communication Control (Report 8381) is generally recommended although additional Type 281 Controls can be added to a Honeywell Series 200 computer system. Each 281 Control requires two input-output address assignments of the associated Series 200 computer.

By means of a 281 Communications Control and appropriate communication facilities, a Honeywell Series 200 system can communicate with a wide variety of remote devices, such as:

- Teleprinters, paper tape readers, and paper tape punches used with Bell System and Western Union telegraph services (Teletype Model 19, 28, 32, 33, 35 and 37 units over TWX, Telex, public telephone network and leased lines).
- Teletype Telespeed 1050 Equipment (Bell System Dataspeed Type 2 Service).
- IBM 1050 Data Communication System.
- Honeywell Data Station.
- Honeywell Keytape Units.
- Honeywell Visual Information Projection (VIP) System.
- Other Honeywell Series 200 computers (H-110, H-120, H-125, H-200, H-1200, H-1250, H-2200, H-4200, or H-8200).
- IBM (Synchronous Transmit Receive (STR) terminals (IBM 1013, IBM 1978, IBM 7702).
- IBM System/360 computers equipped with 2701 Data Adapter Units or 2702 or 2703 Transmission Controls.
- UNIVAC 1004 Card Processors equipped with a DLT 2 feature.

There are two basic models and a number of variations in the 281 series. The characteristics of each model (type of communications service and terminals, transmission speed, and data set requirements) are presented in Table I.

The associated computer can test for the presence of incoming data or for readiness of the control to transmit data. The 281 can perform the same tests and interrupt the computer program automatically. Data being transmitted and received by a Communication Control is protected by a transmission-lapse check, by a character parity check, and by an optional longitudinal parity check in some models. The failure of a transmission or parity check sets a program-testable indicator.

TABLE I: HONEYWELL TYPE 281 SINGLE-CHANNEL CONTROL UNITS

Characteristic	Narrow-Band				
	281-1A	281-1B	281-1C	281-1D	281-1E
Buffer size	8 bits	8 bits	8 bits	8 bits	8 bits
Transmission speed	6.6 char/sec	10 char/sec	6.0, 6.6, 7.5, or 10 char/sec	10 char/sec	14.8 char/sec
Transmission method	Serial by bit	Serial by bit	Serial by bit	Serial by bit	Serial by bit
Transmission code (1)	5-level Baudot; 7.5-unit	8-level USASCII; 11-unit	5-level Baudot; 7.5-unit	8-level USASCII; 11-unit	6-level IBM code; 9-unit
Transmission mode	Half-duplex	Half-duplex	Half-duplex	Half-duplex	Half-duplex
Order of bit transmission	Low-order bit first	Low-order bit first	Low-order bit first	Low-order bit first	Low-order bit first
Synchonrization	Start/stop	Start/stop	Start/stop	Start/stop	Start/stop
Compatible remote terminal	Teletype Model 32	Teletype Models 33 and 35	Teletype Models 19 and 28	Teletype Models 33 and 35	IBM 1050 Data Communication System
Reference (2)	6803	6804; 6805	6802	6804; 6805	6447
Compatible communication facility	Western Union Telex Service	Bell System TWX CE (100 Speed) Service	Common-carrier leased telegraph-grade line	Bell System Type 1006 Data Channel; Western Union Class D Data Channel	Bell System TWX CE (100 Speed) Service
Compatible data set (3)	None required	Bell System Data Phone Data Set 103A	None required	Bell System Data Set 103F or Western Union 180 Baud Data Modem	Bell System Data-Phone Data Set 103A
Comments	Manual dialing				

(1) See also the Reference entry in this column.
(2) This refers to the report where the specified remote terminal is covered.
(3) In some cases, equivalent data sets can be used; check with your local communications consultant.

.15 Description (Contd.)

With most models of the 281, each message character is stored in two core storage locations of the associated computer system. With the 281-1 models using 5- or 6-level codes, each character occupies one storage location. Unused bit positions are automatically zero filled.

The 281 Control Unit can transmit or receive in either of two modes: character or message. In the character mode, the transmission or reception of each message character must be individually programmed; i.e., an interrupt sequence must be executed for each message character. An interrupt sequence requires approximately 400 microseconds for an H-200 Processor and is proportionate for other models of the Series 200 line. In the character mode, the computer's input-output channel is released after the transfer of each message character. In the message mode, the input-output channel is not released until after the entire data block has been transferred. The demand on the central processor in the message mode is only the time required to transfer data between the 281 Control Unit and the processor (one or two core storage cycles per message character). An interrupt is not generated in the message mode until the whole data block has been transferred.

For a brief outline of the characteristics of the Honeywell Series 200 family of computers, see Paragraph 8381.23.

.16 First Delivery: . . . . . July 1964.

.17 Availability: . . . . . 6 months.

.2 CONFIGURATION

There are currently twenty-one different models of the Type 281 Control Unit, each designed for a specific combination of communication facilities and remote terminals. The characteristics of each model are presented in Table I.

One or more Type 281 Control Units can be connected to a Honeywell Series 200 Central Processor via one input and one output trunk per 281.

Connections to standard communications facilities are also described in Table I, along with compatible data sets if any are required.

TABLE I: HONEYWELL TYPE 281 SINGLE-CHANNEL CONTROL UNITS (Contd.)

Characteristic	Narrow-Band	Voice-Band			
	281-K	281-1H	281-1M	281-1R (4)	281-2A
Buffer size	8 bits	8 bits	8 bits	8 bits	8 bits
Transmission speed	14.8 char/sec	105 char/sec	120 char/sec	120 char/sec	1200 or 1800 bits/sec
Transmission method	Serial by bit	Serial by bit	Serial by bit	Serial by bit	Serial by bit
Transmission code (1)	6-level IBM code; 9-unit	Any 5-, 6-, 7-, or 8-level code; 10-unit	8-level USASCII; 10-unit	8-level USASCII 10-unit	IBM 4-of-8 constant ratio code; 8-unit
Transmission mode	Half-duplex	Half-duplex	Half-duplex	Half-duplex	Half-duplex
Order of bit transmission	Low-order bit first	Low-order bit first	Low-order bit first	Low-order bit first	Low-order bit first
Synchronization	Start/stop	Start/stop	Start/stop	Start/stop	Synchronous
Compatible remote terminal	IBM 1050 Data Communication System	Teletype Telespeed 1050 Equipment; Bell System Data-speed Type 2 Service	Honeywell Data Station	Honeywell VIP	IBM Synchronous Transmit Receive Terminals such as 7702 and 1013
Reference (2)	6647	6800	6383	6384	6450; 6444
Compatible communication facility	Bell System Type 1006 Data Channel; Western Union Class D Data Channel	Public switched telephone network; common-carrier leased voice-band line.			
Compatible data set (3)	Bell System Data Set 103F; Western Union 180 Baud Data Modem	Bell System Data-Phone Data Set 202C; Bell System Data Set 202D, Western Union 1200 Baud Data Modem, or Western Union 2400 Baud Data Modem			
Comments					

(1) See also the Reference entry in this column.
(2) This refers to the report where the specified remote terminal is covered.
(3) In some cases, equivalent data sets can be used; check with your local communications consultant.
(4) The 281-1R can also be used locally up to 50 feet from the 281 Control Unit; the 281-1S is equivalent to the -1R but, is used for local operation only at distances up to 200 feet from the 281 Control Unit.

.3 INPUT

All input to the 281 Control Unit is transferred from the associated Series 200 computer under control of the computer program. Input to the computer can be from the console keyboard, punched cards, punched paper tape, magnetic tape, magnetic drum, or magnetic strip devices.

.35 Message Configuration: . . . . . except with the 281-1 models, each message is preceded by a start-of-message character; if the message length is not fixed, the message must contain an end-of-message character; message length is dependent upon remote terminal equipment and core storage availability.

.36 Operating Procedure

(1) Operator establishes connection manually by dialing or signaling.

(2) The 281 is set to transmit or receive.

(3) The Initialize button is pressed and the data set is switched to data mode.

.4 OUTPUT

All output from the 281 Control Unit is transferred to the associated Series 200 computer under control of the computer program. Output from the computer can be printed copy, punched cards, punched paper tape, magnetic tape, or magnetic disc.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors: . . . . . no checking is performed on data transferred from the associated computer system to the 281 Control Unit.

TABLE I: HONEYWELL TYPE 281 SINGLE-CHANNEL CONTROL UNITS (Contd.)

Characteristic	Voice-Band (Contd.)				Broad-Band
	281-2B	281-2D	281-2M	281-2R(4)	281-2F
Buffer size	8 bits	8 bits	8 bits	8 bits	8 bits
Transmission speed	2000 or 2400 bits/sec	2000 or 2400 bits/sec	2000 or 2400 bits/sec	2000 or 2400 bits/sec	40,800 bits/sec (5100 char/sec)
Transmission method	Serial by bit	Serial by bit	Serial by bit	Serial by bit	Serial by bit
Transmission code (1)	Any 5-, 6-, 7-, or 8-level code; 8-unit	IBM 4-of-8 constant ratio code; 8-unit	8-level USASCII	8-level USASCII	Any 8-level code
Transmission mode	Half-duplex	Half-duplex	Half-duplex	Half-duplex	Half- or full-duplex
Order of bit transmission	Low-order bit first	Low-order bit first	Low-order bit first	Low-order bit first	Low-order bit first
Synchronization	Synchronous	Synchronous	Synchronous	Synchronous	Synchronous
Compatible remote terminal	Remote Honeywell Computers	IBM Synchronous Transmit Receive Terminals such as 7702 and 1013	Honeywell Data Station	Honeywell VIP	Other Honeywell Series 200 computers; UNIVAC 1004 with DLT-2B
Reference (2)	6380; 6381; 8380 8381	6450; 6444	6383	6384	6382; 6860
Compatible communication facility	Public switched telephone network; common-carrier leased voice-band line.				Common-carrier leased broad-band line (Series 8000 wideband Channel Type 8800)
Compatible data set (3)	Bell System Data-Phone Data Set 201A; Bell System Data Set 201B or Western Union 2400 Baud Data Modem.				Type 8801 Series Terminal
Comments					Can transmit or receive in message mode only

(1) See also the Reference entry in this column.
(2) This refers to the report where the specified remote terminal is covered.
(3) In some cases, equivalent data set can be used; check with your local communications consultant.
(4) The 281-2R can also be used locally up to 50 feet from the 281 Control Unit; the 281-2S is equivalent to the 2R but, is used for local operation only at distances up to 200 feet from the 281 Control Unit.

.52 Data Transmission Errors

Type of checking: . . . . . character and longitudinal parity checking is available for some narrow-band and all voice- and broad-band models of the 281; there is no extra cost for the character parity check option.

Error indication: . . . . . a testable indicator is set.

Correction procedure: . . . . . under control of computer program; usually retransmission.

.53 Data Recording Errors: . . . . . no checking is performed on data transferred from the 281 Control Unit to the computer system.

.55 Line Malfunctions

Detection: . . . . . testable indicator is set if no data is received within a specified time.

Action: . . . . . under program control.

.6 CONDITION INDICATORS: . . . . . there are no condition indicators associated with the 281 Control Unit.

.7 DATA TRANSMISSION

.71 Basic Characteristics: . . . . . see Table I.

.72 Connection to Communications Lines: . . see Table I.

.73 Transmission Control

Call initiation: . . . . . manual dialing or signaling.

Call reception: . . . . . capable of unattended operation.

Functional operations:. . . . . in some models special characters in the received data can cause message termination, an interrupt signal to be generated, parity checking to be inhibited, etc.; in all models, characters in incoming data can be used to control operations by appropriate programming.

.74 Multistation Operation: . . . . . no provisions other than the facilities offered by programming of the associated computer system; it would depend on the remote terminal's ability to respond to messages, and would require program analysis of responses.

.8 PHYSICAL SPECIFICATIONS

Component:	Logic Cabinet*
Width (inches)	39
Depth (inches)	30
Height (inches)	42
Weigth (pounds)	400
Power (KVA)	0.148
Voltage	115
Frequency (cps)	60
Phases	1
Temperature range (°F)	60 to 85
Humidity range (%)	40 to 60
Heat (BTU/hr)	319

* The indicated dimensions are those of the Honeywell Series 200 Logic Cabinet, which can accommodate four logic drawers. Each 281 Control Unit occupies one logic drawer. Any number of logic cabinets can be incorporated in a Honeywell Series 200 computer system.

.9 PRICE DATA

Component or Feature	Monthly Rental,* $	Purchase Price, $	Monthly Maintenance, $
Type 281 Single-Channel Communicatione Control Unit			
Models -1A, -1B, -1C, -1D, -1E, -1H, -1K, -1M	145	6750	22
Model -1R	190	8930	30
Model -1S	205	9620	32
Models -2A, -2D, -2F	215	10125	34
Models -2, -2M	175	8100	27
Model -2R	230	10765	36
Model -25	235	10995	36
Options			
087 Long Check (longitudinal parity check; not available on 281-1 models)	50	2250	7

* Rates shown are for prime-shift use with a lease agreement of five years; most rates are higher for lease periods of less than five years. Hourly rates for extra-shift usage are approximately ten percent of prime-shift rates.

HONEYWELL DATA STATION

.1 GENERAL

.11 Identity: . . . . . Honeywell Data Station.

.12 Manufacturer: . . . . . Honeywell EDP Division
60 Walnut Street
Wellesley Hills, Mass. 02181

.13 Basic Function: . . . . . transmission and reception of data over a voice-band communications line with a Honeywell Series 200 computer at up to 120 char/sec or at 250 or 300 char/sec; off-line data preparation and recording; input can be punched cards, optically coded cards, punched paper tape, or keyboard; output can be paper tape or printed copy.

.14 Basic Components: . . . . . see Table I.

.15 Description

A Honeywell Data Station consists of a group of input and/or output devices (see Table I) interconnected by a 288-1 or 288-3 Central Control Unit and is intended for use as a remote terminal for a Honeywell Series 200 computer system. The Data Station can also be used off-line to perform data transcription functions such as listing punched cards, preparing punched paper tape, etc. Communication between a Series 200 computer and a Data Station must be initiated by the remote computer.

Data transmission is in the half-duplex mode. The 288-1 Central Control Unit operates asynchronously at up to 120 characters per second; the 288-3 Central Control Unit operates synchronously at 250 or 300 characters per second. Both control units connect to either a common-carrier leased voice-band line or the public telephone network.

The transmission of each data block must be acknowledged with a special message that specifies correct or incorrect reception. The Data Station automatically checks character and block parity and responds with the appropriate message. Parity information is automatically supplied by both control units when transmitting. If the optional buffer feature is included, the remote computer can initiate retransmission of a data block received in error. Without the optional buffer, correction is a manual operation in response to a specific message from the remote computer. (The paper tape reader can be automatically backspaced by a control message from the remote computer.) Data blocks can be of any length without the buffer option; with the buffer option, blocks are restricted to a maximum length of 132 characters for the 288-1 Control Unit and 145 characters for the 288-3 Control Unit.

Special messages are used to address the Data Station and select components, to request retransmission, to request operator communication, to set an alarm, and to initiate other control functions.

The basic components of a Honeywell Data Station are listed in Table I; a configuration guide is presented in Figure 1. Note that no punched card output device is currently available. A Data Station can consist of any combination of devices listed in Table I, provided that the total number of Device Control Areas does not exceed five. A 288-1 or 288-3 Control Unit is required in all configurations, and a keyboard (either separate or in combination with a printer) is required for remote operation. The 289-9 Printer can only be used with the 288-3 Control Unit.

Optional features available for use with the 288-1 or 288-3 Central Control Units include:

- Buffer Option: Provides two 132-character (288-1 Control Unit) or two 145-character (288-3 Control Unit) delay-line buffers. In the local mode, the buffer allows validation of keyboard input. In the remote mode, the buffer option provides error correction by retransmission, for both input and output data. The buffer option permits a transmission rate of 120 characters per second (288-1 Control Unit) or 250 or 300 characters per second (288-3 Control Unit), until the buffer

TABLE I: HONEYWELL DATA STATION BASIC COMPONENTS

Component	Device Control Areas Required	Model Number	Function
Control Unit	0	288-1	Controls other components excluding Line Printer.
Control Unit	0	288-3	Controls other components including Line Printer.
Page Printer and Keyboard	2	289-2	Printed output (10 cps); keyboard data entry.
Page Printer and Keyboard	2	289-3	Printed output (40 cps); keyboard data entry.
Keyboard	1	289-2A	Keyboard data entry where a printer is not desired.
Paper Tape Reader	1	289-4	Reads paper tape (120 cps).
Paper Tape Punch	1	289-5	Punches paper tape (120 cps).
Punched Card Reader	1	289-7	Reads punched cards (120 cps).
Optical Bar Code Reader	1	289-8	Reads bar or mark-sense coded cards (50 or 25 cps).
Remote Line Printer	1	289-9	Printed output (400 lpm).

.15 Description (Contd.)

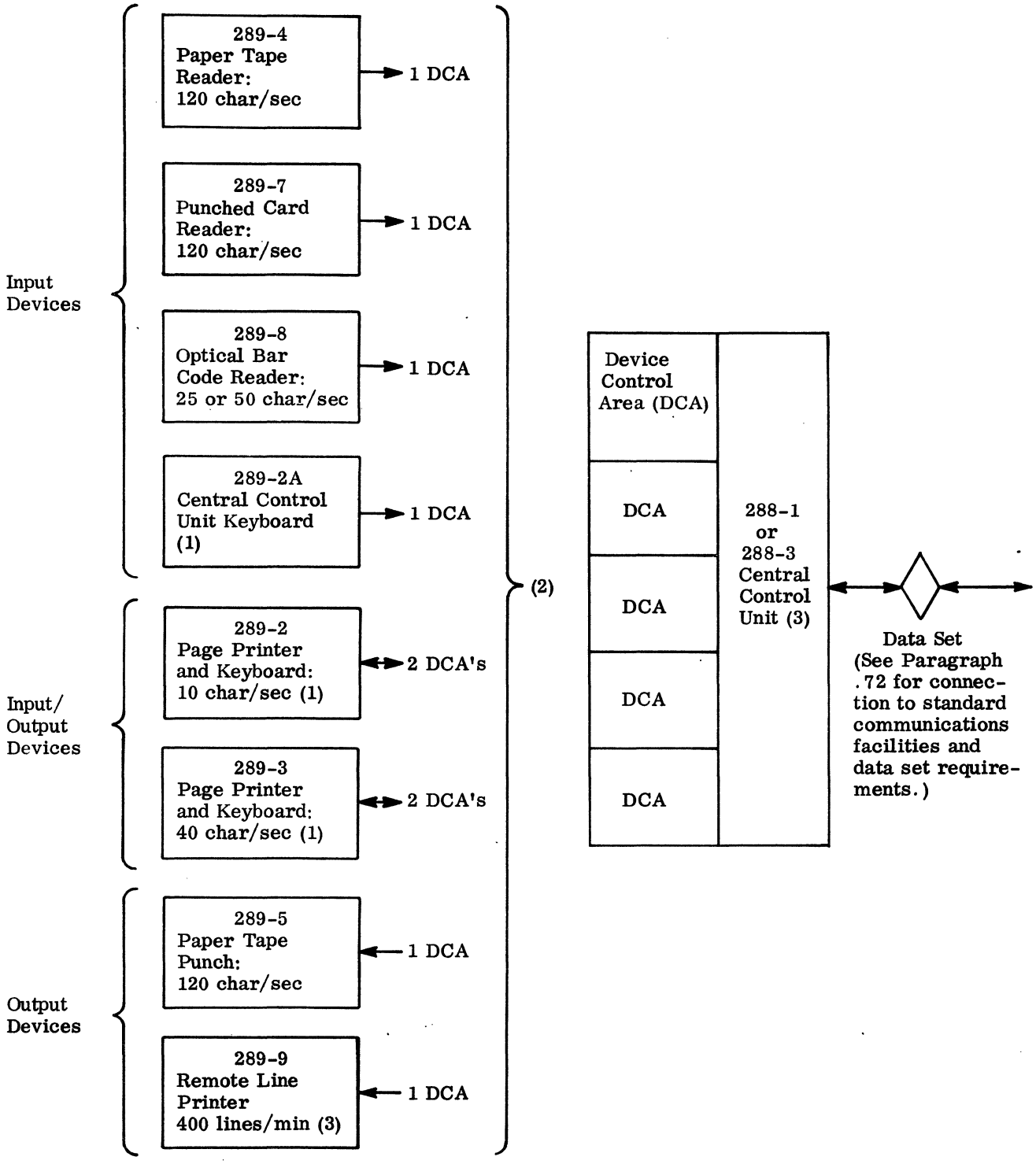
is filled with data from the remote computer or after it has been loaded with data from a local input device, regardless of the speeds of the peripheral devices involved. Without the buffer, the effective transmission rate is limited to the speed of the slowest operating device, and compensating delete characters must be inserted between the data characters by the computer when transmitting to one of the printers. The buffer is required when the optical bar code reader, the card reader, or the Remote Line Printer is included in the Data Station.

- Extended Operations Option (includes the following five features) —
  (1) Alert Alarm: Provides a visual alarm indicator that can be turned on by the computer in the event of a Data Station component failure or detection of a transmission error. The computer can deactivate the Data Station and the alarm by means of a message containing special control codes.
  (2) Telephone: Permits voice communication between the Data Station and computer operators.
  (3) Terminal Addressing: Enables the computer to address and communicate with any one of many Data Stations sharing a common line.
  (4) Enquiry: Allows the computer to request the Data Station to repeat the last reply transmitted in response to a block of data received by the Data Station.
  (5) Buffer Bypass: Permits bypassing of the Data Station Buffer in either the remote or local mode to allow messages of improper format or excess length.
- Multi-Line Block Option: Allows printing multiple lines from one 145-character data block when Buffer Option is included. Lines are delimited by line feed characters; these control codes do not occupy buffer space.

.16 First Delivery: . . . . . August 1965.

.17 Availability: . . . . . 6 months.

.2 CONFIGURATION: . . . . . See Figure 1.



(1) One keyboard is necessary for remote operation,

(2) The Central Control Unit can accommodate up to five Device Control Areas (DCA's); any combination of devices using up to 5 DCA's is permitted. Any one input device can operate with any or all output devices simultaneously.

(3) The 288-3 Central Control Unit is required for the 289-9 Remote Line Printer.

Figure 1. Honeywell Data Station Configuration Possibilities

.3 INPUT

.31 Prepared Input

289-4 Paper Tape Reader —

Input medium:	fully punched; oiled, dry, or mylar; 1-inch-wide tape.
Input code:	8-level USASCII; see Table II.
Quantity of data:	1 to N characters per block, not including control characters; N is limited to 132 characters (including control characters) if buffer is used.
Rated input speed:	120 char/sec.
Effective speed:	limited by block length, control messages, and speed of printer if used to record transmitted data.
Comments:	asynchronous; can read in either direction, under control of remote computer.

TABLE II: HONEYWELL DATA STATION USASCII TRANSMISSION CODE

Bits 4, 3, 2, 1	Bits 7, 6, 5 (1)							
	000	001	010	011	100	101	110	111
0000			Space	0	\	P	@	
0001	SOH	CS	!	1	A	Q		
0010	STX	TEL	"	2	B	R		
0011	ETX	BCA	#	3	C	S		
0100	EOT	DAC	$	4	D	T		
0101	ENQ	NACK	%	5	E	U		
0110	ACK		&	6	F	V		
0111	BELL	DPB	'	7	G	W		
1000			(	8	H	X		
1001			)	9	I	Y		
1010	LF		*	:	J	Z		
1011			+	;	K	[		
1100			,	<	L	~		
1101	CR		-	=	M	]		
1110			.	>	N	^		
1111			/	?	O	—		DEL

(1) The eighth bit is an even parity bit.

Control Characters

SOH*	— Start of heading.	CR	— Carriage return.
STX*	— Start of text.	CS*	— Control sample.
ETX	— End of text.	TEL*	— Telephone (operator signal).
EOT	— End of transmission.	BCA*	— Branch request signal.
ENQ*	— Enquiry.	DAC*	— Deactivate signal.
ACK*	— Acknowledge.	NACK*	— Negative acknowledge.
BELL*	— Audible signal.	DPB*	— Delay line buffer bypass.
LF	— Line feed.	DEL	— Delete.

*These characters are not on the Data Station keyboard.

289-7 Punched Card Reader —

Input medium:	standard 80-column punched cards.
Input code:	standard Hollerith card code; see Table III.
Quantity of data:	1 to N characters per block, not including control characters; N is limited to 132 (including control characters) if buffer is used; block can be read from up to 15 cards.
Character set:	48 alphanumeric and special characters.
Rated input speed:	100 cards/min.
Effective speed:	limited by block length, control messages, and speed of printer if used to record transmitted data.
Comments:	punched disc allows reading of selected fields; cards are end-read; requires buffer option 088-1.

TABLE III: HONEYWELL DATA STATION PUNCHED CARD CODE

USASCII Char (3)	Card Code	Key Punch Char (1)	USASCII Char (3)	Card Code	Key Punch Char (1)	USASCII Char (3)	Card Code	Key Punch Char (1)	USASCII Char (3)	Card Code	Key Punch Char (1)
Space	blank	Space	0	0	0	\		(2)	P	11-7	P
!		(2)	1	1	1	A	12-1	A	Q	11-8	Q
"		(2)	2	2	2	B	12-2	B	R	11-9	R
#		(2)	3	3	3	C	12-3	C	S	0-2	S
$	11-8-3	$	4	4	4	D	12-4	D	T	0-3	T
%		(2)	5	5	5	E	12-5	E	U	0-4	U
&		(2)	6	6	6	F	12-6	F	V	0-5	V
'		(2)	7	7	7	G	12-7	G	W	0-6	W
(	0-8-4	%[(]	8	8	8	H	12-8	H	X	0-7	X
)	12-8-4	¤[)]	9	9	9	I	12-9	I	Y	0-8	Y
*	11-8-4	*	:		@[:]	J	11-1	J	Z	0-9	Z
+	12	&[+]	;		(2)	K	11-2	K	[		(2)
,	0-8-3	,	<		(2)	L	11-3	L	~		(2)
-	11	-	=	8-3	#[=]	M	11-4	M	]		(2)
.	12-8-3	.	>		(2)	N	11-5	N	^		(2)
/	0-1	/	?		(2)	O	11-6	O	—		(2)

(1) Key punch characters are for a standard key punch keyboard arrangement. Characters in brackets (e.g., [+]) appear in place of the corresponding key punch character in a FORTRAN

(2) There are no corresponding characters in a standard or FORTRAN keyboard arrangement.

(3) The card codes are translated into the corresponding USASCII transmission codes (see Table II).

289-8 Optical Bar Code Reader —

Input medium:	optically-coded card or paper documents, 5 to 8 inches long and 3.5 inches wide.
Input code:	5-level bar code including parity (each character consists of 5 vertical printed bars per column, arranged horizontally in a yes-or-no position); 2-level mark-sense code which allows operator to enter up to four characters of data: see Table IV.
Quantity of data:	up to 80 characters per block (read from up to seven documents).
Character set:	digits 0 through 9 for bar code; letters D through G for mark-sense code.
Rated input speed:	50 char/sec for bar coded documents; 25 char/sec for mark-sense coded documents.
Effective speed:	limited by block length, control messages and speed of printer if used to record transmitted data.
Comments:	documents are end-read; bar code can be printed on Honeywell high-speed printers or lithographed; mark-sense characters must be marked with a number 2 black lead pencil or equivalent; mark-sense coding can follow bar coding on the same document; requires buffer option 088-1.

TABLE IV: HONEYWELL DATA STATION OPTICAL BAR CODE READER (OBCR) DATA CODES

Code	OBCR Character	OBCR Bit Configuration P 4 3 2 1	USASCII Character Generated (1)
Bar Code	1	0 0 0 0 1	1
	2	0 0 0 1 0	2
	3	1 0 0 1 1	3
	4	0 0 1 0 0	4
	5	1 0 1 0 1	5
	6	1 0 1 1 0	6
	7	0 0 1 1 1	7
	8	0 1 0 0 0	8
	9	1 1 0 0 1	9
	0	1 1 0 1 0	0
	Space	0 1 0 1 1	Space
	(2)	1 1 1 0 0	<
	(3)	0 1 1 0 1	=
	(4)	0 1 1 1 0	>
	(5)	-	?
Mark-Sense Code	D	0 0	D
	E	0 1	E
	F	1 0	F
	G	1 1	G

(1) See Table II for USASCII Transmission code.

(2) Start or end of information.

(3) Unspecified.

(4) Mark-sense code follows.

(5) Parity or dual-bit error.

.32 Manual Input

Keyboard (289-2A, 289-2, or 289-3) —

Method of entry: . . . . . 48-key keyboard.

Quantity of data: . . . . . 1 to N characters per block, not including control characters; N is limited to 132 (including control characters) if buffer is used.

Character set: . . . . . 65 characters, including upper-case alphabetics, numerics, 24 specials, and 5 control characters.

Comments: . . . . . a keyboard is required for remote operation.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration: . . . . . 3 to N characters per block including start-of-text character, data or control characters, end-of-block or end-of-transmission character, and longitudinal check character. When the buffer is used, N is limited to 132 characters. All control characters are automatically generated by the Control Unit for all input devices except the keyboard. The longitudinal check character is automatically calculated and inserted for all inputs by the Control Unit.

.36 Operating Procedure

- Turn on Data Station, select transmission mode (local, remote), and load devices (cards in reader, paper in printer, etc.).
- Insert the program disc (for reading selected punched card fields) and set "Cards per Block" and "Documents per Block" switches if necessary.
- In the local mode, press Master Clear Switch, activate desired devices, select single block or continuous read, set Buffer Bypass switch if desired, and press Run button to start.
- In remote mode, insure that the data set is ready, and wait for computer to activate Data Station.

Detected errors which require manual intervention can be flagged and corrected according to preset procedures. If the buffer is overloaded in remote mode, the overflow information is lost. The block must be retransmitted after removing the cause of the overflow.

.37 Entry of Time and Date: . . . . . no provisions.

.4 OUTPUT

.41 Output to Punched Tape

289-5 Paper Tape Punch —

Tape size:	fully punched, 1-inch paper tape.
Tape code:	8-level USASCII code; see Table III.
Rated punching speed:	120 char/sec.
Effective speed:	limited by block length, control messages, and speed of printer if used to record transmitted data.
Format control:	none.
Comments:	contains a one-character buffer.

.44 Output to Printer

289-2 or 289-3 Page Printer and Keyboard —

Output medium:	friction-fed or pin-fed, continuous or fanfold forms 8.5 inches wide; maximum printed line length is 72 characters.
Character set:	59 characters, including upper-case alphabetics, numerics, and 24 specials; see Table II.
Rated printing speed —	
289-2:	10 char/sec.
289-3:	40 char/sec.
Effective speed:	limited by block length, control messages, and functional operations, such as line feed and carriage return.
Format control:	via special control codes in received data; operations include space, line feed, and carriage return; there is no backspace or horizontal tab.
Comments:	asynchronous; printing is performed by paired hammers and rotating print drum.

289-9 Remote Line Printer —

Output medium:	printed continuous forms from 4 to 20 inches wide; maximum printed line length is 120 characters; optional line length is 132 characters.
Character set:	63 characters, including upper-case alphabetics, numerics, and 27 specials. See Table II.
Rated printing speed:	400 lines per minute.
Effective speed:	limited by block length, control messages, and transmission speed.
Format control:	via special control codes in received data; operations include horizontal tab, vertical tab, and head-of-form.
Comments:	the 289-9 Printer can only be used when operating with the 288-3 Central Control Unit.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors

Optical Bar Code Reader —

Type of checking:	character parity (odd) and character validity check on bar code characters; no check on mark-sense coded data.
Error indication:	substitution of "?" character for character in error.
Correction procedure:	manual, in response to a specific message from the remote computer.

Punched Card Reader —

Type of checking:	column-counter check; cards are read by two independent read stations and the data compared bit for bit.
Error indication:	separate indicator lamps for each check; reader halts; the "?" character can be substituted in place of error character for a column-counter check instead of halting reader.
Correction procedure:	operator intervention is required.
All other input devices:	no checking.

.52 Data Transmission Errors

Type of checking:	character parity (even) check and longitudinal block redundancy check.
Error indication:	transmission of negative acknowledge message or halt transmission (if certain control messages are received in error).

Correction procedure —

With buffer option:	automatic retransmission.
Without buffer option:	manual, in response to messages from remote computer.

.53 Data Recording Errors: no checking.

.54 Component Malfunctions

Punched Card Reader —

Type of checking:	feed malfunction; improper setting of block size switch.
Error indication:	lamp is lighted.
Correction procedure:	manual.

Optical Bar Code Reader —

Type of checking:	feed malfunction; improper setting of block size switch; full stacker; empty hopper.
Error indication:	lamp is lighted.
Correction procedure:	manual.

.55 Line Malfunctions

Detection:	failure to receive any data signals within a period of 30 seconds when in receive mode.
Action:	automatic disconnect.

.6 CONDITION INDICATORS: lamps and/or switches are provided to indicate power on, transmission error, device malfunction, and various device settings; audible alarm is optional to indicate errors or malfunctions.

.7 DATA TRANSMISSION

The 288-1 or 288-3 Control Unit is the interface between all of the Data Station components and the data set. One input device and any or all of the output devices can operate simultaneously. The Data Station cannot initiate communication with the computer or with another

Data Station. The transmission speed when the Data Station is transmitting without the buffer option is the speed of the input device. The transmission speed when the Data Station is receiving is always 120 characters per second (when the 288-1 Central Control Unit is employed) or 250 or 300 characters per second (when the 288-3 Central Control Unit is employed. If the slow printer is being used as an output device when the buffer option is not included, delete characters must be interspersed among the data characters to reduce the effective speed to that of the printer (10 or 40 characters per second, depending on model).

The transmission speed in either direction is always that of the Central Control Unit when operating with the buffer.

.71 Basic Characteristics

Rated transmission speed —	
288-1 Control Unit:	up to 120 char/sec (1200 bits/sec).
288-3 Control Unit:	250 or 300 char/sec (2000 or 2400 bits/sec).
Transmission method:	serial by bit.
Transmission code:	8-level USASCII code; see Table II (a total of 10 bits including start, stop, and parity bits are transmitted for each character when the 288-1 is employed).
Transmission mode:	half-duplex.
Order of bit transmission:	low order bit (bit 1) is transmitted first.
Synchronization —	
288-1 Control Unit:	start-stop.
288-3 Control Unit:	synchronous.

.72 Connection to Communications Lines

Communications Line	Data Set*
Common-carrier leased voice-band line:	Bell System Data Set 201B or 202D; Western Union 2400 Band or 1200 Band Data Modem.
Public telephone network:	Bell System Data-Phone Data Set 201A or 202C.

* In some cases, equivalent data sets can be used; check with your local communications consultant.

.73 Transmission Control

Call initiation:	only when addressed by remote computer.
Call reception:	capable of unattended operation.
Functional operations:	function codes within a data message specify line feed and carriage return; separate messages containing control characters are used to signal the operator, light an alarm indicator, activate selected components, etc.

.74 Multistation Operation: the Data Station does not contain any direct provisions for polling or selective addressing, but the Data Station can respond to addressing information contained in a separate message from the remote computer if the Extended Operations option is included; the remote computer controls all polling and addressing functions when multiple Data Stations operate over the same line.

.8 PHYSICAL SPECIFICATIONS

Component	288-1 Control Unit	288-3 Control Unit	289-2A Keyboard	289-2 Page Printer and Keyboard	289-3 Page Printer and Keyboard
Width (inches)	22	22	22	22	22
Depth (inches)	22	22	22	22	22
Height (inches)	31	30	31	31	31
Weight (pounds)*	80	260	60	80	75
Power (KVA)	0.367	0.70	0.129	0.129	0.145
Heat (BTU/hr)	700	1750	260	260	290

Component	289-4 Paper Tape Reader	289-5 Paper Tape Punch	289-7 Punched Card Reader	289-8 Optical Bar Code Reader	289-9 Remote Line Printer	
					Printer	Control
Width (inches)	22	22	22	22.5	76	30
Depth (inches)	22	22	22	22	30	30
Height (inches)	31	40	31	31	42	42
Weight (pounds)*	65	110	75	80	1100	400
Power (KVA)	0.091	0.142	0.200	0.176	1.70	1.15
Heat (BTU/hr)	180	285	400	236	5320	2730

*Weights are approximate and subject to change.

General Requirements

Voltage: . . . . . 115 volts.
Frequency: . . . . . 60 cps.
Phases: . . . . . 1.

Temperature range / Humidity range: . . . . . Honeywell states that the Data Station is designed to operate in a normal office environment, with no special air conditioning required.

.9 PRICE DATA

Component or Feature	Monthly Rental, $	Purchase Price, $	Monthly Maintenance, $
288-1 Central Control Unit	170	6,750	62
088-1 Buffer option	85	3,150	30
088-2 Extended Operations option	45	1,350	17
288-3 Central Control Unit	255	9,900	92
088-3 Buffer option	85	3,150	30
088-4 Extended Operations option	40	1,350	17
289-2A Central Control Unit Keyboard	40	1,350	17
289-2 Page Printer (10 char/sec) and Keyboard	80	2,925	30
289-3 Page Printer (40 char/sec) and Keyboard	200	7,875	72
289-4 Paper Tape Reader (120 char/sec)	75	2,700	29
289-5 Paper Tape Punch (120 char/sec)	105	3,825	39
289-7 Card Reader (120 char/sec; requires Buffer option 088-1)	85	3,150	30
289-8 Optical Bar Code Reader (25 or 50 char/sec; requires Buffer option 088-1)	280	11,250	103
289-9 Remote Line Printer	810	40,500	125
1034 Extension of Print Positions from 120 to 132	50	2,250	12
089-2 Multi-Line Block option (requires 088-3 option)	15	675	2

*Rates shown are for prime-shift use with lease agreements of five years; some rates are higher for lease periods of less than five years. Hourly rates for extra-shift usage are approximately ten percent of prime-shift.

HONEYWELL SERIES 200 VISUAL INFORMATION PROJECTION SYSTEM

.1 GENERAL

.11	Identity:	Series 200 Visual Information Projection System (VIP).
.12	Manufacturer:	Bunker-Ramo Corporation 445 Fairfield Avenue Stamford, Connecticut 06904
	Marketed by:	Honeywell EDP Division 60 Walnut Street Wellesley Hills, Mass.
.13	Basic Function:	transmit data to a computer; display data received from a computer or entered via a keyboard; input can be from a keyboard, paper tape reader or teleprinter keyboard; output can be to video display device, paper tape punch, or teleprinter.

.15 Description

The Honeywell Series 200 computer family now includes in its peripheral equipment line an array of Visual Information Projection (VIP) facilities, most of which are manufactured by the Bunker-Ramo Corporation. Bunker-Ramo markets the same line of equipment under the name Series 200 Data Display System; a detailed analysis of the Bunker-Ramo equipment can be found in Report 6060.

This report presents a summary of the equipment, the differences between the equipment marketed by Honeywell and Bunker-Ramo, and information pertinent to inclusion of the display equipment into a Honeywell Series 200 Computer System. Refer to Report 6060 for additional information.

Differences Between Honeywell and Bunker-Ramo Equipment

The primary differences between the Bunker-Ramo Series 200 Data Display System and the Honeywell VIP System are some packaging and nameplate changes, different model numbers, and a different pricing structure (see Paragraphs 6060.9 and 6384.9). The Honeywell components are assigned 300-series numbers in place of the Bunker-Ramo 200-series numbers; the last two digits are the same.

Basic Facilities

The viewing screen of the Display Stations is a cathode ray tube that utilizes a high-contrast, low-persistence, emerald green phosphor. Each displayed character is formed by a 5-by-7 dot matrix and can be adjusted for brightness, focus, and size. The character height can be adjusted from approximately typewriter size up to 0.25 inch. The displayed data is regenerated more than 40 times per second, producing a character display which appears steady to the human eye.

An Entry Marker or cursor indicates the current writing position on the viewing screen; it steps to the next position as each character is entered. Optional editing features permit the cursor to be moved to any line and any character position for character deletion or correction purposes.

Message data is entered via the keyboard of the Display Station. It is immediately displayed on the screen and simultaneously stored in the station's Universal Control Unit buffer. Nothing is transmitted to the local or remote central processor until the Transmit Key is depressed. A Carriage Return/Line Feed key, as well as Erase and Clear keys, are provided to facilitate message preparation. Function keys are included to call for user-specified functions at the central computer site. Responses from the computer can be displayed in addition to or in place of the input query.

.15 Description (Contd.)

Model 303 Display Station

Model 303 provides a 5.5-inch by 7.75-inch display viewing area on a screen that can be separated from the keyboard input device. The data display capacity is 32, 64, 128, 256, 384, or 768 characters, arranged in various numbers of lines, as shown in Table I. The keyboard of the Model 303 Display Station is a 4-row, modified Teletype unit that includes 26 alphabetic and 10 numeric characters in addition to 3 fixed special symbols and 15 variable special symbols. Special keys for message editing can also be provided as standard or optional features.

Model 304 Display Station

Model 304 is the same as Model 303 except that a keyboard with electronic contact keys is used in place of the mechanical keyboard of the 303.

Model 317 Display Station

Model 317 is the same as Model 303 but without a data entry keyboard. Model 317 is for display only.

Model 311 Display Station

Model 311 is a combined keyboard/display unit that includes a 4.75-inch by 3.75-inch viewing screen, four special symbol keys, and a block of ten numeric input keys. Twelve other keys are provided for user-specified special functions and message editing operations. The 311's data display capacity is 32, 64, 128, 256, or 384 characters, arranged in a set number of line combinations; see Table I.

Model 312 Display Station

Model 312 is the same as Model 311 with the addition of a separate block of keys for the 26 alphabetic letters.

Different models can be intermixed on a single control unit, provided that each model installed has the same data display arrangement (i.e., the same maximum number of lines and characters per line displayed). The varied data display capacities that can be selected with each Display Station model are summarized in Table I.

Display Control

The Display Stations described above require a Model 323 Universal Control Unit to provide individual, local buffering of data during message preparation and reply transmission. A Universal Control Unit also provides the power supply and general control facilities for one or more Display Stations.

The basic Universal Control Unit contains one buffer module with a storage capacity of 768 characters. This basic storage capacity can serve the number and types of Display Stations indicated in Table I. Expansion modules are available for extending the basic buffer storage capacity of the Universal Control units in increments of 768 characters. The 323 Universal Control Unit can add 8 Expansion Modules, providing a total buffer

TABLE I: DATA ARRANGEMENTS ON VIEWING SCREEN

Display Capacity (Characters)	Display Station Model		Number of Lines Displayed	Number of Characters/Line	Maximum Number of Devices per Buffer Module
	311 or 312	303, 304, or 317			
32	x	x	2	16	12
32	x	x	4	8	12
64	x	x	2	32	12
64	x	x	4	16	12
128	x	x	4	32	6
256	x	x	8	32	3
378	x	x	9	42	2
384	x	x	12	32	2
768		x	12	64	1

(Contd.)

storage capacity of 6,912 characters. The limitations on combinations of Expansion Modules and display and non-display devices are the same as those listed in the report on the Bunker-Ramo equipment; see Paragraph 6040.2.

In addition to controlling the operations of the Display Stations, the Universal Control Unit can control on-line receive-only printers, paper-tape readers and punches, and Model 33 or 35 Teletype Keyboard Send-Receive (KSR) Page Printers as components in a remote data communications system. For each non-display device that is connected, a special Control Module must be added to the Universal Control Unit.

Included within the Universal Control Unit cabinet is a Model 331 or Model 332 Communication Interface Module. These modules provide the necessary data interface to either a communications line or to a local central processor.

All data transmission in a Honeywell Visual Information Projection system uses the 7-level ASCII character code plus single-bit parity. Data is transferred between processor and Universal Control Unit either in an asynchronous serial-by-bit mode (using a 10-level code that includes start and stop bits in addition to the basic 8-level character code) or in a synchronous serial-by-bit mode (using the basic 8-level character code), as selected when ordered.

When the Display Stations form part of a remote communications network, Bell System DataPhone Data Sets 201A, 201B, 202C, or 202D are used as interfacing units at both ends of the communications line. Final linkup to a Series 200 computer is accomplished by a Model 281 or Model 286 Communication Control Unit connected to a computer I/O channel. These single- and multi-line control units are described in Reports 6382 and 8381 respectively. The compatible units are the 281-1R or -1S or the 286 with a 285-1R or -1S Adapter for transmission at 1,200 bits per second, and the 281-2R or -2S or the 286 with the 285-2R or -2S Adapter for transmission at 2,000 or 2,400 bits per second.

The Display Stations can also be used as local input/output devices; the Universal Control Unit and its Communication Interface unit connect directly to a Model 281 or 286 Communication Control Unit. No data sets are required for this operation. A 339 Clock Generator (Data Set Bypass) is required if the 332 Interface is used. The Universal Control Unit must be located within 50 feet (with the -1R or -2R) or within 200 feet (with the -1S or -2S) of the 281 or 286 Control Unit. Each Display Station is connected to the Universal Control Unit by an individual cable with a nominal length of up to 1,000 feet.

Optional Features

The following special features are available for the Model 323 Universal Control Unit:

- 341/342/343 Expansion Modules; these modules, described above, provide increased buffer storage capacity for the Universal Control Unit.
- 351 Message-Editing Module: provides the display Stations with single-step or repetitive left movement of the cursor.
- 352 Multi-Message Transactions Module: provides the capability to retain several inquiry and response messages on the viewing screens of any Display Station controlled by the Universal Control Unit in which this feature is installed.
- 355 Polling Control Module: enables the central processor to control the transmission of all messages within the Visual Information Projection system.

Programming

According to Honeywell, all programming facilities required to utilize the Display Stations are included in Communications I/O C, the software package provided for the control of all communications devices connected to a Model 286 Communication Control Unit. The user must code in detail only his message display formatting routine, a task that appears to be similar to coding printer formatting routines.

.16 First Delivery: . . . . . October 1966.

.17 Availability: . . . . . 6 months.

.8 PHYSICAL SPECIFICATIONS

Component	Display Stations			Universal Control Unit (3)
	Model 303 or 304 Keyboard	Model 303 or 304 Display Unit, or Model 317	Model 311 or 312	Model 323
Width (inches)	17.81	14.06	11	59
Depth (inches)	8.87	14.25	22.5	20
Height (inches)	6.12	16.25	11.3	59
Weight (pounds)	18(303); 10(304)	35	32	425 max
Power (KVA) (1)	—	0.17	0.11	1.8 max
Voltage (2)	115 ± 10%	115 ± 10%	115 ± 10%	115 ± 10%
Frequency (cps)	60	60	60	60
Phases	1	1	1	1
Temperature Range (°F.)	32 to 131	32 to 131	32 to 131	40 to 95
Heat (BTU/hr)	?	?	375	6,150

(1) Approximate.

(2) Capability available for use with a 220 volt, 50 cps power supply on special request.

(3) Houses Expansion Modules, Communications Interface and non-display device controls.

.9 PRICE DATA

Component or Feature	Monthly Rental,* $	Purchase Price, $	Monthly Maintenance, $
Display Stations			
Model 303 (alphanumeric, removable, mechanical keyboard)	74	2,600	20
Model 304 (same as 303 but with electronic keyboard)	84	3,020	21
Model 317 (same as 303 but without keyboard; display only)	55	1,980	10
Model 311 (numeric, integral keyboard)	55	1,840	16
Model 312 (same as 311 but with separate block of alphabetic keys added to keyboard)	60	1,980	18
Universal Control Units			
Model 323 (up to 8 Expansion Modules)	255	10,820	60
Expansion Modules			
Model 341	70	2,810	10
Model 342	109	4,475	15
Model 343	25	940	5
Editing Options			
351 Logic Module for Message Editing	6	260	NC
352 Logic Module for Multi-Message Transactions	NC	NC	NC

* Based on 5-year rental agreement

(Contd.)

.9 PRICE DATA (Contd.)

Component or Feature	Monthly Rental,* $	Purchase Price, $	Monthly Maintenance, $
Communications Interfaces			
Model 331	84	3,870	10
Model 332	109	5,250	12
355 Polling Control	16	555	2
Model 339 Clock Generator (Data Set Bypass)	11	410	NC
Controls for Non-Display Devices			
Model 353 RO Print Control	55	2,030	8
Model 353A RO Printer Control	25	990	3
Model 354 Paper Tape Reader Control	55	2,030	8
Model 356 Paper Tape Punch Control	55	2,000	9
Model 357 KSR Control	55	2,100	9
Non-Display Devices			
364 Paper Tape Reader (Teletype Model CX)	36	925	19
366 Paper Tape Punch (Teletype Model BRPE)	102	3,110	43
358 KSR, Friction Feed (Teletype Model 33)	31	600	20
359 KSR, Friction Feed (Teletype Model 35)	72	1,805	38
360 RO Printer, Friction Feed (Teletype Model 33)	31	550	21
361 RO Printer, Friction Feed (Teletype Model 35)	67	1,600	36
362 RO Printer, Sprocket Feed (Teletype Model 35)	72	1,820	38

* Based on 5-year rental agreement.

HONEYWELL KEYTAPE

.1 GENERAL

.11 Identity: ..... K-700 and K-900 Series Keytape Units; see Table I for a list of the current models in each product line.

.12 Manufacturer: ..... Honeywell
Electronic Data Processing Division
60 Walnut Street
Wellesley Hills, Massachusetts 02181

.13 Basic Function: ..... transmission and reception of data over a voice-band line; input is from magnetic tape recorded in a 7-channel or 9-channel IBM compatible format; source tape can be recorded and verified via keyboard.

.14 Basic Units: ..... see Table I.

.15 Description

The Honeywell K-700 and K-900 Series Keytape Units are designed to reduce or eliminate the need for punched cards as an input medium for computer installations. The K-700 Series Keytape Units record data entered from a keyboard directly on magnetic tape in a format compatible with IBM 729 Series Magnetic Tape Units; the K-900 Series record in a format compatible with IBM 2400 Series Magnetic Tape Units. The units used to record data can also be used to verify previously recorded records. Table I presents a list of the current models available in the K-700 and K-900 Series product line.

TABLE I: HONEYWELL K-700 AND K-900 SERIES KEYTAPE UNITS

Keytape Model (1)	Auxiliary Input/Output Device	Pooling Control (2)	Communications Interface	Check Digit Device
K-700/K-900	None	No	No	No
K-710/K-910	None	No	Yes	No
K-711/K-911	Card Reader	No	No	No
K-712/K-912	None	Yes	No	No
K-713/K-913	Adding Machine	No	No	No
K-714/K-914	None	No	No	Yes
K-715/K-915	Line Printer	No	No	No
K-731/K-931	Card Reader	No	Yes	No
K-732/K-932	None	Yes	Yes	No
K-733/K-933	Adding Machine	No	Yes	No
K-734/K-934	None	No	Yes	Yes
K-735/K-935	Line Printer	No	Yes	No
K-741/K-941	Card Reader	Yes	No	No
K-743/K-943	Adding Machine	Yes	No	No
K-744/K-944	None	Yes	No	Yes
K-750/K-950	Adding Machine	No	No	Yes
K-751/K-951	Adding Machine and Card Reader	No	No	No
K-752/K-952	Card Reader	No	No	Yes

(1) See text for additional details about the capabilities of individual models; both 7-channel (700 Series and 9-channel (900 Series) units with corresponding capabilities are entered together.

(2) Pooling control is the capability for transcription of data from one magnetic tape to another on a different unit; this capability is used to collect several short tapes onto one longer tape.

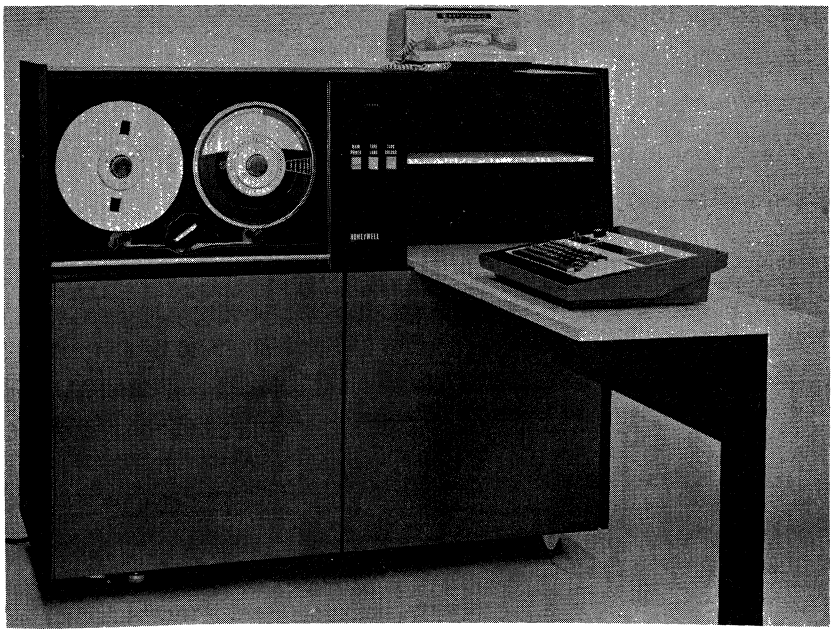


Figure 1. Honeywell Model K-710 or K-910 Keytape Unit

.15 Description (Contd.)

The K-700 and K-900 models are the basic members of the Honeywell Keytape product line. Both units are functionally the same except for the difference in recording format. The Keytape Units provide the same general facilities for preparation and verification of magnetic tape records that a conventional keypunch and verifier provide for punched cards, plus some specialized capabilities.

A magnetic core buffer, the central component of the Keytape units, holds the keyed-in data or data received from a communications line (K-710 or K-910 only) when recording and the record to be checked when verifying. The core storage unit provides ease and flexibility of preparing, verifying, and searching magnetic tape records and permits storing a program to define the tape record format and to automatically initiate certain operations. The basic core storage unit provides 80 positions. Core storage positions can be added in increments of 10 up to a maximum core size of 120 positions on the K-910; an optional 120-character buffer is available for the K-710.

The program storage area contains an extra three or four bits of storage for each character position of the record; the fourth bit is used to control auxiliary devices. Its function is similar to that of a program card in keypunch units. Codes stored in the bits are used to delimit fields within a record and to define operations such as automatic duplication or verification of common information, automatic skipping, and alphabetic (lower) or numeric (upper) shift. The field definition allows fields to be skipped out, either in their entirety or after they have been partially filled with data. The other program functions relieve the operator of the necessity of depressing keys for the related functions. The Alternate Program feature provides additional bits for each character position to allow two different record formats to be defined.

The Program switch is used to select which of the two programs is to be active at the beginning of each record. Program memory is loaded from the keyboard. A feature allowing program data to be read from a mark sensed card is expected to be announced this year.

In addition to the data and program bits in each memory position, an additional bit, called the "duplify" bit, is provided. In the Data Verify mode this bit enables the Keytape unit's memory to compare the record being read in with the record being read out of memory. The "duplify" bit is set in every memory location where the record just read is the same as the previous record. This allows the operator to manually initiate automatic verification of fields that are duplicated from record to record.

(Contd.)

.15 Description (Contd.)

There are five principal modes of operation for all Keytape units; two additional modes are incorporated in the K-710 and K-910 to be used for data communications. The five principal modes, as selected by the operator, are Data Entry, Data Verify, Search, Program Entry, and Program Verify. In addition to these principal operating modes, the K-710 and K-910 incorporate Send and Receive modes for data communication.

Data is recorded on magnetic tape in the Data Entry mode. Data entered via the keyboard is stored in the core storage unit. Fixed data can be automatically retained from record to record. When a complete record has been assembled, the recording action can be initiated automatically or manually.

Data is written on the tape along with the character parity bits and the longitudinal parity check character. The tape is then automatically backspaced and read, and the recorded data is compared bit for bit with the data stored in memory. The recorded character parity bits and the longitudinal check character are also checked. The keyboard is locked for approximately 150 milliseconds during the checking operation.

A magnetic tape previously recorded by a Keytape unit is checked in the Data Verify mode. If a discrepancy is detected while data is being keyed in to verify the tape record, the keyboard is locked and the operator is alerted by indicator lamps and audible alarm. The operator can determine whether there is an error in the tape record by making repeated attempts to key in the character, or by observing the one-character data display. Corrections are made by depressing the Error Reset key, and either the Correction key or the Field Correction key, and then keying the correct character or field. The Release key is then depressed, and the record is written on tape, backspaced, and checked as when recording. The operator can then reverify all or part of the record.

Automatic verification of duplicate information in a series of records can be specified by the program. The operator can also initiate automatic verification of a data field by depressing the Dup key; the data field is compared against the corresponding field in the preceding record. Character and longitudinal parity are checked as the record is read in.

In the Search mode, a particular record can be located on the tape if it contains a unique identifying code or field. The identifying data is keyed into memory in the same position it occupies in the record. The tape halts when a match is found or when more than 18 inches of blank tape is encountered. The Search mode can be used to locate the beginning point of an interrupted recording or verifying operation, or to locate a specific record for modification or correction.

The basic or alternate program is entered via keyboard in the designated program storage area of the core buffer when the Keytape unit is placed in the Program Entry mode. A previously entered program is checked in the Program Verify mode by rekeying the program in sequence to the stored program. A verify error occurs when the key just depressed does not compare with the corresponding program character in the core buffer.

A 49-key keyboard arranged in a conventional IBM 029 Keypunch style is employed by both K-700 and K-900 Series Keytapes. This keyboard is also available, for the K-700 Series only, with key top characters similar to those printed by Honeywell printers. The keyboard provided with the K-700 Series Keytapes is capable of producing 64 code combinations using the Upper and Lower control keys. The K-900 Series keyboard includes a Multiple Code key to be used to produce any of the 256 possible discrete code combinations by depressing several keys at once.

All keyboard character keys are repetitive; i.e., if a key is held depressed, the corresponding character is repetitively entered into memory. There is an approximate half-second delay after the key depression before the repetitive action begins to help prevent inadvertent entry of extra characters. The repetition rate is 10 characters per second.

The remainder of this report is devoted to describing the data communications aspect of Keytape units equipped with a communications interface. See AUERBACH Data Handling Reports, Report 2400, for a detailed analysis of the other members of the Keytape family that are used for input preparation.

Keytape Models K-710 and K-910 can communicate with other K-710 and K-910 Keytape terminals or with a Honeywell Series 200 computer system. Keytape terminals are designed to provide buffered, asynchronous communications in a half-duplex mode with a remote Keytape

.15 Description (Contd.)

terminal over the public telephone network at 1200 bits per second, or over a leased voice-band line at 1800 bits per second. Data transfer between terminals is under control of the programs stored in the sending and receiving buffers.

The data transmission code employed by the Keytape models is 6-level BCD for the K-710 and 8-level EBCDIC for the K-910. Each BCD character transmitted includes 6 data bits, a control bit (7th bit), an even parity bit (8th bit) and unity start and stop bits totaling 10 bits per character. The control bit defines the transmitted character as a control ("0") or data ("1") character. Each EBCDIC character transmitted includes 8 data bits, an even parity bit, and unity start and stop bits totaling 11 bits per character.

Data can be transmitted between K-710 and K-910 Keytape terminals; Honeywell recommends that tapes recorded in EBCDIC be translated to BCD format prior to transmitting from the K-910 Keytape terminal to the K-710 Keytape terminal; the translation is normally done via computer. The K-910 is placed in a K-710 compatible mode by a switch on the K-910 keyboard. Data is transmitted from the K-910 to the K-710 as though a K-710 were transmitting. When transmitting data from a K-710 to a K-910, the tape recorded by the K-910 must be translated to the EBCDIC code. Only the basic 64 character set; i.e., alphanumerics plus 28 special characters can be transmitted from a K-910 Keytape terminal operating in the K-710 compatible mode.

An Odd/Even message code (eight bits) precedes each transmitted record to ensure against the loss or duplication of records. An Odd/Even message code is generated at both sending and receiving terminals. A message code error results when the two codes do not agree.

Error signaling in response to incorrect message codes or data transmission errors is performed via the reverse-channel technique. The inherent value of this technique is that it eliminates the time required for line turn-around to allow the receiver to transmit an acknowledge code.

An interrupted signal on the reverse channel during data transmission is interpreted by the sending terminal as a request for retransmission. The signal on the reverse channel is normally interrupted at the end of a transmission (i.e., after the last character is received correctly) and is not returned until the currently received record has been successfully written on magnetic tape. Once the signal is returned, the sending terminal, if ready, begins to transmit the next record to the receiving terminal.

If the reverse-channel signal is not returned within a thirty-second period, initiated at the start of the last record, transmission is halted and operator intervention is required. For a further description of the reverse-channel technique, see Report 6221, Digitronics Reverse-Channel Dial-o-verter Line.

Other Keytape Models

Other models in the K-700 and K-900 Series Keytape line which contain a communications interface are described in the following paragraphs. All these units can be operated as a basic Model K-700 or K-900 Keytape unit when not in the send or receive modes. In appearance, the other models are identical with the K-710 and K-910 Keytape units except for the addition of an auxiliary input or output device.

Model K-731 and K-931 Keytape/Communicator/Card Reader

These units are similar to the K-710 and K-910 Keytape units with the addition of an 80-column punched card reader. Data is read photoelectrically from cards and can be entered into memory for recording on the magnetic tape, in addition to keyed-in data, under manual or program control. The Model K-731 translates Hollerith card code to either IBM BCD code or to Honeywell code as specified by the customer. The K-931 translates Hollerith card code to IBM EBCDIC code. Cards can also be fed one at a time. The capacity of both the input hopper and output stacker is 500 cards. An incrementing record counter that counts each record entered on tape is a standard feature.

Models K-732 and K-932 Keytape/Communicator/Poolers

These units are similar to the K-710 and K-910 Keytape units with the addition of a pooler control. The pooler control permits consolidating a number of records from two or three other Keytape Poolers on a single tape for entry into a computer system. The pooler includes

(Contd.)

.15 Description (Contd.)

an editing capability. Data read from one Keytape Pooler and written on another can be edited by both read and write programs. Standard features include an incrementing record counter and stop code recognition. The record counter indicates the number of records pooled; stop code recognition permits the user to specify any of four codes that cause tape motion to automatically halt.

Models K-733 and K-933 Keytape/Communicator/Adding Machines

These units are similar to the K-710 and K-910 Keytape units with the addition of a 12-column adding machine that can be operated from the keyboard. Data keyed into the fields specified by program codes is entered into memory and transferred to the adding machine accumulator. The entered data is not recorded nor is the data added or listed until the Left zero key is depressed. Keying errors can be corrected by backspacing and rekeying the correct data prior to depressing the Left zero key. Fields within a data record can be added and listed or only listed on the adding machine under program control.

Models K-734 and K-934 Keytape/Communicator/Check Digit Devices

These units are similar to the K-710 and K-910 Keytape units with the addition of a check digit capability. Numeric fields formulated by modulo 7, 10, or 11 check digit techniques can be verified when entered. Only one of the three techniques can be specified. Modulo-10 check digit operates in both generate and validate modes; modulo-7 and -11 operate in validate mode only. In general, a check digit, the last digit in the numeric field, is formulated by arithmetic manipulation performed on the preceding digits in the field.

Models K-735 and K-935 Keytape/Communicator/Line Printers

These units are similar to the K-710 and K-910 Keytape Units with the addition of a 300 line-per-minute printer. The printer can receive data directly from a communications line or from magnetic tape. Printing and recording operations, when receiving data from a communications line, are simultaneous. Transmitted data can also be printed during the transmit operation. These operations are under control of the stored program. The buffered line printer is capable of printing up to 120 or 132 (optional) characters per line and can handle pin-fed fanfold forms up to 20 inches wide. Vertical spacing can be manually selected at 6 or 8 lines per inch.

The printer can operate in one of two modes: List mode, or Format Control mode. In the List mode, data is printed in the same format as received by the printer. Format control operations, including horizontal tabulation, spacing, and line feed, are initiated by control characters when the printer is in the Format Control mode. Zero suppression is optionally available when the Left zero option is included. Zero suppression converts high-order zeros in the left zero field to blanks.

.16 First Delivery: . . . . . July 1968.

.17 Availability: . . . . . ?

.2 CONFIGURATION

The Model K-710 and K-910 Keytape terminals include:

- A magnetic tape drive compatible with IBM 729 series units (K-710) or IBM 2400 series units (K-910),
- A magnetic core buffer,
- A keyboard for entering data, and
- A communications interface.

See Table I for the auxiliary device included with other Keytape models.

A data set is required to connect either Keytape terminal to a communications line. All auxiliary input/output devices included with the Honeywell Keytape units, except the Line Printer, can be used only for data transcription purposes or in the preparation of a tape; they cannot interface directly with a communications line. The adding machine included with the K-733 and K-933 Keytape terminals is operated from the K-733 or K-933 concurrently with entering data into the Keytape buffer; data cannot be transferred from the buffer to the adding machine.

.3 INPUT

.31 Prepared Input

K-700 Series Keytape magnetic tape drive —

Input medium:	0.5-inch magnetic tape recorded at 556 bits/inch; 200 or 800 bit/inch densities are optional; compatible with IBM 729 Series tape format.
Input code:	6-bit BCD (even parity) or binary (odd parity); see Table II.
Quantity of data:	80 characters; optionally 120 characters.
Character set:	64 characters; alphanumerics plus special and record format characters.
Rated input speed:	13,344 char/sec (556 bits/inch), 4,800 char/sec (200 bits/inch), or 19,200 char/sec (800 bits/inch).
Effective speed:	limited by block length and transmission speed.

K-900 Series Keytape magnetic tape drive —

Input medium:	0.5-inch magnetic tape recorded at 800 bits/inch; compatible with IBM 2400 Series tape format.
Input code:	8-level EBCDIC code plus odd parity; see Table II.
Quantity of data:	80 characters; optionally 90, 100, 110, or 120 characters.
Character set:	256 characters.
Rated input speed:	19,200 char/sec.
Effective speed:	limited by block length and transmission speed.

Punched Card Reader (with K-711 or K-911 Keytape units) —

Input medium:	standard 80-column punched cards.
Input code:	standard Hollerith card code.
Quantity of data:	80 characters per card.
Character set:	64 characters.
Rated input speed:	100 cards/min.
Effective speed:	75 cards/min.
Comments:	Hollerith card code is translated to IBM BCD or binary code (K-711) or to EBCDIC code (K-911) when data is transcribed on magnetic tape; data is recorded on magnetic tape via the core buffer.

.32 Manual Input

Keyboard (with all Keytape units) —

Method of entry:	49-key keyboard.
Quantity of data:	up to capacity of buffer.
Character set:	64 characters; 26 alpha, 10 numeric, and 27 special.
Comments:	64 code combinations can be produced by using two Upper and Lower control keys; 14 of the 49 keys are used to initiate special functions; keyboard data is entered on tape via the core buffer; character keys are repetitive at 10 char/sec following a short delay; 256 code combinations can be produced by using the Multiple Code key (only on the K-900 Series keyboards).

.33 Fixed Input: a data field can be entered into the buffer and automatically or manually duplicated in all subsequent records.

.34 Transaction Code Input: no provision.

(Contd.)

TABLE II: HONEYWELL KEYTAPE TRANSMISSION CODE*

Code	BCD	EBCDIC
Symbol**	Bit Position P 7 6 5 4 3 2 1	Bit Position P 8 7 6 5 4 3 2 1
A	1 1 0 1 0 0 0 1	1 1 1 0 0 0 0 0 1
B	1 1 0 1 0 0 1 0	1 1 1 0 0 0 0 1 0
C	0 1 0 1 0 0 1 1	0 1 1 0 0 0 0 1 1
D	1 1 0 1 0 1 0 0	1 1 1 0 0 0 1 0 0
E	0 1 0 1 0 1 0 1	0 1 1 0 0 0 1 0 1
F	0 1 0 1 0 1 1 0	0 1 1 0 0 0 1 1 0
G	1 1 0 1 0 1 1 1	1 1 1 0 0 0 1 1 1
H	1 1 0 1 1 0 0 0	1 1 1 0 0 1 0 0 0
I	0 1 0 1 1 0 0 1	0 1 1 0 0 1 0 0 1
J	1 1 1 0 0 0 0 1	0 1 1 0 1 0 0 0 1
K	1 1 1 0 0 0 1 0	0 1 1 0 1 0 0 1 0
L	0 1 1 0 0 0 1 1	1 1 1 0 1 0 0 1 1
M	1 1 1 0 0 1 0 0	0 1 1 0 1 0 1 0 0
N	0 1 1 0 0 1 0 1	1 1 1 0 1 0 1 0 1
O	0 1 1 0 0 1 1 0	1 1 1 0 1 0 1 1 0
P	1 1 1 0 0 1 1 1	0 1 1 0 1 0 1 1 1
Q	1 1 1 0 1 0 0 0	0 1 1 0 1 1 0 0 0
R	0 1 1 0 1 0 0 1	1 1 1 0 1 1 0 0 1
S	0 1 1 1 0 0 1 0	0 1 1 1 0 0 0 1 0
T	1 1 1 1 0 0 1 1	1 1 1 1 0 0 0 1 1
U	0 1 1 1 0 1 0 0	0 1 1 1 0 0 1 0 0
V	1 1 1 1 0 1 0 1	1 1 1 1 0 0 1 0 1
W	1 1 1 1 0 1 1 0	1 1 1 1 0 0 1 1 0
X	0 1 1 1 0 1 1 1	0 1 1 1 0 0 1 1 1
Y	0 1 1 1 1 0 0 0	0 1 1 1 0 1 0 0 0
Z	1 1 1 1 1 0 0 1	1 1 1 1 0 1 0 0 1
1	0 1 0 0 0 0 0 1	1 1 1 1 1 0 0 0 1
2	0 1 0 0 0 0 1 0	1 1 1 1 1 0 0 1 0
3	1 1 0 0 0 0 1 1	0 1 1 1 1 0 0 1 1
4	0 1 0 0 0 1 0 0	1 1 1 1 1 0 1 0 0
5	1 1 0 0 0 1 0 1	0 1 1 1 1 0 1 0 1
6	1 1 0 0 0 1 1 0	0 1 1 1 1 0 1 1 0
7	0 1 0 0 0 1 1 1	1 1 1 1 1 0 1 1 1
8	0 1 0 0 1 0 0 0	1 1 1 1 1 1 0 0 0
9	1 1 0 0 1 0 0 1	0 1 1 1 1 1 0 0 1
0	1 1 0 0 0 0 0 0	0 1 1 1 1 0 0 0 0
Space	0 1 0 0 1 1 0 1	1 0 1 0 0 0 0 0 0
¢	0 1 1 0 1 0 1 0	0 0 1 1 1 1 0 1 1
$	1 1 1 0 1 0 1 1	1 0 1 0 1 1 0 1 1
*	1 1 1 0 1 1 0 0	0 0 1 0 1 1 1 0 0
"	0 1 1 0 1 1 0 1	1 0 1 1 1 1 1 1 1
≠ ¬	0 1 1 0 1 1 1 0	0 0 1 0 1 1 1 1 1
!	1 1 1 0 1 1 1 1	0 0 1 0 1 1 0 1 0
<	1 1 1 1 0 0 0 0	1 0 1 0 0 1 1 0 0
/	0 1 1 1 0 0 0 1	1 0 1 1 0 0 0 0 1
'	1 1 0 0 1 0 1 0	0 0 1 1 1 1 1 0 1
=	0 1 0 0 1 0 1 1	0 0 1 1 1 1 1 1 0
:	1 1 0 0 1 1 0 0	1 0 1 1 1 1 0 1 0
-	0 1 1 0 0 0 0 0	0 0 1 1 0 0 0 0 0
>	0 1 0 0 1 1 1 0	1 0 1 1 0 1 1 1 0
&	1 1 0 0 1 1 1 1	0 0 1 0 1 0 0 0 0
+	0 1 0 1 0 0 0 0	0 0 1 0 0 1 1 1 0
$	1 1 1 1 1 0 1 0	1 0 1 1 1 1 1 0 0
'	0 1 1 1 1 0 1 1	1 0 1 1 0 1 0 1 1
(	1 1 1 1 1 1 0 0	0 0 1 0 0 1 1 0 1
Cr —	0 1 1 1 1 1 0 1	1 0 1 1 0 1 1 0 1
¤ |	0 1 1 1 1 1 1 0	1 0 1 0 0 1 1 1 1
c	1 1 1 1 1 1 1 1	1 0 1 0 0 1 0 1 0
;	0 1 0 1 1 0 1 0	1 0 1 0 1 1 1 1 0
.	1 1 0 1 1 0 1 1	0 0 1 0 0 1 0 1 1
)	0 1 0 1 1 1 0 0	1 0 1 0 1 1 1 0 1
%	1 1 0 1 1 1 0 1	0 0 1 1 0 1 1 0 0
▬	1 1 0 1 1 1 1 0	
?	0 1 0 1 1 1 1 1	0 0 1 1 0 1 1 1 1
STX	1 0 0 0 0 0 1 0	1 0 0 0 0 0 0 1 0
ETX	0 0 0 0 0 0 1 1	0 0 0 0 0 0 0 1 1
DC1	0 0 0 1 0 0 1 0	0 0 0 0 1 0 0 0 1
DC2	0 0 0 1 0 0 1 0	0 0 0 0 1 0 0 1 0

* When transmitting data from a K-910 Keytape terminal to a K-710 Keytape terminal, the low order six bits contain data, bits 7 and 8 are transmitted as ones and bit 9, parity.

** Symbols that are unique to the K-910 Keytape terminal are presented to the right of the first entry, all other symbols are common to both the K-710 and K-910 Keytape terminals.

.35 Message Configuration: . . . . . messages are transmitted in fixed-length records as specified by program; record size can be from one to 80 characters, or up to 120 characters optionally; the text portion of each record is preceded by an STX character and an Odd/Even character and terminated by an ETX character and a longitudinal parity character.

.36 Operating Procedure

Before a message is transmitted, predetermined programs and time of transmission should be established between the communicating terminals. Programs can not be loaded from tape and, therefore, must be entered manually from the keyboard.

(1) Load program into memory.

(2) Mount tape reel.

(3) Set control switches on keyboard.

(4) Establish connection by dialing or manually signaling.

(5) Depress Data key on data set.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.43 Output to Magnetic Tape

K-700 Series Keytape magnetic tape drive —

Tape size:	0.5-inch magnetic tape recorded at 556 bits/inch; 200 or 800 bit/inch densities are optional; compatible with IBM 729 Series tape format.
Tape code:	6-bit BCD (even parity) or binary (odd parity); see Table II.
Rated output speed:	13,344 char/sec (556 bits/inch), 4,800 char/sec (200 bits/inch), or 19,200 char/sec (800 bits/inch).
Effective speed:	limited by block length and transmission speed.
Format control:	extensive tape format control is provided by stored program; see Paragraph .15 for description.
Comments:	records are recorded in fixed length format; an 80-character record is standard; with options, records can be 120 characters in length.

K-900 Series Keytape magnetic tape drive —

Tape size:	0.5-inch magnetic tape recorded at 800 bits/inch; compatible with IBM 2400 Series tape format.
Tape code:	8-level EBCDIC code plus odd parity; see Table II.
Rated output speed:	19,200 char/sec.
Effective speed:	limited by block length and transmission speed.
Format control:	extensive tape format control is provided by stored program; see Paragraph .15 for description.
Comments:	records are recorded in fixed length format; an 80-character record is standard; with options, records can be 90, 100, 110, or 120 characters in length.

.44 Output to Printer

Output medium:	pin-fed fanfold forms up to 20 inches wide.
Character set:	64 characters including alphabetic, numeric, and 28 special symbols; see Table II.
Rated printing speed:	300 lines/minute.
Effective speed:	limited by line spacing, number of characters per line, and transmission speed.

(Contd.)

.44 Output to Printer (Contd.)

Format control:	controlled by horizontal and vertical tab function codes.
Comments:	horizontal spacing is 120 or 132 (optional) char/line; vertical spacing is 6 or 8 lines/inch; printer can operate in either of two selectible modes: List mode lists data as received; Format Control mode allows format operations to be performed; data can be received from remote terminal or transcribed from mangetic tape via the core buffer; zero suppression is optional and requires the Left Zero option.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors

Type of checking:	character parity and longitudinal parity are checked when each record is read from magnetic tape.
Error indication:	audible alarm sounds; lamp is lighted.
Correction procedure:	tape is automatically back-spaced and record is re-read; operator intervention is required when an error is detected after the eighth consecutive re-read operation.

.52 Data Transmission Errors

Type of checking:	character parity and longitudinal parity.
Error indication:	indicator lamp is lighted; reverse-channel signal is interrupted for 200 milliseconds.
Correction procedure:	automatic retransmission of record received in error up to two consecutive times; the third consecutive error halts transmission, audible alarm is sounded, lamp is lighted, and operator intervention is required.

.53 Data Recording Errors

Type of checking:	each record is re-read and checked bit for bit with the buffer contents; character and longitudinal parity are also checked.
Error indication:	tape halts, lamp is lighted, and audible alarm is sounded.
Correction procedure:	tape is automatically backspaced and data is re-written up to eight times; operator intervention is required when error occurs after eighth consecutive re-write operation.

.55 Line Malfunctions

Detection:	absence of signal on reverse channel for 30 seconds.
Action:	operation halts, unit disconnects, and audible alarm sounds.

.6 CONDITION INDICATORS

A back-lighted display panel, consisting of 18 to 20 panel lamps, numerically displays (1) the active memory position, (2) the data stored in the active memory position, or (3) the contents of the controlling program memory for that position as determined by the Memory Inquiry switch located to the left of the display panel. Numeric digits are displayed directly as numeric digits. Alpha or special characters are displayed as two numbers; a decoding chart just above the display defines the displayed alpha or special characters.

A comprehensive array of indicator lamps provides error status, transmission status, and verification status displays. An audible alarm is included in conjunction with the error status indicators.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed: . . . . . 1200 bits/sec over the public telephone network; 1800 bits/sec over a leased voice-band line.

Transmission method: . . . . . serial by bit.

Transmission code: . . . . . 6-level BCD plus control and parity bits (K-710); 8-level EBCDIC plus parity (K-910); both transmission codes include even parity and start — stop bits producing a total of 10 bits/char (K-710) or 11 bits/char (K-910).

Transmission mode: . . . . . half-duplex.

Order of bit transmission: . . . . . low-order data bit (b1) first.

Synchronization: . . . . . asynchronous; a single start and stop bit append each transmitted character.

.72 Connection to Communications Lines

Communications Line or Service	Data Set*
Public telephone network operating at the following speed: 1200 bits/sec:	Bell System Data-Phone Data Set 202C.
Common-carrier leased voice-band line operating at the following speed: 1800 bits/sec:	Bell System Data Set 202D or Western Union 1800 Baud Data Modem.

.73 Transmission Control

Call initiation: . . . . . manual dialing or signaling.

Call reception: . . . . . operator must establish voice communication and then switch to data mode.

Functional operations: . . . . . under control of stored program; see Paragraph .15 for description.

.74 Multistation Operation: . . . . . no provision.

.8 PHYSICAL SPECIFICATIONS

Component	KEYTAPE Unit (1)
Width (inches)	50
Depth (inches)	18
Height (inches)	43
Weight (pounds)	600
Power (KVA)	0.72
Voltage	120
Frequency (cps)	60
Phases	1
Temperature Range (°F)	50 to 90
Humidity Range (%)	20 to 80
Heat (BTU/hr)	2,300

(1) Dimensions do not include auxiliary devices. Reading table holds keyboard and is 30 inches wide, 19 inches deep and 27 inches high.

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant. Bell System 202C2 and 202D2 Data Sets provide reverse-channel capability. Bell System 201A and 201B Data Sets and Western Union Data Sets do not provide reverse-channel capability, except through the use of a full-duplex line.

(Contd.)

.9 PRICE DATA

Component or Feature	Monthly Rental, (1) $	Purchase Price, $	Monthly Maintenance, $
Keytape Model K-710	245	11,500	35.00
Keytape Model K-910	270	12,500	38.00
Options: (2)			
120-character record length (3)	15	750	2.00
90-character record length (4)	5	250	0.75
100-character record length (4)	10	500	1.50
110-character record length (4)	15	750	2.00
120-character record length (4)	20	1,000	2.50
800 bpi recording (3)	5	250	0.75
200 bpi recording (3)	NC	NC	NC
Right justification	5	250	0.75

NC — No Charge.

(1) Based on a one year lease.

(2) A one-time charge of $25 is applied for field installation of each option.

(3) K-700 Series option.

(4) K-900 Series option.

IBM 65/66 DATA TRANSCEIVERS

.1 GENERAL

.11 Identity: . . . . . IBM 65 Data Transceiver;
IBM 66 Data Transceiver.

.12 Manufacturer: . . . . . International Business Machines Corporation
112 East Post Road
White Plains, New York.

.13 Basic Function: . . . . . card-to-card transmission of punched-card data over telephone or telegraph communications facilities.

.14 Basic Components

Name: . . . . . Data Transceiver.
Model number: . . . . . 65.
Basic function: . . . . . bidirectional punched-card data transmission.

Name: . . . . . Data Transceiver.
Model number: . . . . . 66.
Basic function: . . . . . bidirectional punched-card data transmission, with printing on card at receiver.

Name: . . . . . Telegraph Signal Unit.
Model number: . . . . . 67.
Basic function: . . . . . provides transmission control when using telegraph-grade lines.

Name: . . . . . Telephone Signal Unit.
Model number: . . . . . 68.
Basic function: . . . . . provides transmission control when using voice-grade lines.

.15 Description:

The IBM 65 or 66 Data Transceiver can transmit data from punched cards or receive transmitted data and punch it into standard 80-column cards. The 66 can also print the data at the top of the corresponding card columns. The 65 and 66 Data Transceivers are based on the IBM 24 Keypunch and 26 Printing Keypunch, respectively, but cannot be used off-line to prepare punched cards. The format of the transmitted data or punched data is controlled by a program card which is mounted on a drum synchronized with the movement of the card being read or punched. Format control is limited to fixed or X-skipping, variable end-of-card, suppression of the blank-column check, and duplication of data punched into the previous card.

The 65/66 Data Transceiver can be connected to a variety of communications facilities, including the public switched telephone network, common-carrier leased voice-grade lines, the TWX network, Western Union Class D service, and common-carrier leased telegraph-grade lines.

The rate of data transmission depends on the particular communications facility and can range from 3 fully-punched cards per minute over 60-speed (45 bits per second) telegraph lines to 11-fully punched cards per minute over voice-grade lines.

Checking facilities include character validity checks on the data read from the cards and the data received by the terminal. The transmission code is a 4-of-8 constant-ratio code, which

.15 Description (Contd.)

is different from the code used by IBM devices such as the 1013, 7702, 7710, or 7711. Normally, when an error is detected, the device halts and manual intervention is necessary for a restart. If the optional Successive-Card Checking feature is installed, a device halt does not occur until three successive card records have been received in error. Cards punched from data received in error are offset in the stacker of the receiver; the corresponding cards at the transmitter are also offset. Card records passing all checks are marked by a special punch in the row 12 position of column 81.

Another optional feature permits up to four independent pairs of Data Transceivers to be operated over a single voice-band line.

The IBM 65/66 Data Transceivers are no longer in production and are available on a rental basis only.

.16 First Delivery: . . . . . ?

.17 Availability: . . . . . these units are no longer in production; availability depends on returns.

.2 CONFIGURATION

An IBM 65 or 66 Data Transceiver Terminal consists of either a 65 or a 66 Data Transceiver and either a 67 Telegraph Signal Unit or a 68 Telephone Signal Unit. The connection to various communications facilities is described in Paragraph .72.

.3 INPUT

.31 Prepared Input

Input medium:	standard IBM 80-column cards (upper corner cuts only).
Input code:	standard Hollerith.
Quantity of data:	1 to 80 char/card; multiple cards can be transmitted automatically.
Character set:	full alphanumeric plus specials.
Rated input speed:	16 columns/sec (65); 14 columns/sec (66).
Effective speed:	3 to 11 fully-punched cards/min, depending on communications facility. The 66 is limited to 10 fully-punched cards/min. The effective speed also depends on the number of columns of data transmitted or punched.

.32 Manual Input: . . . . . no provision.

.33 Fixed Input: . . . . . no direct provision; however, under control of the program card at the receiving terminal, specified data can be duplicated from previous card.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration: . . . . . 1 to 80 characters per card, under control of the program card. Control signals and idle characters are supplied automatically or manually by operator.

(Contd.)

.36 Operating Procedure

(1) Establish connection by telephone, teleprinter message, or by schedule.

(2) Sequentially set receive and transmit signal-level switches.

(3) Insert program card on program drum at each location.

(4) Place cards in feed hopper.

(5) Receiver operator feeds 3 blank cards into position.

(6) Receiver operator presses Start key.

(7) Transmitter operator feeds 3 cards into position.

(8) Start light goes on at receiver and transmitter.

(9) Transmitter operator presses Start key to begin transmission.

(10) After last card has been transmitted, lamps and buzzers signal operators to press appropriate keys and buttons to end transmission.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.42 Output to Punched Cards

Card type and size:	standard IBM 80-column (upper corner cuts only).
Card code:	standard Hollerith.
Rated punching speed:	16 columns/sec (65); 14 columns/sec (66).
Effective speed:	3 to 11 fully-punched cards/min, depending on communications facility. The 66 is limited to 10 fully-punched cards/min.
Format control:	program card.
Comments:	Model 66 can interpret and print each character over the corresponding card column.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors

Type of Checking:	character validity and various checks on functional operations such as skipping or feeding.
Error indication:	machine halt at end of card, light, and buzzer. If all checks are passed, a punch is placed in the 12 row of column 81.
Correction Procedure:	press Release key, refeed last three cards, press Start key.

.52 Data Transmission Errors

Type of checking:	character validity.
Error indication:	same as .51, above.
Correction procedure:	same as .51, above.

.52 Data Transmission Errors (Contd.)

Comments:	with the Successive-Card Checking feature, a machine halt occurs only after three successive cards have been received in error; cards punched from erroneously-received data are offset at both the transmitting and receiving terminal.

.53 Data Recording Errors

Type of checking:	failure to punch, to skip or feed properly, or to punch the proper number of characters; timing checks such as receiving data while skipping.
Error indication:	see .51, above.
Correction procedure:	see .51, above.

.55 Line Malfunctions: no checking provisions.

.6 CONDITION INDICATORS

Input device available:	none.
Input device busy:	lamp.
Remote receiver ready:	lamp.
Remote receiver busy:	none.
Power on:	lamp.
Improper data entry:	lamp, buzzer, machine halt.
Transmission error:	lamp, buzzer, machine halt.
Recording error:	lamp, buzzer, machine halt.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	depends on communications facility; separate removable speed selector modules are available for each speed capability.
Transmission method:	serial by bit.
Transmission code:	4-of-8 Transceiver code; see the code table in the report on the IBM 7740 Communication Control System, Paragraph 8440.24.
Transmission mode:	half-duplex.
Order of bit transmission:	?
Synchronization:	start and stop bits are transmitted with each character.

.72 Connection to Communications Lines

Communications Line	Data Set*
Common-carrier leased telegraph-grade lines (up to 73 bits/sec):	none required.
Common-carrier leased narrow-band Data Channels (up to 75 bits/sec):	Bell System Data Set 103F or Western Union 75 Baud Data Modem.

* In some cases, equivalent data sets can be used; see your local common-carrier communications consultant.

(Contd.)

Communications Line	Data Set*
Bell System Schedule 3A Data Channel (up to 150 bits/sec):	Bell System Data Set 103F
Western Union Class D Data Channel (up to 180 bits/sec):	Western Union 180 Baud Data Modem
Common-carrier leased voiceband line:	Bell System Data Set 103F or Western Union 180 Baud Data Modem
Public switched telephone network:	Bell System Data-Phone Data Set 103A

.73 Transmission Control

Call initiation:	manual dialing or signaling.
Call reception:	operator must establish connection.
Remote functional operations:	none.

.74 Multistation Operation: . . . . . no provision.

.8 PHYSICAL SPECIFICATIONS

Component	Model 65 Data Transceiver	Model 66 Data Transceiver	Model 67/68 Signal Units
Width (inches)	31	31	19
Depth (inches)	29	29	27
Height (inches)	39	39	30
Weight (pounds)	290	275	180
Power (kw)	0.85	0.85	**
Voltage	115 or 208/230	115 or 208/230	**
Frequency (Hz)	60	60	—
Phases	1	1	—
Temperature Range (°F)	50-90	50-90	—
Humidity Range (%)	30-65	30-65	—
Heat (BTU/hr)	2,059	1,958	—

.9 PRICE DATA

Component or Feature	Monthly Rental $	Purchase Price, $
65 Card Unit	87	No longer in production; not possible to purchase
66 Printing Card Unit	107	
67 Telegraph Signal Unit	82	
68 Telephone Signal Unit	82	
Digital Data Set Feature	20	
Successive-Card Checking Feature	18	

* In some cases, equivalent data sets can be used; see Sections 4620 and 4640 for a current list of modems available from independent manufacturers of telephone equipment.

** Included in 65/66 Transceivers

IBM 1013 CARD TRANSMISSION TERMINAL

.1 GENERAL

.11 Identity: ..... 1013 Card Transmission Terminal.

.12 Manufacturer: ..... International Business Machines Corporation
Data Processing Division
112 East Post Road
White Plains, New York.

.13 Basic Function: ..... transmits data from punched cards; receives and punches data into punched cards.

.15 Description

The IBM 1013 Card Transmission Terminal is a punched card terminal capable of sending or receiving data at speeds up to 300 characters per second. It transmits data from punched cards, using a fixed or variable program, and punches cards from received data in a fixed or variable format (editing only; no data rearrangements). The IBM 1013 operates over the public switched telephone network or common-carrier leased voice-grade lines, using the appropriate common-carrier data set, or over any equivalent channel with input-output connections conforming to the Electronic Industries Association Standard RS 232.

The 1013 is one of the IBM STR (Synchronous Transmit-Receive) terminal units and can communicate with other members of the STR group when set to compatible data rates. The terminals with which a 1013 can communicate include:

- Another 1013.
- An IBM 7701 or 7702 Magnetic Tape Transmission Terminal.
- An IBM 7740 Communication Control System.
- An IBM 1973 Data Transmission Terminal.
- An IBM 1978 Print Read Punch Terminal.
- An IBM 7750 Programmed Transmission Control.
- An IBM 7711 Data Communication Unit.
- An IBM System/360 Data Processing System via a 2701 Data Adapter Unit.
- An IBM 1401, 1440, or 1460 Data Processing System via a 1009 or 7710 Data Transmission Unit.

The 1013 transmits and receives data in a half-duplex mode. If full-duplex facilities are used, data transmission is still half-duplex, but synchronization can be maintained in both directions at the same time. This reduces the turnaround time when exchanging control signals.

The 1013 can operate in any of five modes, selected by the operator.

The Program Entry mode allows the operator to enter the data from four program cards into reserved areas of buffer storage. The program cards contain instructions for controlling the format of the Variable-Program Transmit or Receive mode. Fixed data, if any, is also included in the program cards.

In the Fixed Transmit mode, 80 characters of data are transmitted from each card.

.15 Description (Contd.)

In the Fixed Receive mode, the received data is expected to be in 80-character records and each record is punched into one card.

The Variable-Program Transmit mode allows a data block of up to 329 characters to be transmitted as one record. The record can consist of from one to seven subrecords, each in the same format. A subrecord consists of up to 80 characters read from a card and up to 47 characters of fixed data previously loaded into the 1013 with the program cards. Some of the control functions provided by the control instructions include fixed or X-skipping, suspension of the blank-column check, variable end-of-card location, deletion of data read from the cards, insertion of fixed data into the transmitted data, and various combinations of these functions.

In the Variable-Program Receive mode, the format of the card punched is controlled by the receiving terminal in the same manner as in the Variable-Program Transmit mode. Up to seven cards can be punched from one received record, depending on the format of the transmitted data. In general, one card is punched for each transmitted card record. Additional fixed data can be inserted into the punched card from the data read from the program cards at the receiving terminal.

The transmission code is the 4-of-8 constant ratio code used by other IBM data communications equipment (but not the IBM 65/66 Data Transceivers). Checking facilities include validity checks on the character codes read from the card and received as data. Detected errors result in up to two retransmissions of the entire record. If an error still persists, manual intervention is required.

.16 First Delivery: . . . . . first quarter, 1963.

.17 Availability: . . . . . ?

.2 CONFIGURATION

The 1013 consists of a 1,000-column-per-second card reader, a 160-column-per-second card punch, buffer storage, electronic control circuits, and an operator's console. Connections to various communication facilities are described in Paragraph .72.

.3 INPUT

.31 Prepared Input

Input medium:	standard IBM 80-column punched cards.
Input code:	standard Hollerith card code; see Table I.
Quantity of data —	
Fixed operation:	80 characters read from a card.
Variable operation:	1 to 80 characters read from a card.
Character set:	56 characters, consisting of alphanumerics and specials; see Table I.
Rated input speed:	1,000 columns/sec.
Effective speed:	approximately 40 to over 400 cards per minute, depending on grade of transmission line used, number of characters per card, transmission mode (full-duplex or half-duplex) and the receiving terminal.

.33 Fixed Input —

Fixed operation:	no provision.
Variable operation:	1 to 47 characters per card transmission; fixed data is stored in the buffer area prior to initiating transmission.

(Contd.)

TABLE I: IBM 1013 DATA CODES

Printed Symbol	Card Code	Intermediate Code	4 of 8 Code
	—	—	248O
0	0	O	28RN
1	1	1R	1OXN
2	2	2R	2OXN
3	3	12	12RN
4	4	4R	4OXN
5	5	14	14RN
6	6	24	24RN
7	7	124	124R
8	8	8R	8OXN
9	9	18	18RN
A	12-1	1RN	1ROX
B	12-2	2RN	2ROX
C	12-3	12N	12OX
D	12-4	4RN	4ROX
E	12-5	14N	14OX
F	12-6	24N	24OX
G	12-7	124N	124N
H	12-8	8RN	8ROX
I	12-9	18N	18OX
J	11-1	1RX	1RXN
K	11-2	2RX	2RXN
L	11-3	12X	12XN
M	11-4	4RX	4RXN
N	11-5	14X	14XN
O	11-6	24X	24XN
P	11-7	124X	124X
Q	11-8	8RX	8RXN
R	11-9	18X	18XN
S	0-2	2RO	2RON
T	0-3	12O	12ON
U	0-4	4RO	4RON
V	0-5	14O	14ON
W	0-6	24O	24ON
X	0-7	124O	124O
Y	0-8	8RO	8RON
Z	0-9	18O	18ON
/	0-1	1RO	1RON
#	3-8	128	128R
.	12-3-8	128N	128N
$	11-3-8	128X	128X
,	0-3-8	128O	128O
@	4-8	48R	48RN
□	12-4-8	48RN	48OX
*	11-4-8	48RX	48XN
%	0-4-8	48RO	48ON
&	12	N	248N
-	11	X	248X
Note 1 (?) &	12-0	ON	28OX
Note 1 (!) -	11-0	OX	28XN
Note 2 ≠	0-2-8	28RO	28ON
Note 2 ≢	12-7-8	1248RN	148N
Note 2 △	11-7-8	1248RX	148X
Note 2 ⧺	0-7-8	1248RO	148O
Note 2 ⌄	0-5-8	148O	28RX
† Substitute Character	5-8	148	1248

Note 1 Plus zero and minus zero print as ? and ! on the 1407.

Note 2 Record Mark ≠, Group Mark ≢, Delta △, Segment Mark ⧺, Word Separator ⌄ can be printed on any 1403 or 1404 with the expanded character set. They are standard on the 1407.

† The substitute character, which is used in the IBM 7701 Magnetic Tape Transmission Terminal, can be received and punched but not transmitted by the IBM 1013. Punching the substitute character code combination stops the 1013, and signals the operator.

Reprinted from IBM 1013 Card Transmission Terminal, p. 7, Form A21-1068, published by IBM.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration

Fixed operation: . . . . . each transmission consists of 80 data characters and control codes which are automatically inserted.

Variable operation: . . . . . up to 329 characters per transmission, consisting of from 1 to 7 card records (each in the same format), fixed data for each card record, and control codes.

.36 Operating Procedure

(1) Dial receiving station or otherwise establish connection; check that data set is ready for transmission; check that 1013's are synchronized and Ready light is on; check other lights.

(2) Select fixed or variable program (one 80-column card per record, or operation under 1013 program control).

(3) Load data cards and press Start key.

A special key, TEL, can be used to signal the remote operator. This is usually used to indicate to the remote operator that voice communication is desired.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.42 Output to Punched Cards

Card type and size: . . . . . standard IBM 80-column punched cards.
Card code: . . . . . standard Hollerith card code.
Rated punching speed: . . . . . 160 columns/sec.
Effective speed: . . . . . depends on transmission speed and location of the last column punched. For transmission speeds of 150 char/sec and higher, the range is approximately 90 to 170 cards/min if the last column punched is 80 or 30, respectively. At the 75 char/sec speed, the punching rate is limited by the transmission speed.

Format control —
Fixed operation: . . . . . none.
Variable operation: . . . . . stored program permits format control (see Description).

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors

Type of Checking: . . . . . invalid card code combinations, column count check, and blank column detection (optional).
Error indication: . . . . . machine halt, audible alarm, and light.
Correction procedure: . . . . . manual intervention.

.52 Data Transmission Errors

Type of checking: . . . . . character validity and longitudinal parity check.
Error indication: . . . . . machine halt, audible alarm, and light after three unsuccessful attempts to transmit full record.

(Contd.)

Correction procedure: . . . . . automatic retransmission of record; manual refeeding of error card after three unsuccessful attempts to transmit record.

.53 Data Recording Errors

Type of checking: . . . . . error in card punching and blank column detection (optional).
Error indication: . . . . . audible alarm, light, and machine halt.
Correction procedure: . . . . . manually eject defective card and resume operation (card will be repunched).
Comments: . . . . . check punch can be put in column 81 of card to indicate correctly-punched card.

.55 Line Malfunctions: . . . . . no specific provision for checking.

.6 CONDITION INDICATORS

Input device available: . . . . . lamp.
Input device busy: . . . . . lamp.
Remote receiver ready: . . . . . lamp.
Remote receiver busy: . . . . . lamp.
Power on: . . . . . lamp.
Improper data entry: . . . . . lamp, audible alarm.
Transmission error: . . . . . lamp, audible alarm.
Recording error: . . . . . lamp, audible alarm.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed: . . . . . 75, 150, 250, or 300 char/sec.
Transmission method: . . . . . serial by bit.
Transmission code: . . . . . 4-of-8 constant ratio code; see Table I.
Transmission mode: . . . . . half-duplex.
Order of bit transmission: . . . . . 1, 2, 4, 8, R, O, X, N; see Table I.
Synchronization: . . . . . synchronous; i.e., synchronization is maintained by the data signals.

.72 Connection to Communications Lines

Communications Line	Data Set*
Common-carrier leased voice-band lines at the following speeds:	
Up to 1,200 bits/sec (75 or 150 char/sec):	Bell System Data Set 202C or 202D, or Western Union 1200 Baud Data Modem.
2,000 bits/sec (250 char/sec):	Bell System Data Set 201A.
2,400 bits/sec (300 char/sec):	Bell System Data Set 201B or Western Union 2400 Baud Data Modem.
Public switched telephone network at the following speeds:	
Up to 1,200 bits/sec (75 or 150 char/sec):	Bell System Data-Phone Data Set 202C.
2,000 bits/sec (250 char/sec):	Bell System Data-Phone Data Set 201A.

Note: Any equivalent transmission medium that meets the standards of Electronic Industries Association's Recommended Standard 232 is usable by the IBM 1013 Card Transmission Terminal.

* In some cases, equivalent data sets can be used; see your local common-carrier communications consultant.

.73 Transmission Control

Call initiation:..... manual dialing or signaling.
Call reception:..... operator must establish voice communication and then switch to data mode.
Functional operations:..... none, except request retransmission.

.74 Multistation Operation: ..... no provision.

.8 PHYSICAL SPECIFICATIONS

Component	1013 Card Transmission Terminal
Width (inches)	47
Depth (inches)	29
Height (inches)	52
Weight (pounds)	800
Power (kw)	1.15
Voltage	115
Frequency (Hz)	60
Phases	1
Temperature Range (°F)	—
Humidity Range (%)	—
Heat (BTU/hr)	3,415

.9 PRICE DATA

Component or Feature	Monthly Rental $	Purchase Price $	Monthly Maintenance $
1013 Card Transmission Terminal	775	42,050	82.50

IBM 1978 PRINT READ PUNCH TERMINAL

.1 GENERAL

.11 Identity: ..... 1978 Print Read Punch Terminal; Models 1, 2, and 3.

.12 Manufacturer: ..... International Business Machines Corporation
Data Processing Division
112 East Post Road
White Plains, New York.

.13 Basic Function: ..... transmit data from punched cards; receive and print data or punch data into cards; operates over a voice-band line.

.14 Basic Components

Name: ..... 1978 Printer
Function: ..... includes line printer, buffers, and control circuitry. Printer is included in all models of the 1978.

Name: ..... 1978 Card Read Punch
Function: ..... provides punched card input and output. Card reading is provided in Models 1 and 2; card punching is provided in Model 2 only.

.15 Description

The IBM 1978 Print Read Punch Terminal is available in three models which provide various combinations of input/output components. The capabilities of the three models are as follows:

- 1978 Model 1 — provides punched card input and printed output.
- 1978 Model 2 — similar to Model 1, and provides punched card output in addition.
- 1978 Model 3 — provides printed output only; no input capabilities.

The 1978 Terminal operates at 75, 150, or 250 characters per second over the public telephone network or a common-carrier leased voice-band line; in addition, it can operate at 300 characters per second over a leased line.

The 1978 is one of the IBM STR (Synchronous Transmit-Receive) terminal units and can communicate with other members of the STR group if compatible data rates and message configurations are employed. Refer to Paragraph 6444.15 of the report on the IBM 1013 Card Transmission Terminal for a list of other terminals in the STR group.

The 1978 transmits and receives in a half-duplex mode. If full-duplex facilities are used, data transmissions are still half-duplex but synchronization can be maintained in both directions at the same time, which reduces turnaround time when exchanging control signals.

The 1978 Terminal is quite similar to the IBM 1013 Card Transmission Terminal; it uses a similar Card Read Punch unit and much of the same control circuitry. The primary difference between the 1978 and the 1013, aside from the printing capability of the 1978, is that the 1978 lacks the complex and flexible, variable programming mode provided in the 1013 (see Paragraph 6444.15).

The Card Read Punch unit is a modified version of the IBM 1442 Card Read Punch. The Printer is a modified version of the IBM 1443 Printer, which uses a horizontally oscillating type-bar. Both the 1442 and 1443 have been used extensively as peripheral devices in IBM computer systems.

The peak card reading speed is 190 cards per minute; the peak card punching speed varies from 91 cards per minute for fully punched cards to 190 cards per minute for cards with 25 or fewer columns punched.

.15 Description (Contd.)

The peak printing speed is 190 lines per minute if the standard 52-character type-bar is used. The Selective Character Set option permits the use of other type-bars having character sets of 13, 39, or 63 characters. The peak printing speed with the non-standard type-bar varies between 475 and 160 lines per minute.

The actual rate at which data can be transmitted depends on the transmitting and receiving components, the turnaround time, and the number of characters per record. See Tables V and VI for additional information about effective transmission rates.

Data is transmitted between a 1978 Terminal and a remote terminal in an alternating sequence of data blocks (transmittal records) and control signals. A transmittal record contains from one to seven subtransmittal records. Each subtransmittal record corresponds to one card or one line of print. The transmittal record can contain up to 329 data characters including certain control characters (see Paragraph .35).

The 1978 operates in one of seven modes:

- Send Normal Mode -- 80 characters are read from each card (one per column) and transmitted. The input cards are punched in standard IBM Card Code.
- Send Binary Mode — 160 characters are read from each card (two per column) and transmitted. The input cards are punched in column binary.
- Send First Character Mode — the code punched in the first card column determines whether the card is read in the normal or binary mode. A 7-9 punch in column 1 indicates column binary reading; all other card punch combinations indicate normal reading. The first card column is transmitted as one or two data characters.
- Receive Punch Normal Mode — received data is expected to be in the form of records containing up to 80 data characters; each record is punched into one card.
- Receive Print Mode — received data is expected to be in the form of records containing up to 80 data characters; each record is printed on one line, with single line spacing. No form skips can be initiated.
- Receive First Character Control Mode — received data records are punched or printed according to the initial character of each record. Cards can be punched in IBM Card Code or in column binary. Single, double, or triple line spacing can be performed after printing each line, or a skip to the top of the next page can be made. With the Skipping Device option, a forms skip can be initiated by the initial data character; actual skipping is controlled by the tape loop carriage control mechanism. Up to 120 or 144 (with optional feature) characters can be printed per line.
- Off-Line Mode — data can be transcribed from punched cards to printed output. One line is printed for each card, with single line spacing. Input cards are expected to be in the standard IBM card code. The rate of transcription varies from 130 cards per minute when using the 63-character type bar to 190 cards per minute with the 13-character type bar.

The transmission code is the IBM 4-of-8 code used by the other terminals in the IBM STR group. Extensive checking provisions are included in the 1978. Character validity checking is performed on data read from a card (in the normal mode) and on data received from a remote terminal. A longitudinal redundancy check (LRC) is performed on each subtransmittal record received and on the entire transmittal record. When transmitting, LRC characters are automatically generated for transmission. Detection of an error in received data causes the 1978 terminal to automatically request a retransmission. If errors persist after a total of three transmissions, the terminal halts and manual intervention is required.

Optional Features

A number of optional features are available for a 1978 Terminal, including:

- Selective Character Set — allows the operator to replace the printer type-bar with one containing a different character set. Type-bars having a character set containing 13, 39, 52 (standard), or 63 characters are available.

(Contd.)

- 24 Additional Print Positions — extends the print line from the standard 120 character positions to 144 positions.
- Skipping Device — provides additional carriage control via the 12-channel tape loop carriage control mechanism. The tape loop moves in synchronization with the form being printed and has 12 channels or columns which are prepunched to indicate different vertical points on the form. Channel 1 is reserved to indicate the top of the page and channel 12 the bottom. Without the Skipping Device option forms skipping is limited to a skip to the top of the next page initiated in the Receive First Character Control Mode or automatically when a punch in channel 12 is detected. With this option, skipping to any one of 9 positions indicated by punches in the corresponding tape column or channel can be initiated by the first data character in the Receive First Character Control Mode.
- Printer Speed Increase — increases the maximum rate of printing with the standard 52 character set from 190 lines per minute to 240 lines per minute.
- Transmit Variable-Length Records — enables from 1 to 148 data characters to be read and transmitted from one or two cards; end-of-record is indicated by a special character (Group Mark) punched in the card; this Group Mark replaces the one normally generated by the control circuitry.
- Automatic Turnaround — enables the 1978 Terminal to automatically switch from the selected transmit mode to Receive First Character Mode when a blank card is detected in the reader. When the following transmission and EOT signal is received, the 1978 switches back to the selected transmit mode.
- Automatic Answer and Disconnect — allows a 1978 Terminal to answer an incoming call automatically, without need for operator attention, and to receive or transmit data automatically.
- Speed Selection Switch — permits operator to select transmission speed.

.16 First Delivery: . . . . . July 1965.

.17 Availability: . . . . . not specified by IBM.

.2 CONFIGURATION

The IBM 1978 Print Read Punch Terminal is available in three models having different combinations of input/output capabilities as follows:

- 1978 Model 1 — provides punched card input and printed output.
- 1978 Model 2 — provides punched card output in addition to punched card input and printed output.
- 1978 Model 3 — provides printed output only.

The physical configurations of the various models are described in Paragraph .8.

The standard communications facilities that can be accommodated and the associated data sets are listed in Paragraph .72.

The optional features available for each model of the 1978 Terminal are listed and described in Paragraph .15.

.3 INPUT

.31 Prepared Input

Card Read Punch (1978 Models 1 and 2) —

Input medium:	standard IBM 80-column punched cards.
Input code:	standard Hollerith card code (see Table I), or column binary.
Quantity of data:	80 characters per card (normal mode) or 160 characters per card (column binary mode).
Character set:	see Table I.
Rated input speed:	190 cards/minute.
Effective speed:	see Tables V and VI.

TABLE I: IBM 1978 TERMINAL DATA CODES

DEFINED CHARACTER	PRINTS AS	PRINT BAR (SEE NOTE 1)					STANDARD CARD CODE	BCD CODE BITS						4 OF 8 CODE BITS							
		13	39	52A	52H	63		C	B	A	8	4	2	1	1	2	4	8	R	O	X	N
BLANK (SEE NOTE 2)		X	X	X	X	X		C											R	O	X	N
PERIOD	.	X	X	X	X	X	12-3-8		B	A	8		2	1	1	2		8				N
LOZENGE	¤			X	)	X	12-4-8	C	B	A	8	4					4	8		O	X	
LEFT BRACKET	[					X	12-5-8		B	A	8	4		1		2	4		R		X	
LESS THAN	<					X	12-6-8		B	A	8	4	2			2	4		R	O		
GROUP MARK	ǂ					X	12-7-8	C	B	A	8	4	2	1	1		4	8				N
AMPERSAND	&			X	+	X	12	C	B	A						2	4	8				N
DOLLAR SIGN	$		X	X	X	X	11-3-8	C	B		8		2	1	1	2		8			X	
ASTERISK	*	X		X	X	X	11-4-8		B		8	4					4	8			X	N
RIGHT BRACKET	]					X	11-5-8	C	B		8	4		1			4	8	R		X	
SEMICOLON	;					X	11-6-8	C	B		8	4	2				4	8	R	O		
DELTA	△					X	11-7-8		B		8	4	2	1	1		4	8			X	
HYPHEN (MINUS SIGN)	-	X		X	X	X	11		B							2	4	8			X	
DIAGONAL	/			X	X	X	0-1	C		A				1	1				R	O		N
COMMA	,		X	X	X	X	0-3-8	C		A	8		2	1	1	2		8		O		
PERCENT MARK	%			X	(	X	0-4-8			A	8	4					4	8		O		N
WORD SEPARATOR	∨					X	0-5-8	C		A	8	4		1		2		8	R		X	
LEFT OBLIQUE	\					X	0-6-8	C		A	8	4	2			2		8	R	O		
SEGMENT MARK	⧻					X	0-7-8			A	8	4	2	1	1		4	8		O		
SUBSTITUTE BLANK (SEE NOTE 2)	↯			X	X	X	2-8			A						2	4	8		O		
NUMBER (POUND SIGN)	#			X	=	X	3-8				8		2	1	1	2		8	R			
AT SIGN	@			X	'	X	4-8	C			8	4					4	8	R			N
COLON (SEE NOTE 3)	:			X	X	X	5-8				8	4		1	1	2	4	8				
GREATER THAN	>					X	6-8				8	4	2			2	4	8	R			
RADICAL	√					X	7-8	C			8	4	2	1	1		4	8	R			
QUESTION MARK (PLUS ZERO)	?			X	X	X	12-0	C	B	A	8		2			2		8		O	X	
A	A		X	X	X	X	12-1		B	A				1	1				R	O	X	
B	B		X	X	X	X	12-2		B	A			2			2			R	O	X	
C	C		X	X	X	X	12-3	C	B	A			2	1	1	2				O	X	
D	D		X	X	X	X	12-4		B	A		4					4		R	O	X	
E	E		X	X	X	X	12-5	C	B	A		4		1	1		4			O	X	
F	F		X	X	X	X	12-6	C	B	A		4	2			2	4			O	X	
G	G		X	X	X	X	12-7		B	A		4	2	1	1	2	4					N
H	H		X	X	X	X	12-8		B	A	8							8	R	O	X	
I	I		X	X	X	X	12-9	C	B	A	8			1	1			8		O	X	
EXCLAMATION POINT (MINUS ZERO)	!			X	X	X	11-0		B		8		2			2		8			X	N
J	J		X	X	X	X	11-1	C	B					1	1				R		X	N
K	K		X	X	X	X	11-2	C	B				2			2			R		X	N
L	L		X	X	X	X	11-3		B				2	1	1	2					X	N
M	M		X	X	X	X	11-4	C	B			4					4		R		X	N
N	N		X	X	X	X	11-5		B			4		1	1		4				X	N
O	O		X	X	X	X	11-6		B			4	2			2	4				X	N
P	P		X	X	X	X	11-7	C	B			4	2	1	1	2	4				X	
Q	Q		X	X	X	X	11-8	C	B		8							8	R		X	N
R	R		X	X	X	X	11-9		B		8			1	1			8			X	N
RECORD MARK	ǂ				X	X	0-2-8			A	8		2			2		8		O		N
S	S		X	X	X	X	0-2	C		A			2			2			R	O		N
T	T		X	X	X	X	0-3			A			2	1	1	2				O		N
U	U		X	X	X	X	0-4	C		A		4					4		R	O		N
V	V		X	X	X	X	0-5			A		4		1	1		4			O		N
W	W		X	X	X	X	0-6			A		4	2			2	4			O		N
X	X		X	X	X	X	0-7	C		A		4	2	1	1	2	4			O		
Y	Y		X	X	X	X	0-8	C		A	8							8	R	O		N
Z	Z		X	X	X	X	0-9			A	8			1	1			8		O		N
ZERO (0)	0	X	X	X	X	X	0	C			8		2			2		8	R			N
1	1	X	X	X	X	X	1							1	1					O	X	N
2	2	X	X	X	X	X	2						2			2				O	X	N
3	3	X	X	X	X	X	3	C					2	1	1	2			R			N
4	4	X	X	X	X	X	4					4					4			O	X	N
5	5	X	X	X	X	X	5	C				4		1	1		4		R			N
6	6	X	X	X	X	X	6	C				4	2			2	4		R			N
7	7	X	X	X	X	X	7					4	2	1	1	2	4		R			
8	8	X	X	X	X	X	8				8							8		O	X	N
9	9	X	X	X	X	X	9	C			8			1	1			8	R			N

NOTES: 1. X in a print bar column indicates that the character is printed by that bar. Any other notation shows the character as it is printed by the 52 - character bar, Arrangement H.

2. The 4 of 8 codes shown are for Binary Mode. In BCD Mode the substitute blank character is deleted from the character set, and the blank has the 4 of 8 Bit Configuration 2 - 4 - 8 - O.

3. The colon is used as the substitute character by the IBM 7702 Magnetic Tape Transmission Terminal.

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(Contd.)

.32 Manual Input: . . . . . no provision.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration

Data is transmitted or received by an IBM 1978 Terminal in a series of data blocks called transmittal records and appropriate control code sequences. Refer to Tables II and III for the structure and definition of each control sequence. Each transmittal record consists of a Start-of-Record sequence followed by one to seven subtransmittal records, and ended by an End-of-Transmittal-Record sequence. Each subtransmittal record consists of data characters followed by a Group Mark or Record Mark code and a Longitudinal Redundancy Check character (LRC).

Depending on the mode of operation (see Paragraph .15), the number of data characters in each subtransmittal record can be up to 161 characters, including the initial control code when used. The number of data characters can vary in subtransmittal records within the same transmittal record, again depending on the mode of operation. The maximum number of data characters per subtransmittal record for each input or output component is shown in Table IV.

The maximum number of data characters per transmittal record, including first character control codes and Record or Group Marks, but excluding LRC characters, is 329. When transmitting, each subtransmittal record corresponds to one card read from the Card Read Punch unit. When receiving, each subtransmittal record corresponds to one card punched or one line printed.

All control codes mentioned in this entry are generated automatically by the 1978 Terminal.

.36 Operating Procedure

(1) Operator establishes connection by dialing or signaling, coordinates the transmission with the remote operator, checks that the data set is ready for transmission, and switches to data mode.

(2) Operator verifies that synchronization between terminals has been established and that all components are in a ready condition by observing the control panel lights.

(3) Operator selects proper operation mode and loads data cards if transmitting or readies the Card Read Punch or Printer if receiving. The transmitting terminal operator then presses the Start key.

The exchanges of data messages and control signals are under the control of the terminals. Further intervention by the operator is required only when errors are repeatedly detected in retransmission of the same data block (transmittal record), when reading, punching, or printing component malfunctions or errors are detected, and when the call is terminated.

The Automatic Answer and Disconnect option permits transmission or reception of messages by an unattended IBM 1978 Terminal.

TABLE II: IBM 4-OF-8 CHARACTER TRANSMISSION CONTROL CODES

Control Code	Symbol (1)	Transmission Code (2)
Idle	IDL	18RO
Error-Inquiry	EI	18RX
Transmit Leader	TRL	14RO
Control Leader	CTL	14RX
SOR/ACK-1	S/A-1	12RX
SOR/ACK-2	S/A-2	12RO

(1) These are the symbols used in Table III.

(2) See Table I.

TABLE III: IBM 4-OF-8 CONTROL MESSAGES

Control Message (1)	Function	Characters Transmitted (2)
Idle	To maintain synchronization.	IDL
End-of-Idle (EOI)	To signal that the direction of Idle transmissions shall be reversed.	CTL IDL
Inquiry	To interrogate remote terminal as to readiness.	TRL EI
Start-of-Record (SOR-1 or SOR-2)	To signal the beginning of a transmittal record; records are alternately designated odd (SOR-1) and even (SOR-2) to provide detection of duplicate transmissions.	TRL S/A-1 or TRL SA-2
Acknowledge (ACK-1 or ACK-2)	To signal readiness to receive in response to an inquiry message; to signal the transmitting terminal that a transmittal record was received without any detected errors.	CTL S/A-1 or CTL S/A-2
Error	To signal the transmitting terminal that errors were detected in one or more subtransmittal records.	CTL EI
End-of-Transmittal Record (EOTR)	To signal the end of a transmittal record.	TRL LRC
End-of-Transmission (EOT)	To signal the remote operator that transmission has been completed (manually initiated).	CTL
TEL	To signal the remote operator; normally used to indicate desire for voice communication (manually initiated).	CTL

(1) All messages except Idle and Start-of-Record cause a change in the direction of transmission; all messages except End-of-Transmission and TEL are automatically initiated.

(2) All messages except Idle are two-character sequences; see Table II for transmission codes.

TABLE IV: MAXIMUM SIZES OF SUBTRANSMITTAL RECORDS

Operation	Component	Maximum Number of Data Characters Per Subtransmittal Record *
Transmit	Card Reader —	
	Normal Mode	80
	Binary Mode	160
Receive	Card Punch —	
	Normal Mode	80
	Binary Mode	161
	Printer —	
	Standard	120
	with Additional Print Positions Feature	144

* Does not include first character control codes.

(Contd.)

.37 Entry of Time and Date: . . . . . no provisions.

.4 OUTPUT

.42 Output to Punched Cards

Card Read-Punch (1978 Model 2 only) —

Card type and size:	standard 80-column punched cards.
Card code:	standard Hollerith card code (see Table I), or column binary.
Rated punching speed:	160 columns/sec; 190 cards/min maximum.
Effective speed:	see Tables V and VI.
Format control:	none.

TABLE V: DATA TRANSMISSION RATE OF IBM 1978 TERMINAL

Characters Per Record (1)	Data Transmission Rate, records/sec (1)							
	Via a Half-Duplex Line Operating at:				Via a Full-Duplex Line (2) Operating at:			
	75 char/sec	150 char/sec	250 char/sec	300 char/sec	75 char/sec	150 char/sec	250 char/sec	300 char/sec
25	150	285	410	470	165	330	550	655
40	95	190	285	335	105	210	345	415
80	50	95	150	175	90	105	180	215
160	25	50	75	90	25	55	90	110

(1) Each record is a subtransmittal record and corresponds to one card or one printed line. Maximum blocking is assumed. See Paragraph .35 for details on message configuration. The rates shown in this table represent the speed at which data is sent over the line. The overall effective rate is governed by the peak reading, punching, or printing rate (see Table VI), or the data transmission rate, whichever is the lowest.

(2) The operation of the terminal is always half-duplex, but full-duplex facilities can be used to maintain synchronization in both directions simultaneously, which reduces turnaround time.

TABLE VI: IBM 1978 TERMINAL PEAK INPUT/OUTPUT RATES (1)

Input or Output Operation	Peak Rate, Cards or lines per minute
Card Reading	190
Printing —	
13-character set	475
39-character set	240
52-character set	190
63-character set	160
Card Punching —	
25 columns	190
40 columns	146
80 columns	91

(1) The overall effective speed of operation will be the lowest of the three following rates: data transmission rate (see Table IV), transmitting component rate, and receiving component rate.

.44 Output to Printer

Printer (all models of 1978) —

Output medium:	pin-fed continuous fan-fold forms from 4.00 to 16.75 inches in width; 120 or 144 (optional) printing positions; 10 characters per inch horizontal spacing and 6 or 8 lines per inch vertical spacing.
Character set:	52 characters standard; 13, 39, or 63 character set available with Selective Character Set option.
Rated printing speed —	
With 13-character set:	475 lines/min.
With 39-character set:	240 lines/min.
With 52-character set:	190 lines/min.
With 63-character set:	160 lines/min.
Effective speed:	see Tables V and VI.
Format control:	vertical forms control via 12-channel paper tape loop mechanism (optional). Skipping operation is initiated by first character control code of a message.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors

Type of checking:	character validity, card registration, character count, and reading lamp checks.
Error indication:	terminal halts, a lamp is lighted, and an audible alarm is sounded.
Correction procedure:	manual intervention.

.52 Data Transmission Errors

Type of checking:	character validity check; longitudinal redundancy check for each subtransmittal record and for entire transmittal record.
Error indication:	output is suspended and an error indication code is transmitted to the remote terminal after complete transmittal record is received.
Correction procedure:	automatic retransmission of entire transmittal record; after a total of 3 failures to receive a record, the terminal halts with a lamp lighted and sounds an audible alarm.
Comments:	when receiving a retransmission, the 1978 punches or prints the entire transmittal record.

.53 Data Recording Errors

Type of checking:	echo check to verify that correct dies have been activated in card punch; character parity checking on data sent to printer, but no direct check on printed output.
Error indication:	a lamp is lighted and an audible alarm is sounded.
Correction procedure:	manual intervention.

.55 Line Malfunctions: no specific provisions for checking.

.6 CONDITION INDICATORS

A comprehensive array of lamps and switches on the main operator panel, which is located on the printer, displays the flow of data through the buffers, the mode of operation, the status of each component, transmission errors, and printer malfunctions. A secondary panel is provided on the Card Read Punch unit to indicate reading or punching malfunctions.

(Contd.)

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	600, 1200, 2000, or 2400 bits/sec (75, 150, 250, or 300 char/sec, respectively).
Transmission method:	serial by bit.
Transmission code:	IBM 4-of-8 Transmission Code (see Table I); a total of 8 bits are transmitted for each character.
Transmission mode:	half-duplex.
Order of bit transmission:	1, 2, 4, 8, R, O, X, N; see Table I.
Synchronization:	synchronous; a special character (Idle) is repeatedly transmitted between terminals prior to data transmission.

.72 Connection to Communications Lines

Communications Line*	Data Set**
Common-carrier leased voice-band line operating at the following speeds:	
Up to 1,200 bits/sec (75 or 150 char/sec):	Bell System Data Set 202C or 202D or Western Union 1200 Baud Data Modem.
2,000 bits/sec (250 char/sec):	Bell System Data Set 201A.
2,400 bits/sec (300 char/sec):	Bell System Data Set 201B or Western Union 2400 Baud Data Modem.
Public telephone network operating at the following speeds:	
Up to 1,200 bits/sec (75 or 150 char/sec):	Bell System Data-Phone Data Set 202C.
2,000 bits/sec (250 char/sec):	Bell System Data-Phone Data Set 201A.

.73 Transmission Control

Call initiation:	manual dialing or signaling.
Call reception:	capable of unattended transmit or receive operation with optional feature.
Functional operations:	none standard (card feed and line advance are automatic at end of each data block); with the Skipping Device optional feature, vertical form skipping in the printer can be initiated by the initial control code for each data block.

.74 Multistation Operation: ..... no special provisions.

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* IBM states that any transmission medium that meets the standards of EIA RS-232A is usable by the IBM 1978 Terminal.

** In some cases, equivalent data sets can be used; see your local common-carrier communications consultant.

.8 PHYSICAL SPECIFICATIONS

Component	IBM 1978 Terminal		
	Model 1	Model 2	Model 3
Width (inches)	86	86	86
Depth (inches)	56	56	56
Height (inches)	49	49	49
Weight (pounds)	1,400	1,400	1,400
Power (KVA)	3.7	4.1	2.8
Voltage	208/230	208/230	208/230
Frequency (Hz)	60	60	60
Phases	1	1	1
Temperature Range (°F)	50-90	50-90	50-90
Humidity Range (%)	20-80	20-80	20-80
Heat (BTU/hr)	11,400	12,600	8,600

.9 PRICE DATA*

Component or Feature	Monthly Rental $	Purchase Price $	Monthly Maintenance $
1978 Terminal			
Model 1 (transmit-receive and print)	1,000	51,800	106.00
Model 2 (transmit-receive and print or punch)	1,100	55,000	118.00
Model 3 (receive and print)	850	42,900	102.00
Optional Features			
Selective Character Set (permits using type-bars with size of character set other than standard)	25	1,375	2.00
Print Positions, 24 additional (expands print line from 120 positions to 144 positions)	45	2,475	2.25
Printer Speed Increase	60	100	8.00
Skipping Device (provides form skipping controlled by carriage control tape loop)	5	150	0.50
Nonstandard Type-Bar**			
13-symbol character set	—	400	—
39-symbol character set	—	450	—
52-symbol character set	—	500	—
63-symbol character set		575	
Transmit Variable-Length Records	15	325	0.50
Automatic Turnaround	35	1,400	1.50
Automatic Answer and Disconnect	40	1,600	1.50
Speed Selection Switch	15	650	1.25

** One type-bar, any size, is included with the basic terminal; these prices apply to additional type-bars.

* Current pricing unavailable; equipment listed under Paragraph .9 no longer in production.

IBM 1050 DATA COMMUNICATIONS SYSTEM

.1 GENERAL

.11	Identity:	IBM 1050 Data Communications System.
.12	Manufacturer:	International Business Machines Corporation Data Processing Division 112 East Post Road White Plains, New York.
.13	Basic Function	transmission of data over voice-band or narrow-band communications lines, and off-line data preparation or recording; input can be from punched cards, punched paper tape, or manual keyboard; output can be to punched cards, punched paper tape, or printed copy.

.14 Basic Components

Name:	Control Unit.
Model number:	1051, Model 1, 2, or N1.
Function:	controls other components.
Name:	Printer-Keyboard.
Model number:	1052.
Function:	printed output; keyboard data entry; off-line data preparation.
Name:	Printer.
Model number:	1053.
Function:	provides additional printing capability.
Name:	Paper-Tape Reader.
Model number:	1054.
Function:	reads punched tape data.
Name:	Paper-Tape Punch.
Model number:	1055.
Function:	punches data on paper tape.
Name:	Card Reader.
Model number:	1056 Model 1 or 2.
Function:	reads punched cards, one at a time or in packs.
Name:	Card Punch.
Model number:	1057.
Function:	punches cards.
Name:	Printing Card Punch.
Model number:	1058 Model 1 or 2.
Function:	punches and prints on cards.
Name:	Programmed Keyboard.
Model number:	1092.
Function:	numeric data entry.

.14 Basic Components (Contd.)

Name:	Programmed Keyboard.
Model number:	1093.
Function:	numeric data entry.

.15 Description:

The IBM 1050 Data Communications System consists of a group of slow-speed devices which can transmit data to or receive data from a 1050 system at another location via the public switched telephone network, the TWX network, a leased voice-band line, a leased common-carrier telegraph network (75 bits per second), or a privately-owned communications network. Data is transmitted at 14.8 characters per second over voice-grade or TWX facilities. Options permit transmission at 8.33 characters per second over leased telegraph facilities (75 bits per second). Data is transmitted in a half-duplex mode (i.e., bidirectional, but in only one direction at a time).

The 1050 system can also be used as a remote terminal with most IBM computer systems. Examples are the IBM 1440 or 1460 computer with the 1448 Terminal Control Unit, or the 1026 Transmission Control Unit, the 1410 and 7000 Series computers with the IBM 7750 Programmed Transmission Control, the IBM 7740 Communication Control System, and IBM System/360 computers with the 2701 Data Adapter Unit or either the 2072 or 2073 Transmission Control Unit.

The 1050 Data Communications System permits bidirectional transmission of data using punched cards, punched tape, printers, and keyboards. A 1050 system at one location consists of a 1051 Control Unit and one or more of the following units:

1052 Printer-Keyboard
1053 Printer
1054 Paper-Tape Reader
1055 Paper-Tape Punch
1056 Card Reader
1057 Card Punch (similar to IBM 24 keypunch).
1058 Printing Card Punch (similar to IBM 26 keypunch).
1092 Programmed Keyboard
1093 Programmed Keyboard.

The 1051 Control Unit is available in three models: Models 1, 2, and N1. Model 1 can operate in either a "line-loop" or a "home-loop" mode. In the line-loop mode, a 1050 station can communicate with remote terminals over a variety of communications facilities. In the home-loop mode, units not being used for data transmission can be interconnected to perform local operations such as the preparation of punched tape from keyboard input. Model 2 can be used only in the line-loop mode, and Model N1 can be used only in the home-loop mode. The primary use of Model N1 is for console facilities for some models of an IBM System/360 computer system.

When equipped with the Master Station special feature, a 1051 Model 1 or 2 Control Unit can initiate polling or addressing operations on a multistation line. Up to 26 1050 systems can communicate over a single leased line, although only one station at a time can transmit. The "polling station" transmits a station code followed by a device address code. If a positive response is received, the remote unit is ready to send data. If a negative response or no response is received, another station or device on the line can be polled. The "addressing station" transmits a code, as in polling. If a positive response is received, the sending device (keyboard, card reader, or punched tape reader) is started.

The response time for a polled or addressed terminal is controlled by the time-out feature. This feature functions in conjunction with the line control discipline. The time-out feature requires the terminal to respond to a poll or address within a set time period (9 to 18 seconds). The result of a time period lapse without a response is: a terminal (except a master station) set to the transmit mode reverts to the receive mode; a terminal set to the receive

(Contd.)

mode with line control inoperative reverts to the transmit mode. A special feature, Text Time-Out Suppression, negates the normal time-out period and permits an unlimited transmission time period.

Error control is handled on a character and message basis. The transmitting terminal inserts an odd parity bit into both keyboard-originated characters and characters read from punched cards prior to transmission. Punched tape characters already contain parity bits. A longitudinal redundancy check character (message parity) is sent at the end of each block of data after the end-of-block character. Character and message parity are checked at the receiving terminal, and if an error is sensed, indicator lamps are turned on at both terminals and transmission is stopped. With the optional feature of Line Correction and Automatic Reread (for card and punched tape), the message is automatically transmitted two more times after error indication, before manual intervention is required.

Some of the more important optional features available for the different models of the 1051 Control Unit include:

- Line Correction (Models 1 and 2): Permits automatic retransmission of data from a 1054 Paper Tape Reader or 1056 Card Reader when an error is detected. When punching with a 1055 Paper Tape Reader, the error block is deleted and repunched; when punching cards with the 1057 or 1058 Card Punch, the card is ejected without a punch in column 81 and a new card is punched.

- Master Station (Models 1 and 2): Permits a 1050 station to perform polling and addressing operations in a multistation network.

- Home Component Recognition (Models 1 and N1): Permits automatic selection of units from a group being operated in a home-loop mode.

- Automatic Ribbon Shift and Line Feed Select (all Models): Permits shifting to upper or lower portion of ribbon and selection of single or double line feed in response to certain control codes.

- Line Adapters (Models 1 and 2): Permits connection to voice-band communication lines. This option provides the necessary modulation and demodulation of the data signals and can be used in place of common-carrier data sets where permitted. One model allows up to four 1050 systems to simultaneously share one voice-band line.

- Home Correction (Models 1 and N1): Provides facilities for error correction in the home-loop mode when preparing punched tapes. These facilities enable an operator to backspace and punch delete codes manually, one character at a time, or to backspace and punch delete codes through an entire record automatically.

- Line Correction Release (Models 1 and 2): Permits resumption of data transmission after a third negative response to a longitudinal parity check on transmitting terminals incorporating the Line Correction feature. With this feature the terminal transmits the next message instead of stopping after the third unsuccessful transmission attempt. If the receiving terminal does not respond to an EOB/LRC at the end of a message block, Line Correction Release does not function and operator intervention is required.

- Reader Stop — Prefix J (Models 1 and N1): Provides modification of the reader skip operation. Instead of the normal termination of a skip operation when detecting a tab, CR/LF, or line feed character, the skip operation is terminated by a prefix code followed by a J character. This feature operates only in the home loop mode.

.15 Description (Contd.)

- Auto-Fill-Character Generation (Models 1 and N1): Permits the 1055, during the process of preparing punched tape, to automatically punch idle characters for the duration of a printer function such as carriage return/line feed, tab, and line feed. This process compensates for the time required for a receiving printer to execute the printer function when the prepared tape is transmitted. This feature along with an operator panel feature permits the 1057 and 1058 to punch idle characters into punched cards during printer functions.
- Audible Alarm (Models 1 and 2): Provides an audible alarm when certain conditions occur (line loop operation only) that require operator intervention. The alarm is manually reset.
- Automatic EOB (all models): Permits automatic generation of an EOB character when the carriage return/line feed function is initiated at the keyboard. The EOB character precedes the CR/LF character. When operating in the home loop mode, the 1055 punches both characters and the 1057 or 1058 punches the EOB character and ejects the card, punching the CR/LF character in the next card.
- Home-Loop Input Component Interlock (Models 1 and N1): prohibits the operation of any input unit connected to a malfunctioning output unit in the home loop mode.
- Keyboard Request (Models 1 and 2): Permits keyboard polling and requires operator attention when the request is initiated.
- Telegraph Line Attachment (Models 1 and 2): Permits connecting the 1051 to a telegraph grade line. Transmission speed is 75 bits per sec (8.3 characters per second). Home loop operation remains at 14.8 characters per second.
- Vertical Forms Control (all models): Provides vertical formatting for 1052 or 1053 Printers; forms movement is initiated by a two-character function code. This feature includes one or two separate bead chains that permit between-forms movement and movement within forms; form feeding can be stopped at pre-set lines.
- Open-Line Detection (Models 1 and 2): Provides a line-carrier indicator lamp to indicate a closed transmission line. An automatic disconnect results when the 1050 is erroneously dialed, when talk keys at both terminals are not depressed (when switching from data to talk mode), or when the carrier is interrupted. The disconnect occurs within 20 to 30 seconds. The effected input-output device also produces an indication of the disconnect by printing a hyphen (1052/1053 Printer) punching a hyphen (1055 Paper Tape Punch) or ejecting a card (1058 Card Punch).

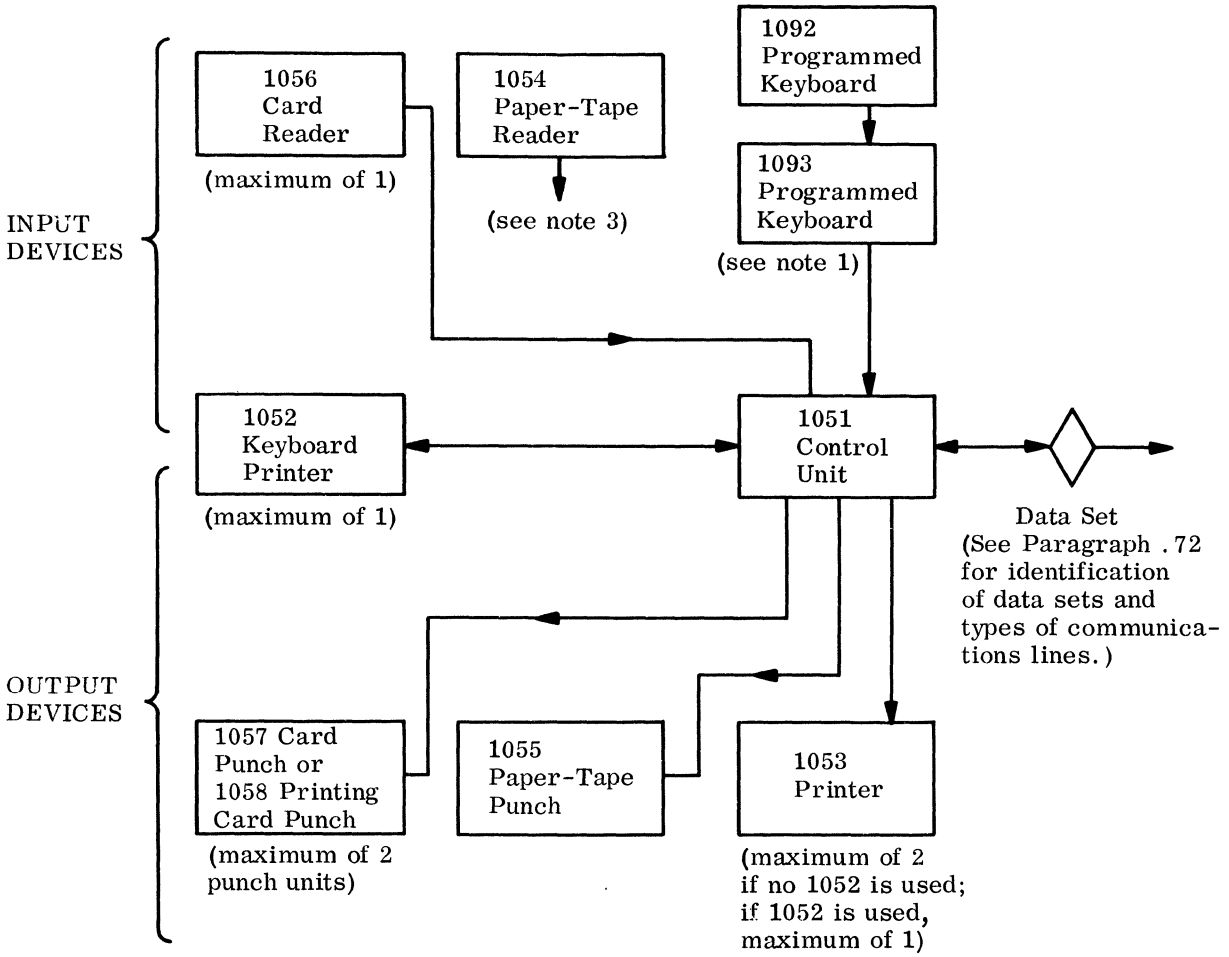
.16 First Delivery: . . . . . January 1964.

.17 Availability: . . . . . maximum of 6 months.

(Contd.)

.2 CONFIGURATION

(Maximum of 2 reader devices and programmed keyboard units.)



Notes: (1) The 1092 and 1093 Programmed Keyboards are shown connected in tandem. These keyboards need not operate in tandem; either can be connected directly to a 1051 Control Unit.

(2) A Maximum configuration is shown. A 1051 station need include only the desired units; for example, a minimum system could include only a 1051 Control Unit and a 1053 Printer.

(3) For strict accuracy, the 1054 is not shown connected to the 1051 because this connection would exceed the maximum number of allowable reader and programmed keyboard devices connected to the 1051.

.3 INPUT

.31 Prepared Input

1054 Paper-Tape Reader -

Input medium:	fully punched, 1-inch, 8-level paper tape. edge-punched documents (optional feature).
Input code:	6-level PTTC/BCD plus odd parity; see Table II.
Quantity of data:	variable.
Character set:	full alphanumeric plus specials.
Rated input speed:	14.8 or 8.33 char/sec, depending on communications facility.
Effective speed:	depends upon block lengths.
Comments:	data read from paper tape can be printed locally, but not punched, while transmitting. feeding of paper tape from the center of the tape roll to allow reading the tape in the same order as punched is provided as an optional feature.

1056 Card Reader, Models 1 and 2 -

Input medium:	standard IBM 80-column punched cards (22 or 51-column cards with an optional feature.)
Input code:	standard Hollerith card code; see Table II.
Quantity of data:	single card, read by column. pack of up to 300 cards (Model 1, with optional feature).
Character set:	see Table II.
Rated input speed:	14.8 or 8.33 characters (columns) per second, depending on communications facility.
Effective speed:	approximately 10 fully-punched cards per minute when reading from pack.
Comments:	optional feature permits use of a punched paper tape control loop to control card passage through reader.

.32 Manual Input

1052 Printer Keyboard -

Method of entry:	via a 53-key keyboard.
Quantity of data:	variable.
Character set:	88 characters, including upper and lower-case alphabetics, numerics, punctuation, and special characters; see Table II.
Comments:	output can be transmitted, or keyboard can be used in local "home unit" operations to prepare paper tape, cards, or printed records.

IBM 1092 Programmed Keyboard, Models 1 and 2 -

Method of entry:	via a 15-column keyboard (Model 1) or 16-column keyboard (Model 2). Each column contains 10 keys.
Quantity of data:	15 or 16 digits, depending on model.
Character set:	digits 0 through 9 only; optional feature permits multiple keys to be depressed in the last two columns and the result to be sent as four 5-bit characters.

(Contd.)

Comments: . . . . . can be used in tandem with 1093 to send up to 26 digits of data. With Model 2, up to 48 different coded overlays can be recognized. The overlay code is transmitted with the data.

1093 Programmed Keyboard, Models 1 and 2 -

Method of entry: . . . . . via a 10-column keyboard. Each column contains 10 keys.
Quantity of data: . . . . . 10 digits.
Character set: . . . . . digits, 0 through 9 only; optional feature permits multiple keys to be depressed in the last two columns, and the result to be sent as four 5-bit characters.
Comments: . . . . . can be used in tandem with 1092 to send up to 26 digits of data. With Model 2, up to 48 different coded overlays can be recognized. The overlay code is transmitted with the data.

.34 Transaction Code Input: . . . . . no special provision.

.35 Message Configuration

Data is transmitted and received by the 1050 Terminal in blocks of one or more variable-length records. Six line control characters are automatically encoded by the control circuitry in the 1051 Control Unit. The line control characters are stripped from the data at the receiving terminal. Table I describes the function of each line control character.

TABLE I: IBM 1050 LINE CONTROL CHARACTERS

Control Character	Function	Character Transmitted
End-of-Transaction	To initiate control mode (indicates end of text mode and causes 1051 to be initialized)	EOT
End-of-Address	To initiate Text mode at a selected 1050 station; initiates longitudinal parity generation and checking at transmitting and receiving stations to indicate a positive response to a poll (the text follows)	EOA
End-of-Block	To halt the transmitting terminal, at the end of a transmitted block, until a negative or positive response is received from the receiving terminal	EOB
Positive Response	To indicate that the addressed terminal is ready to receive To indicate that a block text was received without error	period (.)
Negative Response	To indicate that the addressed terminal is not ready to receive To acknowledge a polling terminal that the polled terminal does not have a message to transmit To indicate that a block of text was incorrectly received	hyphen (-)
Positive Answer	To select all on-line output components and to deselect all on-line input components; used in alternate-transmission, inquiry applications with a remote processing site; it indicates that the remote site is about to transmit	number sign (#)

TABLE II: IBM 1050 DATA CODES

PTTC/BCD Code				TRANSMISSION CODE	PTTC/EBCD Code			
LOWER CASE		UPPER CASE			LOWER CASE		UPPER CASE	
Symbol	Card Code	* Card Code	Symbol	B A C 8 4 2 1	Symbol	Card Code	Card Code	Symbol
1	1	8-6	=	1	1	1	8-6	=
2	2	12-8-4	ㄩ	2	2	2	12-8-4	<
3	3	11-8-6	;	C 2 1	3	3	11-8-6	;
4	4	8-2	:	4	4	4	8-2	:
5	5	0-8-4	%	C 4 1	5	5	0-8-4	%
6	6	8-5	'	C 4 2	6	6	8-5	'
7	7	8-1	"	4 2 1	7	7	0-8-6	>
8	8	11-8-4	*	8	8	8	11-8-4	*
9	9	12-8-5	(	C 8 1	9	9	12-8-5	(
0	0	11-8-5	)	C 8 2	0	0	11-8-5	)
a	12-1	12-0-1	A	B A 1	a	12-0-1	12-1	A
b	12-2	12-0-2	B	B A 2	b	12-0-2	12-2	B
c	12-3	12-0-3	C	B A C 2 1	c	12-0-3	12-3	C
d	12-4	12-0-4	D	B A 4	d	12-0-4	12-4	D
e	12-5	12-0-5	E	B A C 4 1	e	12-0-5	12-5	E
f	12-6	12-0-6	F	B A C 4 2	f	12-0-6	12-6	F
g	12-7	12-0-7	G	B A 4 2 1	g	12-0-7	12-7	G
h	12-8	12-0-8	H	B A 8	h	12-0-8	12-8	H
i	12-9	12-0-9	I	B A C 8 1	i	12-0-9	12-9	I
j	11-1	12-11-1	J	B C 1	j	12-11-1	11-1	J
k	11-2	12-11-2	K	B C 2	k	12-11-2	11-2	K
l	11-3	12-11-3	L	B 2 1	l	12-11-3	11-3	L
m	11-4	12-11-4	M	B C 4	m	12-11-4	11-4	M
n	11-5	12-11-5	N	B 4 1	n	12-11-5	11-5	N
o	11-6	12-11-6	O	B 4 2	o	12-11-6	11-6	O
p	11-7	12-11-7	P	B C 4 2 1	p	12-11-7	11-7	P
q	11-8	12-11-8	Q	B C 8	q	12-11-8	11-8	Q
r	11-9	12-11-9	R	B 8 1	r	12-11-9	11-9	R
s	0-2	11-0-2	S	A C 2	s	11-0-2	0-2	S
t	0-3	11-0-3	T	A 2 1	t	11-0-3	0-3	T
u	0-4	11-0-4	U	A C 4	u	11-0-4	0-4	U
v	0-5	11-0-5	V	A 4 1	v	11-0-5	0-5	V
w	0-6	11-0-6	W	A 4 2	w	11-0-6	0-6	W
x	0-7	11-0-7	X	A C 4 2 1	x	11-0-7	0-7	X
y	0-8	11-0-8	Y	A C 8	y	11-0-8	0-8	Y
z	0-9	11-0-9	Z	A 8 1	z	11-0-9	0-9	Z
Space	Blank	Blank	Space	C	Space	Blank	Blank	Space
#	8-3	0-8-7	±	8 2 1	#	8-3	8-7	"
&	12	12-8-6	+	B A C	&	12	12-8-6	+
.	12-3-8	12-8-1	.	B A 8 2 1	.	12-3-8	11-8-7	¬
-	11	0-8-6	–	B	-	11	0-8-5	—
$	11-8-3	11-8-2	!	B C 8 2 1	$	11-8-3	11-8-2	!
@	8-4	11-8-7	¢	A	@	8-4	12-8-2	¢
,	0-8-3	0-8-1	,	A C 8 2 1	,	0-8-3	12-8-7	|
/	0-1	12-8-2	?	A C 1	/	0-1	0-8-7	?

* With extended character punching and reading special features installed in 1056 Model 1 and 1057 Model 1. Shaded areas indicate the differences in card codes and graphics between the PTTC/BCD Code set with the Extended Character Reading and Extended Character Punching special features installed and the PTTC/EBCD Code set used with the 1056 Model 3 and 1058 Model 2. The transmission code is the same for both code sets.

Reprinted from IBM 1050 Data Communication System Principles of Operation, Form A24-3474-0 published by IBM.

(Contd.)

TABLE III: IBM 1050 FUNCTION CODES

Symbol	Card Code	Transmission Code B A C 8 4 2 1	Meaning
BY	0-9-4	A 8 4	Bypass
RES	11-9-4	B 8 4	Restore
RS	9-5	8 4 1	Reader Stop
LF	0-9-5	A C 8 4 1	Line Feed
NL*	11-9-5	B C 8 4 1	New Line
HT	12-9-5	B A 8 4 1	Horizontal Tab
UC	9-6	8 4 2	Upper Case
EOB	0-9-6	A C 8 4 2	End of Block
BS	11-9-6	B C 8 4 2	Backspace
LC	12-9-6	B A 8 4 2	Lower Case
EOT	9-7	C 8 4 2 1	End of Transmission
PRE	0-9-7	A 8 4 2 1	Prefix
IL	11-9-7	B 8 4 2 1	Idle
DEL	12-9-7	B A C 8 4 2 1	Delete
Cancel Key		B C	

*The eighth track of the tape is punched with the NL code when the 1050 system has either the Line Correction or Home Correction special feature (or both) installed. This punch is not included in the parity check of the NL character and therefore is not transmitted.

Adapted from IBM 1050 Data Communication System Principles of Operation, Form A24-3474-0, published by IBM.

.36 Operating Procedure

For point-to-point operation, the operator can initiate a connection by dialing another station and verifying that the other station is ready for a period of transmission. If the Master Station Feature is installed, remote components can be automatically polled or addressed. The operator can insert successive message cards; each card contains the receiving unit's address for each message. The optional Pack Feed Feature allows up to 300 cards to be sent without operator attention. Multiple messages can be sent by paper tape without operator attention, once the tape has been initially positioned.

For multistation operation, the keyboard, paper tape reader, or card reader can be used to provide either polling or addressing characters for remote stations. Messages are automatically received following polling. Errors are indicated and require manual intervention according to preset procedures. A special feature allows for two additional attempts to send a message in which an error has been detected.

After addressing for transmission requests, the operator may key the message to the addressed unit. If the message is in a machine-readable form, the paper tape reader or card reader automatically sends the message (one block of indefinite length on paper tape, or one or several cards) to the addressed unit. Pressing the system reset button, when using tape or cards, automatically initiates polling and transmission.

When the 1050 system is connected via communications lines to a computer system, all polling and addressing are controlled by the computer.

.37 Entry of Time and Date: . . . . . no special provision.

.4 OUTPUT

.41 Output to Punched Tape

1055 Paper-Tape Punch -

Tape size: . . . . . chad (fully punched) 1-inch, 8-level paper tape. Chad edge-punched documents (optional feature).

Tape code: . . . . . 6-level PTTC/BCD plus odd parity; see Table II.

Rated punching speed: . . . . . 14.8 or 8.33 char/sec, depending on communication facility.

TABLE IV: UNUSED CODES*

PTTC/BCD Code			Transmission Code	PTTC/EBCD Code		
Symbol	Lower Case Card Code	Upper Case Card Code	B A C 8 4 2 1	Symbol	Lower Case Card Code	Upper Case Card Code
PN	9-4	9-4	C 8 4	PN	9-4	9-4
PF	12-9-4	12-9-4	B A C 8 4	PF	12-9-4	12-9-4
PZ	12-0	8-7	B A C 8 2	Unassigned	12-0	1-8
MZ	11-0	0-8-5	B 8 2	Unassigned	11-0	12-1-8
↕	0-8-2	12-8-7	A 8 2	Unassigned	0-2-8	0-1-8

*These codes serve no assigned function in the 1050 System and are not printable, but are valid data codes.

Adapted from IBM 1050 Data Communication System Principles of Operation, Form A24-3474-0, published by IBM.

.41 Output to Punched Tape (Contd.)

Effective speed: . . . . . depends upon block length.
Format control: . . . . . a hole is punched in level 8 for start of message block, beginning of each data line, error control or manual delete codes (optional features).
Comments: . . . . . power-driven take up reel is available optionally.

.42 Output to Punched Cards

1057 Card Punch;
1058 Printing Card Punch -

Card type and size: . . . . . standard IBM 80-column cards.
Card code: . . . . . standard Hollerith code, or extended Card Code (optional); see Table II.
Rated punching speed: . . . . . 14.8 or 8.33 characters (columns) per second, depending on communication facility.
Effective speed: . . . . . approximately 10 fully-punched cards per minute.
Format control: . . . . . program card.
Comments: . . . . . these units are similar to the IBM Model 24 and 26 keypunches, respectively. The 1058 prints the data at the top of each column under control of the operator or program card.

.44 Output to Printer

1052 Printer Keyboard;
1053 Printer -

Output medium: . . . . . friction-fed forms
pin-fed forms in 12 widths from 5.25 to 13.12 inches (optional).
maximum printed line length is 13 inches.
printing is 10 or 12 characters per inch horizontally and 6 or 8 lines per inch vertically.
fan-fold forms up to 15 inches in width can be fed and stacked.
Character set: . . . . . 88 characters, including upper and lower-case alphabetics, numerics, punctuation, and special characters; see Table II.
Rated printing speed: . . . . . 14.8 or 8.33 char/sec, depending on the communication facility.

(Contd.)

Effective speed:	somewhat below rated speed due to carriage return, line feed, and other operations.
Format control:	controlled by function codes; functions include line feed, carriage return, case shift, backspace, and horizontal tab.
Comments:	printing mechanism is similar to IBM Selectric Typewriter.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors:	no provision for checking.

.52 Data Transmission Errors

Type of checking:	an odd parity bit is attached to each character transmitted and is checked by the receiving terminal. a longitudinal redundancy check character (LRC) is generated for the entire message and is checked by the receiving terminal.
Error indication:	if a parity error occurs, a hyphen character is punched on all receiving tape punches, a hyphen or underscore character (depending on shift status) is typed on all receiving printers, the data check light at the receiving station is turned on, and the receiving station is caused to generate negative answers to the LRC. if LRC characters are unequal, the receiving terminal data-check light is turned on, a hyphen character is sent to the transmitting terminal, and the transmitting device halts.
Correction procedure:	manual intervention. two automatic retransmissions (with optional feature).
Comments:	all error detection is controlled by the 1501 Control Unit.

.53 Data Recording Errors

Type of checking:	no checking.
Comments:	when punching cards, an "X" punch is punched in column 81 to indicate that the data on the card has passed the LRC check.

.55 Line Malfunctions

Type of checking:	optionally monitors for loss of carrier.
Action:	automatic disconnect after 20 to 30 seconds.

.6 CONDITION INDICATORS

The 1052 Printer Keyboard contains all important switches and lamps. If the 1050 station does not include a 1052, the switches and lamps are located in a separate switch unit.

Input device available:	none.
Input device busy:	none.
Remote receiver ready:	lamp (optional).
Remote receiver busy:*	lamp.
Power on:	lamp.
Improper data entry:	none.
Transmission error:	lamp.
Recording error:	none.
Request to send data:	lamp.
Open transmission line:	lamp (optional).

* This condition is recognized by the remote terminal sending a negative response or no response. Except when polling, this is equivalent to an error condition. When polling, and a negative response or no response is received, the polling continues with no indication.

.7 DATA TRANSMISSION

The 1051 Control Unit is the interface between all 1050 system components and a communications data set. Only one component can transmit or receive at a time.

.71 Basic Characteristics

Rated transmission speed:	14.8 char/sec (134.89 bits/sec) on voice-grade lines. 8.33 char/sec (75 bits/sec) on telegraph-grade lines.
Transmission method:	serial by bit.
Transmission code:	IBM Standard Perforated Tape and Transmission Code; see Table II. a total of nine bits, including start, stop, and parity bits, are transmitted for each character.
Transmission mode:	half-duplex.
Order of bit transmission:	B, A, 8, 4, 2, 1, C; see Table II.
Synchronization:	start and stop bits are transmitted with each character.

.72 Connection to Communications Lines

Communication Line	Data Set*
Common-carrier leased telegraph-grade lines (75 bits/sec):	none required.
Bell System Type 1006 Data Channel (150 bits/sec):	Bell System Data Set 103F.
Western Union Class D Data Channel (180 bits/sec):	Western Union 180 Baud Data Modem.
Common carrier leased voice-band line:	Bell System Data Set 103F or Western Union 180 Baud Data Modem.
Public switched telephone network or Bell System TWX CE network:	Bell System Data-Phone Data Set 103A.
Privately-owned voice-band network:	furnished by IBM.

.73 Transmission Control

Call initiation:	manually by operator, or by polling or addressing by master station.
Call reception:	capable of unattended operation.
Functional operations:	16 different function codes can be received from a remote station to perform a variety of functions such as turning punch on, line feed, and carriage return.

.74 Multistation Operation

Polling:	the master station transmits a two-character code specifying a particular station and a specific device. The polled station responds with a negative response or a positive response followed by text. If no response is received within two seconds, polling is continued.

* In some cases equivalent data sets can be used; see your local common-carrier communications consultant.

(Contd.)

polling can be performed manually via the keyboard or automatically via a paper tape reader or card reader. Sequence of polling is determined by the operator via the keyboard or as punched in the paper tape or card.

Addressing: . . . . . the master station sends a station device code to a particular station which will receive the succeeding message.

addressing can be controlled through manual operation of keyboard, by paper tape reader, or card reader. If the addressed station responds positively, message transmission may begin. If the addressed station responds negatively, the next station on the line is addressed; if no response is received, the data check light is turned on.

.8 PHYSICAL SPECIFICATIONS

Component:	1051 Control Unit +	1052 Printer-Keyboard	1053 Printer	1054 Paper-Tape Reader	1055 Paper-Tape Punch	1056 Card Reader	1057 Card Punch	1058 Printing Card Punch
Width (inches)	26	23	23	13.75	15.375	12.5	31	31
Depth (inches)	15	19.75	11.5	13	17.125	15	28	28
Height (inches)	27	9	9	6.375	8.25	27	39	39
Weight (lbs.)	195	65	35	20	26	40	215	215
Power (KVA)	0.375	0.115	0.115	0.115	0.115	0.200	0.420	0.420
Voltage	115 (208/230 optional)							
Frequency (cps)	60							
Phases	1							
Temperature range, °F	50-100	50-100	50-100	50-100	50-100	50-100	50-100	50-100
Humidity range, %	10-80	10-80	10-80	10-80	10-80	10-80	10-80	10-80
Heat (BTU, hr)*	1280	392	392	870	870	690	1433	1433

* Based on maximum usage of optional features.

\+ The 1051 Control Unit supplies power to each component.

.9 PRICE DATA

Component or Feature	Monthly Rental $	Purchase Price $	Monthly Maintenance $
1051 Control Unit			
Model 1	73	3,410	10.00
Model 2	49	2,475	9.75
Model N1	58	2,960	10.50
1051 Special Features			
Line Correction	10	560	0.75
Line Correction Release	2.50	115	0.50
Master Station	15	820	0.50
Home Component Recognition	3	135	0.25
Home Correction	10	560	0.50
Automatic Ribbon Shift and Line Feed Select	3	105	0.25
Reader Stop — Prefix J	5	230	0.50
Auto-Fill Character Generation	2	100	0.25
Audible Alarm	5	230	0.50
Automatic EOB	5	230	0.50
Home Loop Input Component Interlock	2.50	115	0.50
Keyboard Request	5	250	0.75
Telegraph Line Attachment	5	250	0.50
Vertical Forms Control	9	400	2.00
Text Time-Out Suppression	?	?	?
Open Line Detection	5	250	NC
CPU Attachment	10	500	0.75
Switch Unit	3	150	0.25
First Printer Attachment			
Models 1 and 2	10	500	0.50
Model N1	NC	NC	NC
Second Printer Attachment	10	500	0.50
First or Second Punch Attachment	5	275	0.25
First Reader Attachment	10	550	0.25
Second Reader Attachment	5	275	0.25
IBM Line Adapter			
Leased Line	10	400	1.00
Shared Line	20	800	1.25
Limited Distance Type 2	10	450	0.50
1052 Printer-Keyboard	63	2,645	17.00
1053 Printer	49	1,940	10.00
1054 Paper-Tape Reader	29	1,505	4.25
1055 Paper-Tape Punch	39	1,965	6.50
1056 Card Reader			
Model 1	68	3,515	8.00
Pack Feed Feature	5	185	0.50
Model 2 (no provision for Pack Feed Feature)	58	3,030	6.75
1057 Card Punch	73	3,005	18.00
1058 Printing Card Punch			
Model 1	92	3,955	20.00
Model 2	136	4,415	40.00
Programmed Keyboard			
1092 Model 1	44	1,745	2.00
1092 Model 2	49	1,940	4.50
1093 Model 1	39	1,550	1.25
1093 Model 2	44	1,745	3.50
Special Features (all models)			
1051 Attachment	7	280	1.00
Multiple Key Depression	7	280	0.50
Tandem Operation	NC	NC	NC
Telegraph Speed	NC	NC	NC
Data Set Attachment	10	400	3.00

NC — No charge

IBM 7702 MAGNETIC TAPE TRANSMISSION TERMINAL

.1 GENERAL

.11	Identity:	7702 Magnetic Tape Transmission Terminal.
.12	Manufacturer:	International Business Machines Corporation Data Processing Division 112 East Post Road White Plains, New York.
.13	Basic Function:	reads data from magnetic tape and transmits it over voice-band lines; receives transmitted data and records it on magnetic tape.

.15 Description

The IBM 7702 contains a magnetic tape unit which serves as the input or recording medium for transmission or reception of data over voice-band lines. The tape unit uses standard 0.5-inch magnetic tape; the tape format is compatible with IBM 727, 729, and 7330 Magnetic Tape Units at 200-bits-per-inch density.

The 7702 can operate over the public telephone switched network or over common-carrier leased voice-grade lines, using appropriate data sets, or over any equivalent channel with input-output connections conforming to the Electronic Industries Association Standard RS 232.

The transmission speed is selected by the operator and can be 150, 250, or 300 characters per second; these correspond to speeds of 1200, 2000, and 2400 bits per second, respectively.

Synchronization is maintained by the data signals themselves or by idle characters transmitted when no data is being transmitted. The 7702 operates in a half-duplex mode; i.e., data can be transmitted bidirectionally, but in only one direction at a time. Reversal of the direction of data transmission requires synchronization to be established in the reverse direction prior to data transmission. Full-duplex communication facilities can be used to maintain synchronization in both directions at the same time and reduce the turnaround time.

The 7702 is one of the IBM STR (Synchronous Transmit-Receive) terminals and can communicate with other members of this group when set to compatible data rates. The terminals with which a 7702 can communicate include:

- Another 7702.
- An IBM 1013 Card Transmission Terminal.
- An IBM 1401 or 1410 Data Processing System equipped with an IBM 1009 Data Transmission Unit.
- An IBM 7710 or 7711 Data Communication Unit.
- An IBM 7740 Communication Control System.
- An IBM 7750 Programmed Transmission Control.
- An IBM System/360 Data Processing System equipped with an IBM 2701 Data Adapter unit.

.15 Description (Contd.)

Error-control in the 7702 is extensive, including reading checks, transmission checks (character validity and message redundancy), and recording checks. Automatic retransmission is performed when errors are detected.

The 7702 terminal can operate in two self-test modes for testing the reading and recording operations. The test provisions will help in isolating troubles in the 7702, the data set, the communications link, or the remote terminal.

.16 First Delivery: ..... first quarter, 1962.

.17 Availability: ..... unit is no longer in production; availability depends on returns.

.2 CONFIGURATION

The 7702 is composed of a magnetic tape unit and the synchronous transmitter-receiver (STR). See Paragraph .72 for the communications facilities to which the 7702 can be connected and the data sets required.

.3 INPUT

.31 Prepared Input

Input medium:	0.5-inch heavy-duty or Mylar magnetic tape.
Input code:	IBM 55-character or 63-character BCD (even parity) or binary (odd parity); see Table I.
Quantity of data:	1 to N characters.
Character set:	see Table I.
Rated input speed:	150, 250, or 300 char/sec, set by switch.
Effective speed:	depends on transmission speed, length of blocks, and whether over half- or full-duplex facilities. For example, the effective speed for transmission of 1,000-character blocks at the 250 char/sec speed is 225 char/sec over half-duplex facilities and 230 char/sec over full-duplex facilities.

.32 Manual Input: ..... no provision.

.33 Fixed Input: ..... no provision.

.34 Transaction Code Input: ..... no provision.

.35 Message Configuration: ..... a message consists of a start-of-record control code, the data characters, an end-of-record control code, and a check character. The control codes are supplied automatically by the 7702.

.36 Operating Procedure

The operator must make several switch settings to make the 7702 compatible with the remote terminal. These settings can be obtained from a prearranged schedule or by voice communication with the remote operator. The sequence of events involved in use of the 7702 is as follows:

- Set full-duplex/half-duplex switch.

(Contd.)

- Set transmission speed.
- Set binary/BCD switch.
- Load tape; check file-protect light.
- Establish voice connection with remote operator (may not be necessary with leased-line operation).
- Press start key and observe synchronization indicator light and run light.
- No further attention is required when receiving; an audible signal is sounded if an end-of-file (end-of-transmission), end-of-reel, or error condition occurs. When transmitting, the end-of-transmission key must be pressed at the end of the transmission.

A special key, TEL, can be used to signal the remote operator. This is usually used to indicate to the remote operator that voice communication is required, perhaps to check switch settings.

.37 Entry of Time and Date: . . . . . no provisions.

.4 OUTPUT

.41 Output to Punched Tape: . . . . . none.

.42 Output to Punched Cards: . . . . . none.

.43 Output to Magnetic Tape

Tape size:	0.5-inch heavy-duty or Mylar magnetic tape.
Tape code:	IBM 55-character or 63-character BCD (even parity) or binary (odd parity); see Table I.
Rated output speed:	150, 250, or 300 char/sec, set by switch.
Effective speed:	see Paragraph .31.
Format control:	none.

.44 Output to Printer: . . . . . none.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors

Type of checking:	character and longitudinal parity checks.
Error indication:	light, buzzer, and terminal halt if error persists after two automatic retransmissions.
Correction procedure:	press start key to initiate an additional three retransmissions; or press "substitute record key" which causes a special one-character record to be transmitted and all invalid characters within the message to be replaced with a special character code.
Comments:	tape is automatically backspaced for retransmission.

.52 Data Transmission Errors

Type of checking:	character validity and longitudinal parity check upon entire message.
Error indication:	see .51, above.
Correction procedure:	see .51, above.

.53 Data Recording Errors

Type of checking:	read-after-write character and longitudinal parity checks.
Error indication:	see .51, above.
Correction procedure:	see .51, above.

.55 Line Malfunctions: no direct provision for checking.

.6 CONDITION INDICATORS

Input device available:	lamp.
Input device busy:	lamp.
Remote receiver ready:	none.
Remote receiver busy:	none.
Power on:	lamp.
Improper data entry:	lamp and buzzer.
Transmission error:	lamp and buzzer.
Recording error:	lamp and buzzer.
Loss of synchronization:	lamp and buzzer.

Note: There are many additional lamps to permit service personnel to monitor and test the various functions of the 7702.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	150, 250, or 300 char/sec. (operator selectable).
Transmission method:	serial by bit.
Transmission code:	IBM 4-of-8 transmission code; see Table I.
Transmission mode:	half-duplex.
Order of bit transmission:	1, 2, 4, 8, R, O, X, N; see Table I.
Synchronization:	synchronous; i.e., synchronization is maintained by the data signals.

72 Connection to Communications Lines

Communications Line	Data Set*
Public switched telephone network at the following speeds:	
1,200 bits/sec:	Bell System Data-Phone Data Set 202C.
2,000 bits/sec:	Bell System Data-Phone Data Set 201A.
Common-carrier leased voice-band line at the following speeds:	
Up to 1,200 bits/sec:	Bell System Data Set 202C or 202D, or Western Union 1200 Baud Data Modem.
2,000 bits/sec:	Bell System Data Set 201A.
2,400 bits/sec:	Bell System Data Set 201B, or Western Union 2400 Baud Data Modem.

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

(Contd.)

TABLE I. IBM 7702 DATA CODES

Symbol	4 of 8 Tr Code 1 2 4 8 R O X N	Mag Tape Code (BCD) 1 2 4 8 C A B
Space	2 4 8 O	C A
Ø	2 8 R N	2 8
1	1 O X N	1 C
2	2 O X N	2 C
3	1 2 R N	1 2
4	4 O X N	4 C
5	1 4 R N	1 4
6	2 4 R N	2 4
7	1 2 4 R	1 2 4 C
8	8 O X N	8 C
9	1 8 R N	1 8
A	1 R O X	1 C A B
B	2 R O X	2 C A B
C	1 2 O X	1 2 A B
D	4 R O X	4 C A B
E	1 4 O X	1 4 A B
F	2 4 O X	2 4 A B
G	1 2 4 N	1 2 4 C A B
H	8 R O X	8 C A B
I	1 8 O X	1 8 A B
J	1 R X N	1 B
K	2 R X N	2 B
L	1 2 X N	1 2 C B
M	4 R X N	4 B
N	1 4 X N	1 4 C B
O	2 4 X N	2 4 C B
P	1 2 4 X	1 2 4 B
Q	8 R X N	8 B
R	1 8 X N	1 8 C B
S	2 R O N	2 A
T	1 2 O N	1 2 C A
U	4 R O N	4 A
V	1 4 O N	1 4 C A
W	2 4 O N	2 4 C A
X	1 2 4 O	1 2 4 A
Y	8 R O N	8 A
Z	1 8 O N	1 8 C A
/	1 R O N	1 A
# =	1 2 8 R	1 2 8 C
.	1 2 8 N	1 2 8 C A B

Symbol	4 of 8 Tr Code 1 2 4 8 R O X N	Mag Tape Code (BCD) 1 2 4 8 C A B
$	1 2 8 X	1 2 8 B
,	1 2 8 O	1 2 8 A
@ '	4 8 R N	4 8
¤)	4 8 O X	4 8 A B
*	4 8 X N	4 8 C B
% (	4 8 O N	4 8 C A
& +	2 4 8 N	A B
-	2 4 8 X	C B
?	2 8 O X	2 8 A B
!	2 8 X N	2 8 C B
RM ‡	2 8 O N	2 8 C A
GM ‡	1 4 8 N	1 2 4 8 A B
MC △	1 4 8 X	1 2 4 8 C B
SM ###	1 4 8 O	1 2 4 8 C A
WS Y	2 8 R X	1 4 8 A
TM √	1 4 8 R	1 2 4 8
>	2 4 8 R	2 4 8 C ,
< Note 1	2 4 R O	2 4 8 C A B
;	4 8 R O	2 4 8 B
\	2 8 R O	2 4 8 A
: Note 2	1 2 4 8	1 4 8 C
Note 1	2 4 R X	1 4 8 C A B
Note 1	4 8 R X	1 4 8 B
Blank Note 3	R O X N	

Control Character	Emitter Input	Emitter Output	Analyzer Input	Analyzer Output
ACK1 - SOR1	R	1 2 R X	1 2 R X	R N
ACK2 - SOR2	0	1 2 R O	1 2 R O	0 N
Inq - Error	8	1 8 R X	1 8 R X	8 N
Idle		1 8 R O	1 8 R O	
TEL	4	4 8 R X	4 8 R X	4
EOT	X	2 8 R X	2 8 R X	X
CL			1 4 R X	1
TL			1 4 R O	2

Note 1--Valid in binary or expanded BCD only.
Note 2--Transmitted as the substitute character. Invalid if read from tape by a transmitter operating in the normal (unexpanded) BCD mode.
Note 3--Valid in binary only.

Reprinted from IBM 7702 Magnetic Tape Transmission Terminal Reference Manual, Form A22-6702, published by IBM.

.73 Transmission Control

Call initiation: . . . . . manual dialing or signaling.
Call reception: . . . . . operator must establish voice communication and then switch to data mode.
Functional operations: . . . . . none, except request retransmission.

.74 Multistation Operation: . . . . . no provision.

.8 PHYSICAL SPECIFICATIONS

Component	7702 Magnetic Tape Transmission Terminal
Width (inches)	29
Depth (inches)	31
Height (inches)	60
Weight (pounds)	950
Power (KVA)	1.27
Voltage	115 ± 10%
Frequency (Hz)	60 ± 1
Phases	1
Temperature Range (°F)	50-90
Humidity Range (%)	20-80
Heat (BTU/hr)	3,650

.9 PRICE DATA

Component	Monthly Rental $	Purchase Price $
7702 Magnetic Tape Transmission Terminal	1,260	56,260

IBM 7710 DATA COMMUNICATION UNIT

.1 GENERAL

.11 Identity: . . . . . IBM 7710 Data Communication Unit.

.12 Manufacturer: . . . . . International Business Machines Corporation
Data Processing Division
112 East Post Road
White Plains, New York.

.13 Basic Function: . . . . . provides IBM 1401 computer system with transmission and reception facilities via voice-band or broad-band communications facilities.

.15 Description

The IBM 7710 Data Communication Unit is a communications line terminal device which permits an IBM 1401 Data Processing System to communicate with a similarly-equipped 1401 at a remote location or with one of several other types of IBM data terminals. These terminals can be any of the following:

- An IBM 1400 or 7000 Series computer system using an IBM 1009 Data Transmission Unit.
- An IBM 1013 Card Transmission Terminal.
- An IBM 7702 Magnetic Tape Transmission Terminal.
- An IBM 7711 Data Communication Unit.
- An IBM 7740 Communication Control System.
- An IBM System/360 computer system using a 2701 Data Adapter Unit.

The transmission speed can be 150, 250, 300, or 5,100 characters per second. Speeds of 300 characters per second and lower are used over voice-band facilities; the 5,100-characters-per-second speed requires broad-band facilities. Data is transferred in a half-duplex mode. Full-duplex facilities can be used to maintain synchronization in both directions at the same time, thereby reducing the turnaround times when sending control signals.

The 7710 is controlled by the 1401 program. However, the 7710 performs code conversions between the 4-of-8 transmission code and the 1401 BCD code, requests data transfers to and from the 1401, and checks character and message parity. The 1401 contains instructions which control the 7710 and which permit logical branching based on signals from the 7710. These enable the 1401 to service 7710 data requests and error indications, reverse transmission direction, and send control characters to the transmitting 1401/7710. If the remote unit is not a 1401/7710 combination, the operator at the remote unit must manually change transmission direction when required. Automatic retransmission can be performed under program control of the 1401.

To support the use of a 7710 with a 1401 to form a data transmission system, three IBM utility programs are available for customer use:

- 1401-7710 Tape Transmit Program: Provides for transmission of tape data from a 7710-equipped 1401 to a remote terminal.

.15 Description (Contd.)

- 1401-7710 Tape Receive Program: Provides for reception by a 7710-equipped 1401 of data transmitted from a remote terminal.

- 1401-7710 Transmit-Receive Utility Program: Provides the user with a means of controlling data transmission between a 1401 with an attached 7710 and a remote terminal, and performs the following functions:

  (a) Transmitting and receiving of data.

  (b) Integration with the user's operating programs.

  (c) Allowing special-purpose programming with a minimum amount of programming effort.

The 7710 includes provision for self-testing. By switch control, it can receive its own transmission, independently of the communications network. Data for the test can be generated under switch control or can be received from the computer. Several diagnostic programs are available for execution in the 1401 to test the 7710, communications link, and remote terminal.

The 7710 can be connected to IBM computers other than the 1401 on a Request Price Quotation (RPQ) basis. On the same basis, broad-band communications facilities can be used at transmission speeds of up to 28,000 characters per second.

.16 First Delivery: . . . . . third quarter, 1963.

.17 Availability: . . . . . no longer in production; availability depends on returns.

.2 CONFIGURATION

A 7710 can be connected to any IBM 1401 computer system except Models A and G via a Serial Input/Output Adapter in the 1401. Two interfaces are available for connection to communications lines. The RS 232 Interface is required for connection to common-carrier voice-band lines and the High-Speed Digital Interface is required for connection to TELPAK facilities. One interface (either one) is standard; a second interface is optional, permitting alternate transmission over both voice-band and broad-band facilities. Connection to communications facilities requires an appropriate data set; the data set requirements are listed in Paragraph .72.

.3 INPUT

All input to the 7710 is from the connected 1401 computer, under control of the program stored in the 1401. Input to the 1401 can be from punched cards, punched paper tape, magnetic tape, or magnetic disc.

.35 Message Configuration

Data is transferred in blocks under control of the stored program. Message length is limited only by core storage availability in the 1401 system. Each message is preceded and followed by control characters automatically supplied by the 7710.

.36 Operating Procedure

The 7710 is normally initialized only during start-up at the beginning of the day; operation thereafter is under control of the 1401. The start-up procedure is as follows:

(1) Select BCD or binary code.

(2) Set speed. (Contd.

(3) Select half-duplex or full-duplex operation.

(4) Check that terminals are in phase.

(5) Press Start switch; 1401 assumes control of transmissions.

.4 OUTPUT

All output from the 7710 is to the connected 1401 computer, under control of the program stored in the 1401. Output from the 1401 system can be to punched cards, punched paper tape, printed copy, magnetic tape, or magnetic disc files.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors

Type of checking:	character parity is checked on the data transferred from the 1401 to the 7710.
Error indication:	light and signal to the 1401.
Correction procedure:	as programmed in the 1401; usually retransfer of data character to the 7710.

.52 Data Transmission Errors

Type of checking:	character validity and longitudinal parity checks.
Error indication:	light and signal to the 1401.
Correction procedure:	as programmed in the 1401; usually retransmission of an entire record.

.53 Data Recording Errors

Type of checking:	the 1401 checks character parity of data transferred to the 1401 by the 7710.
Error indication:	light and error signal to the 7710, causing an error control signal to be transmitted to the remote terminal.
Correction procedure:	as programmed in the 1401; usually retransmission of an entire record.

.55 Line Malfunctions

Detection:	loss of synchronization (lamp), continuous retransmission attempts.
Action:	call service personnel.

.6 CONDITION INDICATORS

Input device available:	lamp.
Input device busy:	lamps.
Remote receiver ready:	no direct indicator.
Remote receiver busy:	no direct indicator.
Power on:	lamp.
Transmission error:	lamp, audible alarm.
Recording error:	lamp, audible alarm.
End of transmission:	lamp, audible alarm.
Computer connected and on:	lamp.
Data set ready:	lamp.
Loss of synchronization:	lamp, audible alarm.
Computer error:	lamp, audible alarm.
Computer program not compatible with record received:	lamp.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed: . . . . . 150, 250, or 300 char/sec over voice-band lines. 5,100 char/sec over broad-band facilities.
Transmission method: . . . . . serial by bit.
Transmission code: . . . . . IBM 4-of-8 code; see Table I.
Transmission mode: . . . . . half-duplex.
Order of bit transmission: . . . . . 1, 2, 4, 8, R, O, X, N; see Table I.
Synchronization: . . . . . synchronous; i.e., synchronization is maintained by the data signals.

.72 Connection to Communications Lines

Communications Line	Data Set*
Public switched telephone network at the following speeds:	
1,200 bits/sec (150 char/sec):	Bell System Data-Phone Data Set 202C or 202D.
2,000 bits/sec (250 char/sec):	Bell System Data-Phone Data Set 201A.
Common-carrier leased voice-band line at the following speeds:	
1,200 bits/sec (150 char/sec):	Bell System Data Set 202C or 202D, or Western Union 1200 Baud Data Modem.
2,000 bits/sec (250 char/sec):	Bell System Data Set 201A.
2,400 bits/sec (300 char/sec):	Bell System Data Set 201B, or Western Union 2400 Baud Data Modem.
Telpak A at 40,800 bits/sec (5,100 char/sec):	**

.73 Transmission Control

Call initiation: . . . . . manual dialing or signaling.
Call reception: . . . . . capable of unattended operation.
Functional operations: . . . . . no direct control; however, incoming data can be used to control operations through appropriate programming.

.74 Multistation Operation: . . . . . no provision.

.8 PHYSICAL SPECIFICATIONS

Component:	7710
Width (inches)	38
Depth (inches)	32
Height (inches)	70
Weight (pounds)	500
Power (KVA)	0.7
Voltage	208/230
Frequency (cps)	60
Phases	1
Temperature Range (°F.)	60-90
Humidity Range (%)	20-80
Heat (BTU/hr)	1,650

* In some cases, equivalent data sets can be used; see your local common-carrier communications consultant.

** Connection to Telpak A service requires a Telpak Channel Terminal A2, which includes a data set.

(Contd.)

TABLE I. IBM 7710 DATA CODES

Symbol	Transmission Code 1	2	4	8	R	O	X	N	Magnetic Tape Code 1	2	4	8	C	A	B
Space (Note 1)		2	4	8		O								A	
0		2		8	R			N		2		8	C		
1	1					O	X	N	1						
2		2				O	X	N		2					
3	1	2			R			N	1	2			C		
4			4			O	X	N			4				
5	1		4		R			N	1		4		C		
6		2	4		R			N		2	4		C		
7	1	2	4		R				1	2	4				
8				8		O	X	N				8			
9	1			8	R			N	1			8	C		
A	1				R	O	X		1					A	B
B		2			R	O	X			2				A	B
C	1	2				O	X		1	2			C	A	B
D			4		R	O	X				4			A	B
E	1		4			O	X		1		4		C	A	B
F		2	4			O	X			2	4		C	A	B
G	1	2	4					N	1	2	4			A	B
H				8	R	O	X					8		A	B
I	1			8		O	X		1			8	C	A	B
J	1				R		X	N	1				C		B
K		2			R		X	N		2			C		B
L	1	2					X	N	1	2					B
M			4		R		X	N			4		C		B
N	1		4				X	N	1		4				B
O		2	4				X	N		2	4				B
P	1	2	4				X		1	2	4		C		B
Q				8	R		X	N				8	C		B
R	1			8			X	N	1			8			B
S		2			R	O		N		2			C	A	
T	1	2				O		N	1	2				A	
U			4		R	O		N			4		C	A	
V	1		4			O		N	1		4			A	
W		2	4			O		N		2	4			A	
X	1	2	4			O			1	2	4		C	A	
Y				8	R	O		N				8	C	A	
Z	1			8		O		N	1			8		A	
/	1				R	O		N	1				C	A	
#	1	2		8	R				1	2		8			
$	1	2		8			X		1	2		8	C		B
,	1	2		8		O			1	2		8	C	A	
@			4	8	R			N			4	8	C		
¤			*4	8		O	X				4	8	C	A	B
*			4	8			X	N			4	8			B
%			4	8		O		N			4	8		A	

Symbol	Transmission Code 1	2	4	8	R	O	X	N	Magnetic Tape Code 1	2	4	8	C	A	B
&		2	4	8				N					C	A	B
—		2	4	8			X								B
ō		2		8		O	X			2		8	C	A	B
0̄		2		8			X	N		2		8			B
Record Mark		2		8		O		N		2		8		A	
Group Mark	1		4	8				N	1	2	4	8	C	A	B
Delta	1		4	8			X		1	2	4	8			B
Segment Mark	1		4	8		O			1	2	4	8		A	
Word Separator		2		8	R		X		1		4	8	C	A	
Tape Mark	1		4	8	R				1	2	4	8	C		
>		2	4	8	R					2	4	8			
<		2	4		R	O				2	4	8		A	B
;			4	8	R	O				2	4	8	C		B
'		2		8	R	O				2	4	8	C	A	
:	1	2	4	8					1		4	8			
(		2	4		R		X		1		4	8		A	B
)			4	8	R		X		1		4	8	C		B
Blank (Note 1)					R	O	X	N					C		

Transmission Control Code Combinations (Note 2)

Idle	1		8	R	O
Error-Inquiry	1		8	R		X
Trans-Leader	1	4		R	O
Cont-Leader	1	4		R		X
SOR-1/ACK-1	1	2		R		X
SOR-2/ACK-2	1	2		R	O	

Note 1: A set-up switch alters the code to correct the coding discrepancy of 1400-series machines as follows:

a. The binary mode is not affected.
b. In the BCD mode, the code for "space" is changed to the C-bit instead of the A-bit. The A-bit code is then treated as a non-valid code combination instead of the C code.

Note 2: These code combinations are used exclusively for exchange of control instruction across the communication channel and never appear at the computer interface.

Reprinted from IBM 7710 Data Communication Unit Principles of Operation, p. 6, Form A22-6776, published by IBM.

.9 PRICE DATA

Component or Feature	Monthly Rental $	Purchase Price $
7710 Data Communication Unit	1,575	No longer in production; not possible to purchase
Dual Communications Interface	20	
Internal Clock*	145	

* This feature is required when 7710 is used with a data set that does not provide clocking pulses.

IBM 7711 DATA COMMUNICATION UNIT

.1 GENERAL

.11 Identity: . . . . . IBM 7711 Data Communication Unit.

.12 Manufacturer: . . . . . International Business Machines Corporation
Data Processing Division
112 East Post Road
White Plains, New York.

.13 Basic Function: . . . . . reads magnetic tape and transmits data over voice-band or broad-band communications facilities.
receives data from communications lines and records it on magnetic tape.

.15 Description:

The IBM 7711 Data Communication Unit is a communications line terminal device which permits transmission and reception of magnetic tape data, independent of computer control. It can be connected to one IBM 729 or 7330 Magnetic Tape Unit, and provides transmission rates of 150, 250, or 300 characters per second over voice-band lines, or up to 28,800 characters per second (230,400 bits per second) over leased broad-band communications services. Data transmission is in a half-duplex mode. Full-duplex lines can be used to maintain synchronization in both directions at once; this reduces the turnaround time when reversing the direction of transmission.

The remote terminals with which a 7711 can communicate include:

- An IBM 1400 or 7000 Series computer system using a 1009 Data Transmission Unit.
- An IBM System/360 computer system using a 2701 Data Adapter Unit.
- An IBM 1013 Card Transmission Terminal.
- An IBM 7701 or 7702 Magnetic Tape Transmission Terminal.
- An IBM 7710 Data Communication Unit.
- An IBM 7740 Communication Control System.
- An IBM 7750 Programmed Transmission Terminal.
- Another IBM 7711.

This compatibility permits tape-to-computer, tape-to-tape, or tape-to-card communications.

The 7711 reads data from the magnetic tape unit, record by record, into its core storage buffer. Records can be variable in length, up to the capacity of the buffer, and can be intermixed BCD and binary. The standard buffer size is 200 characters, and options provide for buffer sizes of 400, 800, 1200, or 2400 characters. To increase transmission efficiency, the buffer is loaded from the tape unit while the 7711 waits for verification of correct transmission of the previous record.

Tape units available for use with the 7711 Data Communication Unit are the IBM 729 II and IV and the IBM 7330. With an extra-cost option, the IBM 729 V or VI units can be used. The

.15 Description (Contd.)

recording density of the tape at a transmitting 7711 terminal can be 200, 556, or (on the 729 V or VI) 800 bits per inch. The tape at a receiving 7711 terminal can be recorded at 200, 556, or (on the 729 V or VI) 800 bits per inch, as selected by the operator. Different densities can be used at the transmitting and receiving terminals if desired. One tape unit can be connected to a 7711 terminal and switched manually to an on-line computer near the 7711.

The 7711 provides tape character parity checking, 4-of-8 transmission code validity checking of the transmitted characters, longitudinal redundancy checking, and automatic refilling or message retransmission when errors are detected.

.16 First Delivery: . . . . . third quarter, 1964.

.17 Availability: . . . . . 9 months.

.2 CONFIGURATION

A data communications terminal using a 7711 Data Communication Unit consists of the following components:

- An IBM 7711 Data Communication Unit with either an RS 232 Interface for voice-band lines or a Digital Interface for broadband lines. One interface is standard; the Dual Interface optional feature permits both interfaces to be included and selected under operator control.
- One IBM 729 Model II, IV, V, or VI Magnetic Tape Unit or one IBM 7330 Magnetic Tape Unit. Use of a 729 Model V or Model VI requires an optional feature.
- An appropriate data set, depending on the particular communications facility to be used. See Paragraph .72 for the usable communications facilities and the required data sets.

.3 INPUT

.31 Prepared Input

IBM 729 or 7330 Magnetic Tape Unit —

Input medium:	0.5-inch, IBM 729-compatible tape.
Input code:	BCD (even parity) or binary (odd parity).
Quantity of data:	variable block size up to 200, 400, 800, 1,200, or 2,400 characters, depending on size of buffer.
Rated input speed:	7,200 char/sec to 90,000 char/sec, depending on tape unit model and recording density.
Effective speed:	somewhat less than transmission speed; see Paragraph .71.

.32 Manual Input: . . . . . no provision.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration: . . . . . up to 2,400 data characters, depending on buffer size, preceded and followed by control codes automatically supplied by the 7711.

.36 Operating Procedure

- Mount tape reels.
- Set tape density switch.
- Set speed.
- Set parity (even or odd).
- Select half-duplex or full-duplex operation.
- Establish connection by manual dialing or signaling.
- Check that terminals are in phase (Ready light on).
- Press Start switch.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.43 Output to Magnetic Tape

IBM 729 or 7330 Magnetic Tape Unit —

Tape size:	0.5-inch, IBM 729-compatible.
Tape code:	IBM BCD (even parity) or binary (odd parity).
Rated output speed:	7,200 char/sec to 90,000 char/sec, depending on tape unit model and recording density.
Effective speed:	somewhat less than transmission speed; see Paragraph .71.
Format control:	none.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors

Type of checking:	character parity and longitudinal parity.
Error indication:	light.
Correction procedure:	automatic backspace and reread before transmission.

.52 Data Transmission Errors

Type of checking:	character validity and longitudinal parity.
Error indication:	light.
Correction procedure:	automatic retransmission of record.

.53 Data Recording Errors

Type of checking:	read-after-write check of character and longitudinal parity.
Error indication:	light.
Correction procedure:	automatic retransmission of record.

.55 Line Malfunctions

Detection:	loss of synchronization (lamp); continuous retransmission attempts.
Action:	call service personnel.

.6 CONDITION INDICATORS

Input device available:	lamp.
Input device busy:	lamp.
Remote receiver ready:	lamp.
Remote receiver busy:	lamp.
Power on:	lamp.
Improper data entry:	lamp.
Transmission error:	lamp.
Recording error:	lamp.
Half-duplex/full-duplex:	lamp.
Recording density:	lamps.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	150, 250, or 300 char/sec over voice-band lines. 5,100 char/sec over broad-band facilities.
Transmission method:	serial by bit.
Transmission code:	IBM 4-of-8 code; see Table I in the report on the IBM 7710 Communication Unit, page 6451:05.
Transmission mode:	half-duplex.
Order of bit transmission:	1, 2, 4, 8, R, O, X, N.
Synchronization:	synchronous; i.e., synchronization is maintained by the data signals.

.72 Connection to Communications Lines

Communications Line	Data Set*
Public switched telephone networks at the following speeds:	
1,200 bits/sec (150 char/sec):	Bell System Data-Phone Data Set 202C or 202D.
2,000 bits/sec (250 char/sec):	Bell System Data-Phone Data Set 201A.
Common-carrier leased voice-band line at the following speeds:	
1,200 bits/sec (150 char/sec):	Bell System Data Set 202C or 202D, or Western Union 1200 Baud Data Modem.
2,000 bits/sec (250 char/sec):	Bell System Data Set 201A.
2,100 bits/sec (300 char/sec):	Bell System Data Set 201B, or Western Union 2400 Baud Data Modem.
Telpak A at 40,800 bits/sec (5,100 char/sec):	(1).
Telpak C at 230,400 bits/sec (28,800 char/sec):	(2).

*In some cases, equipment data sets can be used; see your local common-carrier communications consultants.

(1) Connection to Telpak A requires a Telpak Channel Terminal A2, which includes a data set.

(2) Connection to Telpak C requires a Telpak Channel Terminal C3, which includes a data set.

(Contd.)

.73 Transmission Control

Call initiation: . . . . . manual dialing or signaling.
Call reception: . . . . . operator must establish voice communication and then switch to data mode.

.74 Multistation Operation: . . . . . no provision.

.8 PHYSICAL SPECIFICATIONS

Component	7711
Width (inches)	29
Depth (inches)	30.6
Height (inches)	58
Weight (pounds)	800
Power (KVA)	2.5
Voltage	208 or 230
Frequency (Hz)	60
Phases	1
Temperature Range (°F)	60-90
Humidity Range (%)	8-80
Heat (BTU/hr)	3,600

.9 PRICE DATA

Compoment or Feature	Monthly Rental $	Purchase Price $	Monthly Maintenance $
7711 Data Communication Unit	1,065	46,755	47
Buffer positions 201-400	20	900	NC
Buffer positions 401-800	39	1,745	NC
Buffer positions 801-1200	68	3,055	NC
Buffer positions 1201-2400	116	5,240	NC
Dual Communications Interface	20	925	NC
Internal Clock	25	1,150	NC
729 V/VI Attachment	10	400	NC
729 II Magnetic Tape Unit	680	34,920	99
729 IV Magnetic Tape Unit	875	40,010	109
729 V Magnetic Tape Unit	725	36,085	103
729 VI Magnetic Tape Unit	920	41,175	114
7330 Magnetic Tape Unit	435	21,340	58

NC — No charge

IBM 2712 REMOTE MULTIPLEXOR

.1 GENERAL

.11 Identity: ..... 2712 Remote Multiplexor, Model 1 and Model 2.

.12 Manufacturer: ..... International Business Machines Corp.
Data Processing Division
112 East Post Road
White Plains, New York

.13 Basic Function: ..... multiplex multiple low-speed data transmissions onto a single voice-band line.

.14 Basic Components

Name: ..... 2712 Remote Multiplexor.
Model number: ..... 1.
Function: ..... multiplex data from up to 10 lines operating at 134.5 bits/sec over a single voice-band line.

Name: ..... 2712 Remote Multiplexor.
Model number: ..... 2.
Function: ..... multiplex data from up to 14 lines operating at 74.2 bits/sec over a single voice-band line.

.15 Description

The IBM 2712 Remote Multiplexor is intended to provide economies in communications line costs by permitting messages from multiple low-speed lines to be transmitted simultaneously over a single voice-band line. The low-speed lines are terminated at the 2712 by data sets, IBM line adapters, or relays in the normal manner. When transmitting, the 2712 selects one bit from each low-speed line during each scan cycle, adds a sync bit, and transmits these bits as a word. When receiving, the 2712 divides each word from the remote station into individual bits and distributes each bit to the appropriate low-speed line. The 2712 can transmit and receive data simultaneously; i.e., full-duplex operation is possible.

The 2712's primary purpose is to concentrate data transmission between a low-speed network and an IBM System/360 computer. The 2712 communicates with the computer via a 2702 or 2703 Transmission Control (see Reports 8443 and 8444). The 2712 has no effect on the programming of the computer; as far as the programmer is concerned, communications over each low-speed line are handled as if the line were connected directly to the Transmission Control.

Two models of the 2712 Remote Multiplexor are available. Model 1 can handle up to 10 narrow-band lines from IBM terminals operating at 134.5 bits per second. Model 2 can handle up to 14 telegraph-grade lines operating at 74.2 bits per second.

.16 First Delivery: ..... July 1966.

.17 Availability: ..... 12 months.

.2 CONFIGURATION

The 2712 Model 1 requires, in addition to the basic unit, a line adapter for each line terminated on the low-speed side and a data set for the single voice-band line terminated on the high-speed side. Three line adapters are available:

- Data Set Line Adapter — Provides for connection of a narrow-band line terminated by a common-carrier data set; see Paragraph .72.
- IBM Line Adapter — Provides for direct cable connection of an IBM 1050 station located not more than 40 feet away.
- IBM Limited Distance Line Adapter — Type 1 — Provides for communication with IBM terminals located not more than 4.75 miles away, via a privately-owned 4-wire transmission line.

.2 CONFIGURATION (Contd.)

Any combination of these adapters that does not include more than one cable-connected IBM Line Adapter, nor more than 10 adapters total, can be used.

The 2712 Model 2 requires, in addition to the basic unit, one Telegraph Line Adapter for each pair of telegraph lines terminated on the low-speed side and a data set for the single voice-band line terminated on the high-speed side.

To allow servicing and testing to be performed, IBM requires that the 2712 Remote Multiplexor be installed within sight (40 feet) of one of the terminal devices in the network.

See Paragraph .72 for the standard communications facilities that can be used and the data sets required, if any.

.3	INPUT:	input to the 2712 is the data transmitted over a group of low-speed lines; the 2712 multiplexes this data for transmission over a single voice-band line.
.4	OUTPUT:	output from the 2712 is the data it transmits to a group of low-speed lines; the 2712 receives this data, in multiplexed form, over a single voice-band line and distributes the individual bits to the appropriate low-speed lines.
.5	ERROR DETECTION AND CORRECTION:	no provisions for checking.

.6 CONDITION INDICATORS

Power on:	lamp.
Out of synchronization:	lamp.
Not connected to output line:	lamp.
CE mode (test):	lamp.

.7 DATA TRANSMISSION

At the present time, the 2712 Remote Multiplexor can only communicate, on the high-speed side, with an IBM System/360 computer via a 2702 or 2703 Transmission Control Unit equipped with the appropriate features (see Reports 8443 and 8444).

When transmitting to a remote System/360 computer, one bit is taken from each low-speed line during each scan cycle. The data bits and one sync bit per cycle are formed into a word which is transmitted over a voice-band line. When receiving data from the remote computer, the word is broken down into individual bits which are distributed to the appropriate low-speed terminals.

The word length for Model 1 is 11 bits (10 data bits and 1 sync bit), and the word length for Model 2 is 15 bits (14 data bits and 1 sync bit).

The 2712 Remote Multiplexor can handle data flow in both directions simultaneously, i.e., full-duplex operation.

.71 Basic Characteristics

Rated transmission speed —	
High-speed side —	
Model 1:	1,526 bits/sec.
Model 2:	1,113 bits/sec.
Low-speed side (each line) —	
Model 1:	134.5 bits/sec.
Model 2:	74.2 bits/sec.
Transmission method:	serial by bit.
Transmission code —	
Model 1:	11 bits/word.
Model 2:	15 bits/word.

(Contd.)

Transmission mode: . . . . . full-duplex.
Synchronization —
High-speed side: . . . . . synchronous (one sync bit is added to each word transmitted).
Low-speed side: . . . . . start/stop.

.72 Connection to Communications Lines

Communications Line	Data Set*
Low-speed side	
Model 1 —	
Bell System Schedule 3A or 4 Data Channels:	Bell System Data Set 103F.
Western Union Class D Data Channels:	Western Union 180 Baud Data Modem.
Model 2 —	
Common-carrier leased telegraph-grade lines:	none required.
High-speed side (Both models)	
Bell System Schedule 4, Type 4A or Type 4B leased Data Channel**:	Bell System Data Set 202D.

.73 Transmission Control: . . . . . the 2712 is a completely passive element in a communications network; it contains no facilities for transmission control.

.74 Multistation Operation: . . . . . no provision.

.8 PHYSICAL SPECIFICATIONS

Component	2712 Remote Multiplexor
Width (inches)	43
Depth (inches)	24
Height (inches)	29
Weight (pounds)	Approx. 400
Power (KVA)	0.5
Voltage	115
Frequency (cps)	60
Phases	1
Temperature range (°F.)	50 to 110
Humidity Range (%)	10 to 80
Heat (BTU/hr)	1,500

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant. See also Paragraph .2, Configuration.

** Full-duplex Type 4A line is required for 2712 Model 2; full-duplex Type 4B line is required for Model 1.

.9 PRICE DATA

Component or Feature	Monthly Rental* $	Purchase Price $	Monthly Maintenance $
2712 Remote Multiplexor:			
Model 1	460	20,080	28.75
Model 2	495	21,605	30.25
Data Set Line Adapter	10	450	0.75
IBM Line Adapter (for connecting a nearby IBM 1050 station)	10	450	0.75
IBM Limited Distance Line Adapter — Type 1	13	585	1.00
Telegraph Line Adapter (provides for connecting two telegraph-grade lines to a 2712 Model 2)	40	1,750	1.75

* Monthly rentals are shown for 24-hour usage.

REPORT UPDATE

IBM 2740 MODEL 2

IBM has introduced a buffered 2740 Communication Terminal, which is designated the Model 2; the previous unbuffered 2740 has been continued with no changes, and is designated the Model 1. Other than the differences stated in this Report Update, the buffered 2740 Model 2 is identical to the unbuffered Model 1.

The 2740 Model 2 can communicate only with a remote System/360 computer equipped with a 2701 Data Adapter Unit or a 2702 or 2703 Transmission Control (see Reports 8442, 8443, and 8444) and only over a leased or privately owned communications facility.

The basic 2740 Model 2 is equipped with a 120-character core buffer. Data entered from the keyboard is stored in the buffer, which allows the typed copy to be visually verified prior to transmission. Received messages are transferred directly to the printer and are not stored.

Optional features include:

- Buffer Expansion — one or two expansion modules can be added to increase the basic buffer capacity to 248 or 440 character positions.
- Buffer Receive — permits received messages to be stored in the core buffer prior to printing; the contents of the buffer is printed when an EOT control character is received.
- Document Insertion — permits single-part ledger cards to be inserted in front of the typewriter platen without using the platen knobs. Manual positioning is required for each new print line; the top 1-1/3 inch and the bottom 1 inch cannot be used for printing. A pin-feed platen cannot be used with this option. The Document Insertion option can be obtained for handling two widths of ledger cards: six or 7-3/8 inches. Either width can be up to five inches long. The positioning of the ledger cards is such that a short space is available ahead of the ledger card for printing on a form carried in the regular carriage. A space 2.5 inches long is provided with the narrower card (6-inch width), and a space 5.5 inches long is provided for the wider card (7-3/8-inch width).
- Edit — provides two additional keys: Line Return and Line Type, to be used for keyboard editing of incorrectly entered data prior to transmission.
- Header Control — permits message header information to be entered from the keyboard and stored in increments of four characters up to a total of 28 characters. The header is stored beginning with the first character position of the buffer. The header is transmitted with each message and can be verified prior to a transmission. Header length must be pre-designated.
- 600 BPS Speed Base — provides data transmission at 600 bits per second (66.7 char/sec) over leased or privately owned facilities. The peak printer rate remains at 14.8 characters per second.
- Telegraph Line Attachment — provides data transmission at 75 bits per second (8.33 characters per second) over a leased telegraph-grade line. The print rate remains at 14.8 characters per second if Buffer Receive option is incorporated. This option cannot be used if the 2740 is connected to an IBM 2712 Remote Multiplexor.
- Split Friction Feed Platen — provides a two-section platen; printing line length is 5-1/2 inches on left side, 7-1/2 inches on right. When this option is included with the Document Insertion option, two separate forms, in addition to a ledger card, can be inserted and individually controlled. Document Insertion and six-lines-per-inch vertical spacing are prerequisite to this option.

Some options available for the Model 1 are not available for the Model 2; see Paragraph .9.

IBM 2750 MODEL 2 PRICES

The price data on page 6454:08 has been updated to reflect current prices and features included with the IBM 2740 Communication Terminal, Models 1 and 2.

IBM 2740 COMMUNICATION TERMINAL

.1 GENERAL

.11 Identity: . . . . . 2740 Communication Terminal.

.12 Manufacturer: . . . . . International Business Machines Corp.
Data Processing Division
112 East Post Road
White Plains, New York.

.13 Basic Function: . . . . . two-way typed-message data communication at 14.8 char/sec over narrow-band or voice-band communications facilities.

.15 Description

The IBM 2740 Communication Terminal is an adaptation of the IBM Selectric Typewriter designed to provide half-duplex typed-message data communications at 14.8 characters per second (134.5 bits per second) over a privately-owned or leased common-carrier narrow-band or voice-band line, or the public telephone network.

The 2740 can communicate with other 2740 terminals or with a remote IBM System/360 computer equipped with a 2701 Data Adapter Unit or a 2702 or 2703 Transmission Control (see Reports 8442, 8443, and 8444). An optional feature provides a 2740 terminal with the capability to respond to polling or selective addressing messages transmitted from the System/360 computer.

The 2740 can operate in either a "communicate" mode for data communications or in a "local" mode for local typing functions. The printing mechanism of the 2740 utilizes an interchangeable "type ball" similar to those used in IBM Selectric Typewriters.

Three different transmission codes and corresponding keyboards can be selected for use with the IBM 2740 Terminal; see Figure 2 and Tables I, II, and III. The Standard Selectric Typewriter code and keyboard permit the use of Selectric typewriter type-balls, but there are differences in the selection of special symbols among the many type-balls offered. The Paper Tape EBCD and BCD Transmission codes are compatible except for punctuation marks and special symbols. These two codes are not compatible with the Standard Selectric Typewriter Codes. IBM emphasizes that any network employing multiple 2740 or 2741 (see Report 6455) Communication Terminals should use the same keyboard and code for all units. If a System/360 computer were included in the 2740 Terminal network, the computer could perform code translations to iron out terminal code compatibility problems, but only at the cost of extra programming and processing time.

Optional features that are available for the 2740 Communication Terminal include:

- Record Checking — Provides for automatic generation and checking of character and message parity. A switch is provided to enable or disable the checking feature.
- Automatic EOB — Provides for transmitting an End-of-Block (EOB) code and message parity character after each line is typed and the carriage is returned. This feature is available only with the Record Checking feature; it provides message parity checking on a line-by-line basis instead of on the whole transmission.
- Dial Up — Permits the 2740 to be connected to the public telephone network via a common-carrier data set.
- Station Control — Provides the 2740 terminal with the capability to recognize and respond to special addressing and control signals transmitted from a System/360 computer. Inclusion of the Station Control feature excludes the Dial Up feature.
- Transmit Control — Allows a remote computer to control the transmit/receive status of a 2740 terminal if operation is over the public telephone network. The Dial Up feature is required for installation of the Transmit Control feature.

Figure 1. IBM 2740 Communication Terminal

.15 Description (Contd.)

- Pin-Feed Platen — Allows sprocketed forms to be used and fed; provides more precise control over vertical positioning and alignment of printing, which could be important if preprinted forms are used.

The 2740 Communication Terminal is connected to a communications line via either a common-carrier data set or an IBM line adapter. Four different IBM line adpaters are available for various types of communications lines. These include:

- Limited Distance Line Adapter Type 1 — For use with a two-wire or four-wire privately-owned or leased common-carrier line not exceeding 4.75 wire-miles in length. The four-wire version of the adapter can be used to communicate with the IBM 2712 Remote Multiplexor.
- IBM Limited Distance Line Adapter Type 2 — For use with a two-wire privately-owned or leased common-carrier line not exceeding 8.0 wire-miles in length.
- IBM Leased Line Adapter — For use with a privately-owned or leased common-carrier voice-band line.
- IBM Shared Line Adapter — Provides the capability for transmitting over a subchannel of a voice-band line; up to four subchannels can be "derived" from a single line. Different models utilize different subchannels. The remote station must be equipped with a similar modem, and only terminals on the same subchannel can communicate with one another.

.16 First Delivery: . . . . . December 1965.

.17 Availability: . . . . . 12 months.

.2 CONFIGURATION

A 2740 Communication Terminal consists of a manual input keyboard, a printing component, special features as desired, and a common-carrier data set or IBM Line Adapter, depending on the tranmission facility employed. See Paragraph .72 for the standard communications facilities that can be used and the data set required.

(Contd.)

TABLE I: IBM STANDARD SELECTRIC TYEPWRITER CODE

	BIT VALUE							
LOWER CASE	B	A	C	B	4	2	1	UPPER CASE
,	B		C			2		;
.	B	A	C		4		1	:
/	B	A			4	2	1	'
'	B		C		4			"
↑		C						¢
+	B	A				2		+
-	B	A		B		2	1	-
×	B	A		B				?
1/2							1	¾/£
2						2		"
3			C			2	1	#
4				B				$
5					4			%
6			C		4	2		¢
7			C		4		1	&
8					4	2	1	*
9				B		2	1	(
0			C	B			1	)
a	B		C		4	2	1	A
b		A	C	B		2	1	B
c		A	C		4	2	1	C
d		A			4		1	D
e		A	C		4			E
f	B	A	C			2	1	F
g	B	A					1	G
h		A		B			1	H
i	B				4	2		I
j	B	A	C					J
k		A			4	2		K
l		A	C	B				L
m	B		C				1	M
n		A	C			2		N
o	B		C	B				O
p	B	A			4			P
q	B	A	C		4	2		Q
r	B				4		1	R
s	B			B			1	S
t		A						T
u		A				2	1	U
v	B					2	1	V
w	B		C	B		2	1	W
x		A	C				1	X
y	B	A	C	B			1	Y
z			C	B		2		Z

THE CODES BELOW ARE NOT PRINTABLE								
FUNCTION CODES								MEANING
PN			C	B	4			Punch On
BY		A		B	4			Bypass
RES	B			B	4			Restore
PF	B	A	C	B	4			Punch Off
RS				B	4		1	Reader Stop
LF		A	C	B	4		1	Line Feed
NL	B		C	B	4		1	New Line (Carrier Return and Line Feed)
HT	B	A		B	4		1	Horizontal Tab
UC				B	4	2		Upper Case
EOB		A	C	B	4	2		End of Block
BS	B		C	B	4	2		Backspace
LC	B	A		B	4	2		Lower Case
EOT			C	B	4	2	1	End of Transmission
PRE		A		B	4	2	1	Prefix
IL	B			B	4	2	1	Idle
DEL	B	A	C	B	4	2	1	Delete
Ⓓ			C		4	2		Bid
Space			C					Space

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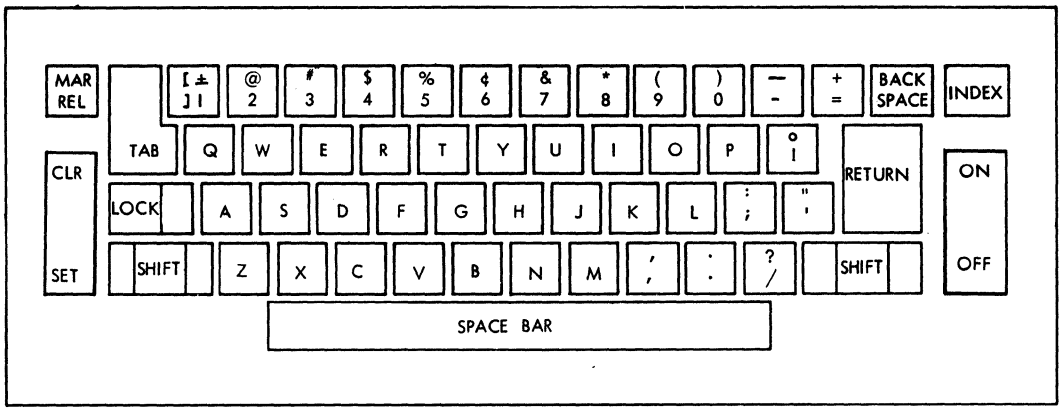

Figure 2. Keyboard used with Standard Selectric Typewriter code (see Table I). Keyboards used with the other codes vary in the selection of punctuation marks and special symbols and their locations.

* Ⓓ transmission control code used by the 2741.

TABLE II: IBM PAPER TAPE TRANSMISSION CODE/BCD

LOWER CASE CHARACTER SET				Bit Value								UPPER CASE CHARACTER SET			
Std	A	H	Typ.	B	A	C	8	4	2	1		Std.	A	H	Typ.
.				B			8		2	1		.			
$			;	B	A		8		2	1		!			;
					A	C	8		2	1					
* '	=		,				8		2	1		‡	##		"
@	:		1/2		A							¢	▲		1/4
&	+		=	B	A	C						+	<		+
	-			B								—	\		—
	/				A	C					1		?		
											1	=	>		±
	2								2			o	)		@
	3					C			2	1			;		#
	4							4				:	$		$
	5					C		4			1	%		(	%
	6					C		4	2			'			¢
	7							4	2	1		"			&
	8						8						*		
	9					C	8			1		(	(		(
	0					C	8		2			)	)		)
	a			B	A					1			A		
	b			B	A				2				B		
	c			B	A	C			2	1			C		
	d			B	A			4					D		
	e			B	A	C		4			1		E		
	f			B	A	C		4	2				F		
	g			B	A			4	2	1			G		
	h			B	A		8						H		
	i			B	A	C	8			1			I		
	j			B		C				1			J		
	k			b		C			2				K		
	l			B					2	1			L		
	m			B		C		4					M		
	n			B				4			1		N		
	o			B				4	2				O		
	p			B		C		4	2	1			P		
	q			B		C	8						Q		
	r			B			8			1			R		
	s				A	C			2				S		
	t				A				2	1			T		
	u				A	C		4					U		
	v				A			4			1		V		
	w				A			4	2				W		
	x				A	C		4	2	1			X		
	y				A	C	8						Y		
	z				A		8			1			Z		

THE CODES BELOW ARE NOT PRINTABLE												
FUNCTION CODES												MEANING
PN				C	8	4						Punch On
BY			A		8	4						Bypass
RES	B				8	4						Restore
PF	B	A	C		8	4						Punch Off
RS					8	4					1	Reader Stop
LF			A	C	8	4					1	Line Feed
NL	B			C	8	4					1	New Line (Carrier Return and Line Feed)
HT	B	A			8	4					1	Horizontal Tab
UC					8	4	2					Upper Case
EOB			A	C	8	4	2					End of Block
BS	B			C	8	4	2					Backspace
LC	B	A			8	4	2					Lower Case
EOT				C	8	4	2				1	End of Transmission
PRE			A		8	4	2				1	Prefix
IL	B				8	4	2				1	Idle
DEL	B	A	C		8	4	2				1	Delete
Ⓓ				C		4	2					Bid
Space				C								Space

Reprinted from IBM 2740 Communication Terminal, Form A24-3403, published by IBM.

.3 INPUT

.31 Prepared Input: . . . . . no provision.

.32 Manual Input

Method of entry: . . . . . via 44-key keyboard; additional keys provide special functions such as backspace, shift, carriage return, horizontal tabs, etc.

Quantity of data: . . . . . variable.

Character set: . . . . . 44 distinct character codes, in conjunction with upper and lower case control codes, provide 88 upper and lower case alphabetic, numeric, and special characters; see Tables I, II, and III.

Comments: . . . . . three keyboards are available which correspond to the three different codes. The keyboard for the Standard Selectric Typewriter Code is shown in Figure 2.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . no provision.

* Ⓓ transmission control code used by the 2741.

(Contd.)

TABLE III: IBM PAPER TAPE TRANSMISSION CODE/EBCD

LOWER CASE	Bit Value B	A	C	8	4	2	1	UPPER CASE
	B	A		8		2	1	¬
$	B		C	8		2	1	!
,		A	C	8		2	1	|
#*				8		2	1	"
@		A						¢
&	B	A	C					+
-	B							_
/		A	C				1	?
1							1	=
2						2		<
3			C			2	1	;
4					4			:
5			C		4		1	%
6			C		4	2		'
7					4	2	1	>
8				8				*
9			C	8			1	(
0			C	8		2		)
a	B	A					1	A
b	B	A				2		B
c	B	A	C			2	1	C
d	B	A			4			D
e	B	A	C		4		1	E
f	B	A	C		4	2		F
g	B	A			4	2	1	G
h	B	A		8				H
i	B	A	C	8			1	I
j	B		C				1	J
k	B		C			2		K
l	B					2	1	L
m	B		C		4			M
n	B				4		1	N
o	B				4	2		O
p	B		C		4	2	1	P
q	B		C	8				Q
r	B			8			1	R
s		A	C			2		S
t		A				2	1	T
u		A	C		4			U
v		A			4		1	V
w		A			4	2		W
x		A	C		4	2	1	X
y		A	C	8				Y
z		A		8			1	Z

THE CODES BELOW ARE NOT PRINTABLE

FUNCTION CODES	B	A	C	8	4	2	1	MEANING
PN			C	8	4			Punch On
BY		A		8	4			Bypass
RES	B			8	4			Restore
PF	B	A	C	8	4			Punch Off
RS				8	4		1	Reader Stop
LF		A	C	8	4		1	Line Feed
NL	B		C	8	4		1	New Line (Carrier Return and Line Feed)
HT	B	A		8	4		1	Horizontal Tab
UC				8	4	2		Upper Case
EOB		A	C	8	4	2		End of Block
BS	B		C	8	4	2		Backspace
LC	B	A		8	4	2		Lower Case
EOT			C	8	4	2	1	End of Transmission
PRE		A		8	4	2	1	Prefix
IL	B			8	4	2	1	Idle
DEL	B	A	C	8	4	2	1	Delete
Ⓓ			C		4	2		Bid
SPACE			C					Space

Reprinted from IBM 2740 Communication Terminal, Form A24-3403, published by IBM.

.35 Message Configuration

With no special features, a transmitted or received message consists of a bid character followed by the text and an end-of-transmission character. With the Record Checking feature installed, the end-of-transmission character is replaced by an end-of-block character followed by a message parity check character (LRC). If the response from the remote terminal is positive (". " character) and there is no more text to transmit, the end-of-transmission character is transmitted. If the response is negative ("-" character), the text is manually rekeyed and retransmitted as before.

If the Transmit Control feature is installed, the remote computer must transmit a two-character sequence (/ space) immediately after the dialed connection is established. The 2740 Terminal and remote computer can then exchange text messages in the format outlined above.

If the Station Control feature is installed, the remote computer initiates all message flow by addressing messages to the terminals or polling the terminals for messages to be transmitted to the computer. When addressing, the computer transmits a four-character message to the terminal consisting of the end-of-transmission character followed by a start-of-address character, a terminal address character, and a space character. The terminal responds with a one-character positive reply (". "). The format of the messages addressed to the individual terminal is then the same as with no special features or with just the Record Checking feature. The message exchange when the computer initiates a polling operation is similar except that the start-of-address character is not included in the polling message and the polled terminal responds directly with text messages in the same format as for the addressing operation.

* Ⓓ transmission control code used by the 2741.

.36 Operating Procedure

(1) Place terminal in Communicate mode (switch).
(2) Establish connection by dialing or manual signaling. (On a dedicated line, a permanent connection can be maintained.)
(3) Press the Bid key.
(4) Key in message.
(5) Press End-of-Transmission key.
(6) Press Dial Disconnect key if operating over a dialed network.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.44 Output to Printer

Output medium:	friction-fed or pin-fed (optional) fanfold forms up to 15.5 inches wide (13-inch writing width).
Character set:	88 printable characters; see Tables I, II, and III.
Rated printing speed:	14.8 char/sec.
Effective speed:	less than rated speed due to carriage return, line feed, or other format operations.
Format control:	controlled by function codes in incoming data, or manually by operator. Controls include line feed, carriage return, case shift, backspace, and horizontal tab.
Comments:	horizontal spacing is 10 char/inch (12 char/inch optional); vertical spacing is 6 lines/inch (8 lines/inch optional).

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors: . . . . . no provision for checking except through visual verification of input data when typed.

.52 Data Transmission Errors

Type of checking:	character and message parity (with optional Record Checking feature only).
Error indication:	when receiving, a hyphen is printed in place of a character received in error; at the end of the message, if a character or message parity error was detected during the message transmission, a hyphen is printed at both receiving and transmitting terminals, and the keyboard is locked, an audible alarm sounded, and the Restart light is turned on at the transmitting terminal.
Correction procedure:	operator at transmitting terminal depresses Restart key and retypes message.

.53 Data Recording Errors: . . . . . no provisions for checking.

.55 Line Malfunctions: . . . . . no special provisions for checking.

.6 CONDITION INDICATORS

Remote receiver ready:	none.
Remote receiver busy:	none.
Power on:	visible switch setting.
Transmission error (with optional feature)	lamp.
Recording error:	none.
Communicate/local:	visible switch setting.
Dial connection (with optional feature):	lamp.
Standby mode:	lamp.
Transmit mode:	lamp.
Receive mode:	lamp.

(Contd.)

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	14.8 char/sec (134.5 bits/sec).
Transmission method:	serial by bit.
Transmission code:	IBM Standard Selectric Typewriter Code, IBM Paper Tape Transmission Code/BCD or /EBCD; see Tables I, II, and III.
Transmission mode:	half-duplex.
Order of bit transmission:	high-order bit is transmitted first (bit position B).
Synchronization:	start/stop.

.72 Connection to Communications Lines

Communications Line	Data Set*
Bell System Data Channel Type 1005 (75 bits/sec):	Bell System Data Set 103F.
Western Union Class D Data Channel:	Western Union 180 Baud Data Modem.
Public switched telephone network:	Bell System Data-Phone Data Set 103A.
Privately-owned or leased common-carrier narrow-band or voice-band line:	IBM Line Adapter.**

.73 Transmission Control

Call initiation:	manual dialing or signaling.
Call reception:	requires operator attention.
Function operations:	16 different control codes can be received from a remote station to perform a variety of functions such as line feed, carriage return, case shift, horizontal tab, backspace, etc.

.74 Multistation Operation:

limited to broadcast operations without special features; i.e., transmissions originating at one terminal will be received and printed by all terminals connected to the same line.

The optional Station Control feature enables a 2740 to respond to polling or addressing messages from a remote System/360 computer. No provisions are included for interpretation of such responses; i.e., 2740's can be used as remote terminals for multistation operation, but not as the central control.

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* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

** See Paragraph .15 of this Report for a description of the IBM Line Adapters available.

.8 PHYSICAL SPECIFICATIONS

Component	2740 Communication Terminal
Width (inches)	28.75
Depth (inches)	25.25
Height (inches)	36.50
Weight (pounds)	325
Power (KVA)	0.15
Voltage	115 or 208/230
Frequency (Hz)	60
Phases	1
Temperature Range (°F)	50-110
Humidity Range (%)	10-80
Heat (BTU/hr)	400

.9 PRICE DATA

Component or Feature	Monthly Rental (1) $	Purchase Price $	Monthly Maintenance $
2740 Communication Terminal			
Model 1	95.00	3,930	21.50
Model 2	145.00	6,015	21.50
Optional Features for Model 1			
Automatic EOB	3.50	160	NC
Dialup	3.00	135	NC
Station Control	15.00	675	NC
Transmit Control	5.00	225	NC
Optional Features for Model 2			
Buffer Expansion			
Positions 121 to 248	10.00	415	0.50
Positions 249 to 440	15.00	620	0.50
Buffer Receive	5.00	205	NC
Document Insertion	6.00	250	1.50
Edit	10.00	415	NC
Header Control	5.00	205	NC
600 bps Speed Base	10.00	415	NC
Telegraph Line Attachment	3.00	130	1.00
Split Friction Feed Platen	—	60	(2)
Optional Features for Either Model			
Pin Feed Platen	—	59.25	(2)
Record Checking	16.50	745	NC
IBM Line Adapters			
Limited Distance — Type 1	3.00	135	NC
Limited Distance — Type 2	10.00	450	0.50
Leased Line Adapter	10.00	400	1.00
Shared Line Adapter (1 subchannel)	20.00	800	1.25

NC — No charge
Notes:
(1) Rentals shown are for 24-hour usage.
(2) Time and materials only.

IBM 2741 COMMUNICATION TERMINAL

.1 GENERAL

.11 Identity: . . . . . 2741 Communication Terminal.

.12 Manufacturer: . . . . . International Business Machines Corp.
Data Processing Division
112 East Post Road
White Plains, New York.

.13 Basic Function: . . . . . two-way typed-message communication at 14.8 char/sec over narrow-band or voice-band communications facilities.

.15 Description

The IBM 2741 Communication Terminal is a slightly-modified IBM Selectric Typewriter with control electronics that enable it to serve as a remote terminal for an IBM System/360 computer. Three keyboards, which correspond to three different transmission codes, are available for the 2741. The same keyboards and transmission codes are available for the IBM 2741 as for the IBM 2740; see Report 6454.

The 2741 can communicate only with an IBM System/360 equipped with a 2701 Data Adapter Unit or a 2702 or 2703 Transmission Control; a 2741 cannot communicate directly with another 2741 terminal. The rated transmission speed is 14.8 characters per second (134.5 bits per second), but input speed is naturally limited by the operator's typing speed.

The 2741 was designed to provide the System/360 computers with easy-to-use remote terminals for various time-sharing or inquiry applications. Toward this purpose, the optional Interrupt feature (also called the Break feature)permits a 2741 to transmit a signal which the remote System/360 computer will interpret as an interrupt signal. This enables the 2741 terminal to establish immediate communication with the remote computer.

Other optional features include a pin-feed platen, connection to the public telephone network (the Dial-Up feature), and Typamatic Keys (which provide automatic repetition of hyphen/underscore, space, and backspace operations when the appropriate key is pressed harder than usual).

Connection to a communication line is via a common-carrier data set or an IBM Line Adapter. The same line adapters are available for the 2741 as for the IBM 2740; see Paragraph 6454.15 in the 2740 report.

.16 First Delivery: . . . . . March 1966.

.17 Availability: . . . . . 12 months.

.2 CONFIGURATION

A 2741 Communication Terminal consists of a manual input keyboard, a printing component, special features as desired, and a common-carrier data set or IBM Line Adapter, depending on the transmission facility employed. See Paragraph .72 for the standard communications facilities that can be used and the data sets required.

.3 INPUT

.31 Prepared Input: . . . . . no provision.

.32 Manual Input

Method of entry: . . . . . via 44-key keyboard; additional keys provide special functions such as backspace, carriage return, horizontal tab, etc.

Quantity of data: . . . . . variable.

Character set: . . . . . 44 distinct character codes, in conjunction with upper and lower case control codes, provide 88 upper and lower case alphabetic, numeric, and special characters; see Report 6454: Tables I, II, and III.

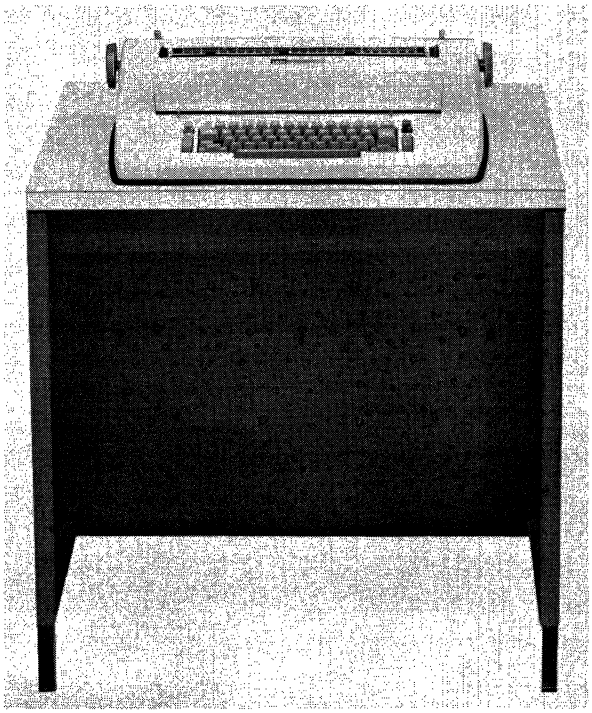

Figure 1. IBM 2741 Communication Terminal

.32 Manual Input (Contd.)

Comments:	three keyboards are available which correspond to the three different codes. The Standard Selectric Typewriter keyboard is shown in Figure 2 of Report 6454.
.33 Fixed Input:	no provision.
.34 Transaction Code Input:	no provision.
.35 Message Configuration:	data characters are preceded by a Ⓓ code (automatically transmitted) and followed by an end-of-transmission code (EOT) keyed in by the operator.

.36 Operating Procedure

To transmit a message to the remote computer, the operator:

(1) Places the terminal in the Communicate mode.

(2) Establishes connection by dialing or manually signaling. On a dedicated line, a permanent connection can be maintained. (After connection is established, a Ⓓ is automatically sent to the computer and the keyboard is unlocked.)

(3) Keys in the message.

(4) Presses either the Attention key or the Carriage Return key. When either key is depressed, an EOT code is sent to the computer.

The terminal is automatically placed in the receive state when a Ⓓ code is received from the computer, in response to a transmitted message. An EOT code received from the computer causes the 2741 to switch to the transmit state and unlocks the keyboard. Communication is terminated by the operator who switches the terminal to the local mode. The terminal also disconnects when power is switched off.

(Contd.)

The 2741 Communication Terminal is designed to communicate with an IBM System/360 computer over a dedicated privately-owned or leased common-carrier communications facility; a permanent connection is maintained between the two stations unless the Dial-Up feature is used.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.44 Output to Printer

Output medium:	friction-fed or pin-fed (optional) fanfold forms up to 15.5 inches wide (13-inch writing width).
Character set:	88 printable characters; see Tables I, II, and III in Report 6454.
Rated printing speed:	14.8 char/sec.
Effective speed:	less than rated speed due to carriage return, line feed, or other format operations.
Format control:	controlled by function codes in incoming data or manually by operator. Controls include line feed, carriage return, case shift, backspace, and horizontal tab.
Comments:	horizontal spacing is 10 char/inch (12 char/inch optional); vertical spacing is 6 lines/inch (8 lines/inch optional).

.5 ERROR DETECTION AND CORRECTION:. no provisions for checking except for visual verification of input data when typed.

.6 CONDITION INDICATORS: . . . . . visible switches for power on/off and terminal mode (communications/local) only.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	14.8 char/sec (134.5 bits/sec).
Transmission method:	serial by bit.
Transmission code:	identical with codes used by IBM 2740; see Report 6454, Tables I, II, and III.
Transmission mode:	half-duplex.
Order of bit transmission:	high-order bit is transmitted first.
Synchronization:	start/stop.

.72 Connection to Communications Lines

Communications Line	Data Set*
Bell System Schedule 3A Data Channel:	Bell System Data Set 103F.
Western Union Class D Data Channel:	Western Union 180 Baud Data Modem.
Public switched telephone network:	Bell System Data-Phone Data Set 103A.
Privately-owned or leased common-carrier narrow-band or voice-band line:	IBM Line Adapter.**

.73 Transmission Control

Call initiation:	manual dialing or signaling.
Call reception:	operator attention is required.

*In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

**See Paragraph 6454.15, in the IBM 2740 report, for a description of the IBM Line Adapters available.

.73 Transmission Control (Contd.)

Functional operations: . . . . . 16 different control codes can be received from a remote station to perform a variety of functions such as line feed, carriage return, case shift, horizontal tab, backspace, etc.

.74 Multistation Operation: . . . . . no provision.

.8 PHYSICAL SPECIFICATIONS

Component	2741 Communication Terminal
Width (inches)	28.75
Depth (inches)	25.25
Height (inches)	36.50
Weight (pounds)	325
Power (KVA)	0.15
Voltage	115 or 208/230
Frequency (Hz)	60
Phases	1
Temperature Range (°F)	50-110
Humidity Range (%)	10-80
Heat (BTU/hr)	400

.9 PRICE DATA

Component or Feature*	Monthly Rental** $	Purchase Price $	Monthly Maintenance $
2741 Communication Terminal	85.00	3,930	23.50
Optional Features			
Dialup	3.00	135	NC
Interrupt	2.50	115	NC
Pin-Feed Platen	—	59.25	***
Typamatic Keys	5.00	225	NC

NC — No charge

* See Paragraph 6454.9 for prices of the various IBM Line Adapters.
** Rentals shown are for 24-hour usage.
*** Time and materials only.

REPORT UPDATE

IBM ASSIGNS MODEL NUMBERS TO ITS 2260 DISPLAY STATIONS

IBM has assigned two model numbers to its 2260 Display Stations without affecting the existing configuration rules presented in the table on page 6456:02. The 2260 Display Station used with the 2848 Model 3 is now designated the 2260 Model 1; the Display Station used with the 2848 Models 1 and 2 is now designated the 2260 Model 2.

DISPLAY STATION PRICES CHANGED

The price data on page 6456:12 has been updated to reflect current prices and features included with the 2260 Display Station.

IBM INTRODUCES TWO CONTROLS FOR LOCAL DISPLAYS

IBM has introduced two new models of the 2848 Display Control for local operation of the 2260 Display Station at a maximum data rate of 2560 characters per second. IBM found that the 2848 Models 1 and 2 could not adequately handle a large number of displays operating locally (i.e., via direct cable connection). Models 21 and 22 have additional transfer buffering to accommodate larger volumes of data. Models 1 and 2 can still be used for small-volume local operation and are significantly less expensive than Models 21 and 22 (see page 6456:12).

The new 2848 Models 21 and 22 Display Controls correspond to the 2848 Models 1 and 2, respectively, in maximum display size and number of connected displays. Model 21 can accommodate up to 12 (basic) or up to 24 (with an expansion unit) 2260 Model 2 Display Stations. Model 22 can accommodate up to 8 (basic) or up to 16 (with an expansion unit) 2260 Model 2 Display Stations. A display adapter is required for each pair of 2260 Display Stations. An alphanumeric keyboard with the numbers arranged in a block format is available with the 2848 Models 21 and 22.

IBM 2260 DISPLAY STATION

.1 GENERAL

.11	Identity:	2260 Display Station; 2848 Display Control, Models 1, 2 and 3; 1053 Model 4 Printer.
.12	Manufacturer:	International Business Machines Corp. Data Processing Division 112 East Post Road White Plains, New York
.13	Basic Function:	visual display, via a cathode ray tube, of data transmitted between a 2260 and a local or remote IBM System/360 computer; data can be entered via a keyboard; printed output is optional.

.14 Basic Components

Name:	2260 Display Station.
Function:	display of alphanumeric data.
Name:	2848 Display Control.
Model number:	1, 2, or 3.
Function:	provides basic control and buffer storage for Display Stations; different models permit connection of different numbers of stations and different display sizes.
Name:	1053 Printer.
Model number:	4.
Function:	provides printed output; maximum of one per 2848 Control.

.15 Description

The IBM 2260 Display Station is designed to facilitate rapid access to data stored in an IBM System/360 computer, under control of a stored program in the computer. The 2260 displays data on the face of a cathode ray tube and can include a keyboard for data entry by the operator.

Multiple 2260 Display Stations can be controlled by a 2848 Display Control. The 2848 Control can be connected directly to a Multiplexor or Selector Channel of an IBM System/360 Model 30, 40, 44, 50, 65, 67, or 75 computer, or it can be connected remotely via a common-carrier leased voice-band line, appropriate data sets, and a 2701 Data Adapter Unit incorporating an IBM Terminal Adapter Type III (see Report 8442). Each 2260 Display Station can be located up to 2,000 cable-feet from the 2848 Control.

The data transmission rate between a directly-connected 2260 station and the computer is 2,560 characters per second. When the 2260 is connected remotely, the data transmission rate is 120 or 240 characters per second (1,200 or 2,400 bits per second, respectively).

The functional operation of the 2260 when connected to a System/360 computer is similar to its operation when connected remotely. The remainder of this report reflects the 2260 Display Station operating remotely, as a communications terminal device, except where specifically stated.

Basic Operation

The 2260 Display Stations and associated 2848 Display Control operate in a half-duplex mode. All communication between the display complex and the remote computer is initiated by the computer.

Displayed data is received from the remote computer or is keyed into the 2260 by the operator. When data is to be entered, the operator keys in the data and depresses the Enter Key. The displayed data will be transmitted to the computer the next time the computer requests a transfer.

Figure 1. IBM 2260 Display Station

.15 Description (Contd.)

Except when an error is detected in a command sequence, all data messages are acknowledged to indicate correct or incorrect reception by both the 2848 Control and the remote computer.

The 7-level ASCII transmission code is employed, with an eighth bit added for character parity. A total of 10 bits are transmitted for each character, including start and stop bits. The remote System/360 computer automatically converts the seven-level code into an eight-level code by adding a bit; see Table II. These converted codes do not correspond to the internal EBCDIC code of a System/360 computer; see Table IV. If extended internal computation or output at the computer site is desired, data received from a 2260 Display Station will need to be converted to the internal code by the stored program in the System/360 computer.

Display Complex

A display complex consists of the following components:

- One 2848 Display Control, Model 1, 2, or 3;
- Up to 24, 16, or 8 2260 Display Stations; depending on which model of the 2848 is incorporated; and
- One 1053 Model 4 Printer (optional).

The maximum number of Display Stations and the maximum display size for each model of the 2848 Display Control are shown in the table below.

2848 Display Control	Maximum Number of 2260 Display Stations	Maximum Size of Display		
		Lines	Char/Line	Characters
Model 1	24	6	40	240
Model 2	16	12	40	480
Model 3	8	12	80	960

(Contd.)

The 2848 Display Control provides the basic control logic and buffer storage for all units, and a character generator for converting the 7-bit ASCII data codes into a 35-bit video display code. Display adapters contain delay-line buffers for each Display Station; these buffers store video display codes and continuously regenerate the display. Characters and symbols are displayed by a 5-by-7 dot matrix; each bit of the video display code corresponds to one dot-matrix position. One Display Adapter is required for each pair of Display Stations. A separate adapter is required for connecting the 1053 Printer.

The Display Station consists of a 12-inch-diameter cathode ray tube with a display field 4 inches high by 9 inches wide. A numeric or alphanumeric keyboard can be incorporated in each 2260 Display Station, or the station can be used without a keyboard for display purposes only. Figure 1 shows the 2260 Display Station with alphanumeric keyboard.

The 1053 Model 4 Printer is a modified version of the IBM Selectric Typewriter and is similar to the printers used in IBM 1050 Data Communications Systems. All Display Stations connected to one 2848 Display Control share the one 1053 Printer.

The Printer Adapter contains a buffer for storing data to be printed. This permits a printing operation to proceed simultaneously with operations by the Display Station. A print operation can be initiated by the remote computer, as described later; a Display Station operator can also cause the station display to be printed.

Commands

The IBM 2260 Display Station, in combination with a 2848 Display Control, is capable of responding to eight commands transmitted by the remote computer.

There are four read commands for transmitting data from the Display Station to the computer:

- Specific Poll to 2260 Station — initiates transfer of data displayed by a specific station to the computer, provided that the Start symbol is displayed and the Enter key has been depressed.
- Specific Poll to Printer — initiates transmission of printer status to computer (e.g., busy, ready, not ready).
- General Poll — initiates transfer of data to computer from all stations that have the Start symbol displayed and in which the Enter key has been depressed. Messages are transferred sequentially and are accompanied by the address of the corresponding Display Station.
- Read Addressed Full Display Station Buffer — initiates unconditional transfer to the computer of the entire buffer for the addressed station.

Selected portions of the display can be transmitted in response to a Specific or General Poll; see the paragraphs under Editing Facilities.

There are four write commands for transferring data to a Display Station or Printer:

- Write Addressed Display Station — conditions the 2848 Control and the addressed station for reception and display of the associated message.
- Erase/Write Addressed Display Station — causes the display of the addressed station to be erased and the cursor to be positioned at the first displayable position.
- Write Printer — conditions the 2848 Control and the 1053 Printer for reception and printing of the associated message. A positive indication of status is returned if the printer is busy or not ready.
- Write Display Station Line Address — same as Write Addressed Display Station except that the display is started on the indicated line instead of on the first line. The Line Addressing Feature is required in the 2848 Display Control for the use of this command.

Editing Facilities

The 2260 Display Station makes limited editing facilities available to the operator. The standard cursor (destructive) can be moved one position at a time either forward or backward; each position occupied by this cursor is erased. The optional non-destructive cursor can be moved forward or backward and also up or down one line at a time; this cursor does not

.15 Description (Contd.)

erase the contents of each position it occupies. Either cursor "wraps around," i.e., moves from the first display position to the last when backspaced or from the last display position to the first when advanced. The entire display can be erased by the operator at any time.

Either cursor can be advanced to be first position of the next line by depressing the New Line key. This operation also causes the New Line symbol to be displayed in the cursor position of the previous line.

When transmitting in response to a Specific Poll or General Poll command, data located between the New Line symbol and the end of that line is not transferred. When receiving, a New Line code in the text data causes the display to jump to the beginning of the next line; data between the New Line symbol and the end of the line is not erased. This "split-screen" capability allows fixed information such as table or entry headings to be continuously displayed without the need for retransmitting them each time.

Error Checking and Correction

Character and longitudinal parity checking is performed on all data received by the 2848 Control from the remote computer; character parity bits and longitudinal check characters are generated and transferred with all data transmitted from the 2848 Control. If the remote computer returns a negative acknowledgment indicating that an error was detected at the computer site, the 2848 Control automatically retransmits the message.

The 2848 Control also checks the parity and validity of each command sequence received from the computer. If errors are detected, the 2848 does not make a response of any kind.

Programming Support

IBM states that the software support for the 2701 Data Adapter Unit is being extended to cover 2260 Display Stations as remote terminals under BTAM and QTAM for the Operating System/360 and under BTAM for the Disk Operating System; see Paragraph 8442.4 in the report on the 2701. The Disk Operating System is the disk-resident version of the Basic Operating System described in the 2701 report.

.16 First Delivery: . . . . . June 1966.

.17 Availability: . . . . . 22 months, maximum.

.2 CONFIGURATION

A network of 2260 Display Stations is composed of:

- One 2848 Display Control, Model 1, 2, or 3.
- Multiple 2260 Display Stations, each with no keyboard, a numeric keyboard, or an alphanumeric keyboard; and
- One 1053 Model 4 Printer if desired.

Table I shows the maximum number of display units that can be connected to each model of the 2848 Control, and the features required. The display size also varies for each model of the 2848 Control; these variations are also shown in Table I.

Each 2260 station can be located up to 2,000 feet from the 2848 Display Control.

The 2848 Control and 2260 Display Station network can communicate over a common-carrier leased voice-band line with an IBM System/360 Model 30, 40, 44, 50, 65, 67, or 75 computer system incorporating an IBM 2701 Data Adapter Unit. The transmission speed is 1,200 or 2,400 bits per second, depending on the Data Set Adapter selected. Once installed, the transmission speed is fixed; i.e., the operator cannot select between the two speeds. See Paragraph .72 for the communications facilities that can be accommodated and the data set required for each.

The 2848 Control can also be connected directly to a control unit position of an input/output channel of an IBM System/360 Model 30, 40, 44, 50, 65, 67 or 75 computer system.

In addition to the capability to connect a 1053 Printer, two other optional features are available: Line Addressing and Non-Destructive Cursor. To incorporate the Line Addressing capability, only one Line Addressing feature is required regardless of the number of Display

(Contd.)

Stations. To incorporate the Non-Destructive Cursor, one Non-Destructive Cursor Feature is required in the 2848 Control, and one Non-Destructive Cursor Adapter is required for each Display Adapter. All Display Stations connected to the same 2848 Display Control must use the same type of cursor.

.3 INPUT

.31 Prepared Input: . . . . . no provision.

.32 Manual Input

Alphameric Keyboard —

Method of entry: . . . . . via optional 50-key keyboard.
Quantity of data: . . . . . up to 240, 480, or 960 characters, depending on the model of the 2848 Control used.
Character set: . . . . . 64 characters, including digits, upper-case letters, and special symbols; see Table II.
Comments: . . . . . 6 keys provide control functions only and do not produce a displayable symbol.

Numeric Keyboard —

Method of entry : . . . . . via optional 26-key keyboard.
Quantity of data: . . . . . up to 240, 480, or 960 characters, depending on the model of the 2848 Control used.
Character set: . . . . . 25 characters, including the numeric digits and 15 special symbols; see Table III.
Comments: . . . . . 8 keys are unused.

TABLE I: 2848 DISPLAY CONTROL CONFIGURATION POSSIBILITIES

Components	2848 Display Control		
	Model 1	Model 2	Model 3
Basic 2848 Display Control; maximum number of:			
Display Adapters	2	1	1
2260 Display Stations	4	2	2
1053 Printers	0	0	1 (1)
3857 Expansion Panel (2); maximum number of:			
Display Adapters	6	4	3
2260 Display Stations	12	8	6
1053 Printers	0	0	0
3858 Expansion Panel (2); maximum number of:			
Display Adapters	4	3	-
2260 Display Stations	8	6	-
1053 Printers	1 (1)	1 (1)	-
Fully expanded configuration; maximum number of:			
Display Adapters	12	8	4
2260 Display Stations	24	16	8
1053 Printers	1	1	1
Display size:			
Number of lines per display	6	12	12
Number of characters per line	40	40	80
Total number of characters per display	240	480	960

(1) Requires special Printer Adapter.

(2) Either or both Expansion Panels can be included in a Model 1 or 2 2848 Display Control configuration.

TABLE II: IBM 2260 DISPLAY STATION ASCII DATA TRANSMISSION CODES (6)

Bits	B_7 B_6 B_X B_5				0 0 0 0	0 0 0 1	0 1 0 0	0 1 0 1	1 0 1 0	1 0 1 1	1 1 1 0	1 1 1 1
	B_4	B_3	B_2	B_1	Col ▸ Row ▾	0	1	2	3	4	5	6	7
	0	0	0	0	0	Note 1 Note 2		SP	0		P	@	P
	0	0	0	1	1	SOH			1	A	Q	A	Q
	0	0	1	0	2	STX			2	B	R	B	R
	0	0	1	1	3	ETX		#	3	C	S	C	S
	0	1	0	0	4	EOT		$	4	D	T	D	T
	0	1	0	1	5		NAK	%	5	E	U	E	U
	0	1	1	0	6	ACK		&	6	F	V	F	V
	0	1	1	1	7			'	7	G	W	G	W
	1	0	0	0	8		CAN	(	8	H	X	H	X
	1	0	0	1	9			)	9	I	Y	I	Y
	1	0	1	0	10	LF		*	:	J	Z	J	Z
	1	0	1	1	11			+	;	K	Note 4	K	Note 5
	1	1	0	0	12	Note 3		,	<	L		L	¬
	1	1	0	1	13			-	=	M		M	
	1	1	1	0	14			.	>	N		N	|
	1	1	1	1	15			/	?	O	_	O	·

Note 1. Displayed on 2260's as the EOM (▬) symbol. Prints on the 1053 Model 1 Printer as the exclamation mark (!).

Note 2. Displayed on 2260's as the Check (▌) symbol. Prints on the 1053 Model 1 Printer as the quote symbol (").

Note 3. Displayed on 2260's as the New Line (◣) symbol. Causes a carriage return and line feed on the 1053 Model 1 Printer.

Note 4. Displayed on 2260's as the Start MI (▶) symbol. Prints on the 1053 Model 1 Printer as a cent sign (¢).

Note 5. The codes represented by the characters within the dotted outline are the ASCII-8 codes for the lower-case alphabetic characters. These codes are converted to upper case by the 2848 and displayed as upper-case characters. If retrieved by a read operation, the codes will be in the upper-case bit configuration.

Note 6. The 8-bit codes shown in this table are the codes as they appear in the core memory of the remote computer. The ASCII transmission code is obtained by deleting Bit X. This conversion is performed by the 2701 Data Adapter Unit prior to transmitting data to a 2260 Display Station and after receiving data from a 2260. See Table IV for the data codes used when a 2260 is connected directly to a System/360 I/O channel.

Note 7. Graphic representations are undefined for the bit patterns outside the heavily outlined portions of the chart. These bit patterns are referred to as undefined graphic bit patterns. If an undefined graphic bit pattern is sent from channel to the device, the graphic that will be displayed or printed by the device is not specified.

Note 8. IBM reserves the right to change at any time the graphic displayed or printed by this device for an undefined graphic bit pattern.

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(Contd.)

TABLE III: IBM 2260 NUMERIC KEYBOARD CHARACTER SET (1)

No Shift	Shift
1	$
2	@
3	%
4	,
5	.
6	/
7	-
8	+
9	*
0	#
Sp	Advance

(1) Control characters are the same as for the alphanumeric keyboard; see Table II.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration

Communication between the remote computer and a 2260 Display Station or 1053 Printer is initiated when the computer transmits a four-character addressing sequence to the 2848 Display Control. This sequence consists of the following characters: EOT (poll or read) or SDH (write), 2848 address, device address, and command character. The two general types of commands are poll (or read) and write.

When a poll command addressed to a Display Station is received, the appropriate 2260 Station responds with a text message consisting of the following characters: STX, 2260 address, text, ETX, and LRC (longitudinal redundancy check). If a parity error is detected in the buffer when transmitting, the CAN character will be inserted just before the ETX character. If the computer receives the message without detecting an error, an ACK character is transmitted. If an error is detected, the NAK character is transmitted and the 2848 Control automatically retransmits the message.

After the message has been correctly received and the acknowledgment transmitted, the computer can transmit one or more messages to the Display Station. Each message from the computer consists of the following characters: STX, text, ETC, and LRC. Each message is acknowledged with an ACK or NAK character. If the command is a General Poll, the other Display Stations connected to the 2848 Control are tested following the completion of the transmission from the first station. If the computer directs a message to one of the stations during the execution of a General Poll operation, the operation must be reinitiated following the transmission of text from the computer to ensure that all stations are polled.

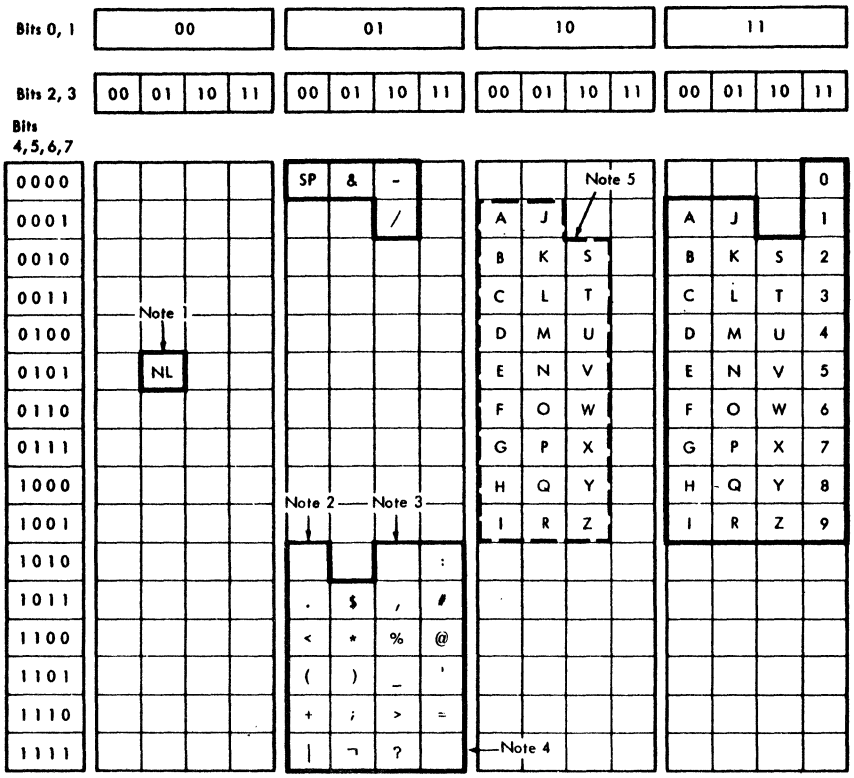
If the command is a write command, the 2848 responds with an ACK character if it receives the command correctly and a NAK if not. The computer then transmits one or more messages to the addressed station in the same format as above. Each message is acknowledged with an ACK or NAK by the 2848. If the command is a Line Address Write, the line address is inserted following the STX character in the computer text message.

The 2848 Control will make no response if it detects a parity error or an invalid command or address in the addressing sequence.

A one-character response of EOT or SOH from the 2848 Control is transmitted to indicate: a negative response to a polling command, end of transmission to a read command, data lost condition to a write command, buffer overflow, or printer busy when addressed. The EOT character normally terminates communication.

The text can contain up to 240, 480, or 960 characters, depending on which model of the 2848 Control is being used; see Table I. Except for data following a New Line symbol, all displayed characters and symbols are included in the text, except the non-destructive cursor; see Table II. The displayed data between a New Line symbol and the end of the line is not transmitted when a 2260 is polled, and will not be overwritten or erased during a write operation.

TABLE IV: IBM 2260 EBCDIC DATA CODES FOR LOCAL OPERATION (6)



Note 1. Displayed on 2260's as the New Line (◢) symbol. Causes carriage return and line feed on the 1053 Model 1 Printer.

Note 2. Displayed on 2260's as the Start MI (▶) symbol. Prints on the 1053 Model 1 Printer as a cent sign (¢).

Note 3. Displayed on 2260's as the EOM (▬) symbol. Prints on the 1053 Model 1 Printer as an exclamation mark (!).

Note 4. Displayed on 2260's as the Check (▌) symbol. Prints on the 1053 Model 1 Printer as a quote (") symbol.

Note 5. The codes represented by the characters within the dotted outline are the EBCDIC codes for the lower case alphabetic characters. These codes are converted to upper case by the 2848 and displayed as upper-case characters. If retrieved by a read operation, the codes will be in the upper-case bit configuration.

Note 6. The data codes in this table are used when the 2260 is connected directly to a System/360 computer I/O channel (via a 2848 Control). These codes correspond to the internal code of the System/360 computers. Bit 7 of the EBCDIC code is the low-order bit and corresponds to bit 1 of the ASCII code.

Note 7. Graphic representations are undefined for the bit patterns outside the heavily outlined portions of the chart. These bit patterns are referred to as undefined graphic bit patterns. If an undefined graphic bit pattern is sent from channel to the device, the graphic that will be displayed or printed by the device is not specified.

Note 8. IBM reserves the right to change at any time the graphic displayed or printed by the device for an undefined graphic bit pattern.

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(Contd.)

.36 Operating Procedure

A message to be transmitted from a 2260 Display Station is composed by positioning the cursor at the desired starting position, depressing the Shift key and Start key (which enters the Start MI symbol in the cursor position), and keying the data. Controls are provided to space forward or backward one position at a time and to move the cursor to the beginning of the next line. The optional non-destructive cursor can be moved up or down one line at a time. The cursor identifies the next display position to be entered. When the standard destructive cursor is moved to a position already containing a display character, that position is erased. The non-destructive cursor can be moved freely without erasing data.

To transmit a message, the Shift key and Enter key are depressed; this action locks the keyboard and puts the Display Station in a wait condition. When the station is polled by the remote computer, the data stored in the buffer will be transmitted to the computer. A successful transmission causes the Start MI symbol to be erased and the keyboard unlocked. If a transmission error is detected at the remote computer, an automatic retransmission can be requested. For certain types of errors, other correction techniques may be used, as controlled by the stored program in the remote computer.

.37 Entry of Time and Date: . . . . . no provisions.

.40 OUTPUT

.44 Output to Printer

1053 Model 4 Printer —

Output medium:	friction-fed forms up to 15 inches in width; pin-feed platen is optional; 13-inch maximum print line; printing is 6 or 8 lines per inch vertically and 10 or 12 characters per inch horizontally.
Character set:	63 characters plus space; see Table II.
Rated printing speed:	14.8 char/sec.
Effective speed:	somewhat below rated speed due to carriage return and line feed operations.
Format control:	controlled by function codes in the data message; EOM causes an exclamation mark to be printed, followed by a carriage return and line feed; the New Line code causes a line feed.
Comments:	printing mechanism is similar to IBM Selectric Typewriter.

.46 Output to Visual Display Device

2260 Display Station —

Output medium:	cathode ray tube; displays orange characters against gray background.
Character set:	digits 0-9, upper-case letters A-Z, and 28 punctuation and special symbols; see Table II.
Character size:	characters are formed by a 5-by-7 dot matrix which is nominally 0.09 inch wide and 0.12 inch high; spacing between characters is 0.05 inch.
Display size:	9 inches wide by 4 inches high on 12-inch diameter tube.
Characters per line:	40 (with 2848 Model 1 or 2) or 80 (with 2848 Model 3).
Lines per display:	6 (with 2848 Model 1) or 12 (with 2848 Model 2 or 3).
Characters per display:	240, 480, or 960 with 2848 Model 1, 2, or 3 respectively.
Buffer capacity:	7,680 characters per 2848 Control.

.46	Output to Visual Display Device (Contd.)	
	Format control:	each space position on the display occupies one character position in the buffer; cursor can be moved one space at a time horizontally in either direction; automatic cursor wrap-around from last position to first when advancing or first position to last when backspacing; Non-Destructive Cursor (optional) can be moved up or down one line at a time; a portion of each line can be fixed and not transmitted; entire display except for fixed portion is transmitted each time.
	Rated output speed:	2,560 char/sec when connected directly to a System/360 channel; 120 or 240 char/sec over a voice-band line.
	Effective output speed:	lower than rated speed due to exchange of control messages and presence of header characters.
.5	ERROR DETECTION AND CORRECTION	
.51	Data Entry Errors:	visual checking only; depression of a key representing a non-existent character causes the Check character to be displayed on the screen.
.52	Data Transmission Errors	
	Type of checking:	character and longitudinal parity checks.
	Error indication:	negative response (NAK) if parity error is detected in text; no response if parity error is detected in address sequence.
	Correction procedure:	automatic retransmission by 2848; as programmed in computer.
.53	Data Recording Errors:	no checking, except visual.
.54	Buffer Errors	
	Type of checking:	character parity is checked prior to transmission from 2848 buffer.
	Error indication:	inclusion of CAN character in transmitted message.
	Correction procedure:	as programmed at the computer.
.55	Line Malfunctions:	no special provisions for checking.
.6	CONDITION INDICATORS:	no indicators other than visible display.
.7	DATA TRANSMISSION	
.71	Basic Characteristics	
	Rated transmission speed:	120 or 240 char/sec (1,200 or 2,400 bits/sec, respectively).
	Transmission method:	serial by bit.
	Transmission code:	7 data bits plus a parity bit and 2 start-stop bits; a total of 10 bits are transmitted for each character; see Table II.
	Transmission mode:	half-duplex.
	Order of bit transmission:	low-order bit is transmitted first, parity bit last.
	Synchronization:	start and stop bits are transmitted with each character.

(Contd.)

.72 Connection to Communications Lines

Communications Line or Service	Data Set*
Bell System Schedule 4 Type 4A Data Channel (1,200 bits/sec):	Bell System Data Set 202D.
Bell System Schedule 4 Type 4B Data Channel (2,400 bits/sec):	Bell System Data Set 201B.

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

.73 Transmission Control

Call initiation:	only when polled or addressed by remote computer.
Call reception:	normally a 2260 complex operates over a dedicated line on which a permanent connection is maintained.
Functional operations:	line feed and carriage return operations can be initiated by control characters in the text of a message.

.74 Multistation Operation

Polling:	the 2260 stations and the associated 1053 Printer are individually addressable; units can be polled individually (Specific Poll) or all units connected to the 2848 Control can be polled for messages (General Poll); a Specific Poll directed toward the Printer ascertains whether the Printer is ready or busy. A specific device address is transmitted with the data in response to polling commands. Only one 2848 Control can be connected to a communications line.
Addressing:	Display Stations cannot communicate directly with one another; the remote computer can selectively communicate with each terminal.

.8 PHYSICAL SPECIFICATIONS

Component	2260 Display Unit (all models)		2848 Display Control (all models)	1053 Model 4 Printer
	Without Keyboard	With Keyboard		
Width (inches)	13.75	13.75	61.5	14
Depth (inches)	13.19	19.38	32.25	14
Height (inches)	17.38	17.38	70.75	17
Weight (pounds)	30	43	1000 (max)	40
Power (KVA)	0.15	0.15	3.3	0.1
Voltage	115	115	208/230	115
Frequency (cps)	60	60	60	60
Phases	1	1	1	1
Temperature Range (°F)	50 to 110	50 to 110	60 to 90	60 to 90
Humidity Range (%)	8 to 80	8 to 80	8 to 80	20 to 80
Heat (BTU/hr)	477	477	10,000	335

.9 PRICE DATA

Component or Feature	Monthly Rental $	Purchase Price $	Monthly Maintenance $
2260 Display Station			
Model 1 or 2	30	970	8.25
Alphameric keyboard	20	600	1.50
Numeric keyboard	10	300	1.00
2848 Display Control			
Model 1	360	15,715	23.00
Model 2	390	16,840	23.50
Model 3	420	17,975	24.00
1053 Model 4 Printer	49	1,940	10.00
Pin-Feed Platen	—	59.25	—
Special Features for 2848			
Display Adapter			
For Model 1	40	1,505	2.00
For Model 2	80	3,005	4.00
For Model 3	100	3,765	5.00
Expansion Unit (#3857; for connection of up to 6, 4, or 3 Display Adapters to 2848 Model 1, 2, or 3)	44	1,905	NC
Expansion Unit (#3858; for connection of up to 4 or 3 Display Adapters and a 1053 Adapter to 2848 Model 1 or 2.)	55	2,260	NC
Line Addressing	10	450	1.25
Nondestructive Cursor (1 per 2848)	10	430	1.00
Nondestructive Cursor Adapter (1 per Display Adapter)	5	215	0.50
1053 Adapter			
For Model 1 or 2	40	1,505	3.25
For Model 3	40	1,505	3.25

NC — No charge

IBM 2780 DATA TRANSMISSION TERMINAL

.1 GENERAL

.11 Identity: . . . . . 2780 Data Transmission Terminal; Models 1, 2, 3 and 4.

.12 Manufacturer: . . . . . International Business Machines Corporation
Data Processing Division
112 East Post Road
White Plains, New York.

.13 Basic Function: . . . . . transmits data from punched cards; receives and prints data or punches data into cards; operates synchronously over a voice-band line at speeds of 1200, 2000, or 2400 bits per second.

.14 Basic Components

Name: . . . . . 2780 Printer.
Function: . . . . . includes line printer, buffers, and control circuitry. Printer is included in Models 1, 2, and 3.

Name: . . . . . 2780 Card/Punch.
Function: . . . . . provides punched card input and output. Card reading is provided in Models 1, 2, and 4; card punching is provided in Models 2 and 4 only.

.15 Description

The IBM 2780 Data Transmission Terminal is available in four models that provide various combinations of input/output components. The capabilities of the four models are:

- 2780 Model 1 — provides punched card input and printed output.
- 2780 Model 2 — provides punched card input and punched card and printed output.
- 2780 Model 3 — provides printed output only (no input capabilities).
- 2780 Model 4 — provides punched card input and output.

Figure 1 shows the 2780 Model 2.

The 2780 Data Transmission Terminal operates at 1200 or 2000 bits per second over the public telephone network or at 1200, 2000, or 2400 bits per second over a leased voice-band line.

The 2780 is designed to use the IBM Binary Synchronous Communications (BSC) technique to transmit data in a half-duplex mode. Essentially, the BSC technique provides for synchronous transmission of a continuous stream of data with all error-checking information transmitted at the end of a record. Alternatively, the USASCII code can be used with conventional character and message parity checking.

Although data can be transmitted or received only in a half-duplex mode, IBM recommends the use of a full-duplex line to significantly reduce the turn-around time when exchanging acknowledgement messages.

The 2780 can be used to communicate with another 2780 Terminal or a System/360 Model 30, 40, 50, 65, or 75 computer equipped with the appropriate multi-line controller and transmission adapters (see Reports 8442 and 8444 on the IBM 2701 Data Adapter Unit and the 2703 Transmission Control). The 2780 can operate as one of several 2780 Terminals in a multi-station arrangement operating over a single leased voice-band line under the control of a System/360 computer. The 2780 can also operate off-line to print data from punched cards.

Three transmission codes are available for the 2780: the 8-level USASCII (formerly ASCII), the 8-level EBCDIC, and the Six-Bit Transcode (SBT); see Tables I, II, and III. The same data-link control characters, described in Paragraph .35, are used with all three codes. Table IV shows the special characters included in each transmission code.

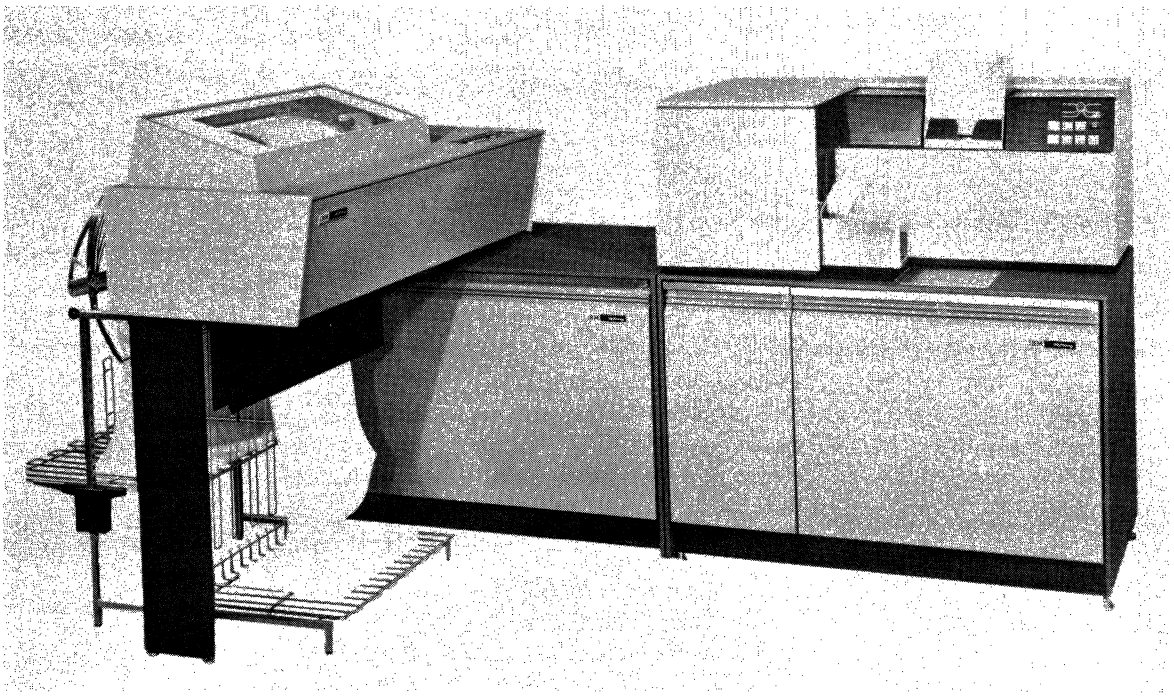

Figure 1. IBM 2780 Data Transmission Terminal, Model 2

.15 Description (Contd.)

The card read/punch unit is a modified version of the IBM 1442 Card Read Punch having a single card path with both read and punch stations. The printer is a modified version of the IBM 1443 Printer which uses a horizontally oscillating type-bar. Both the 1442 and 1443 have been used extensively as peripheral devices in IBM computer systems.

The peak card reading speed is 400 cards per minute; the peak card punching speed is from 91 to 355 cards per minute, depending on the number of columns punched. The cards are fed from a hopper with a capacity of 1200 cards, read or punched column by column, and loaded into a 1300-card-capacity stacker.

The peak printing speed is 240 lines per minute if the standard 52-character type-bar is used. The Selective Character Set option permits the use of other type-bars having character sets of 39, 47, or 63 characters. The peak printing speed with the non-standard type-bar varies from 200 to 300 lines per minute.

The print cycle time for the standard 240-line-per-minute printer is 250 milliseconds. The actual print operation requires 198 milliseconds; the remaining 52 milliseconds are used to move paper and to restore the print hammers. Skips or line spaces greater than two lines require an additional 10 milliseconds per line.

The print line can be optionally expanded from the standard 80 character positions to 120 or 144 character positions. All arrangements print 10 characters per inch, horizontally. A 12-channel punched tape loop, of which only nine channels can be used, is employed to define the vertical format.

The 2780 contains two buffers which are used to transfer data between the communications line and the reader, punch, or printer. A 400-character line buffer stores data transferred between the communications line and the I/O buffer. Without options, the line buffer can only store up to two 80-character records. When the Multiple Record Transmission feature is employed, all 400 character positions of the line buffer can be used. The I/O buffer contains 200 character positions and stores a single 80-character punched card record or a printer record of up to 144 characters. The I/O buffer is used to interface the reader, punch, and printer with the line buffer.

All models of the 2780 except the Model 3 can operate as either a receiving or a transmitting terminal. Model 3 operates as a receiving terminal only. When transmitting, each data block that is transmitted is acknowledged with a special message that specifies correct or incorrect reception. When receiving, the 2780 responds to the transmitting station in the same manner.

(Contd.)

The 2780 operates in one of six modes that are switch-selected by the operator:

- Print Mode — Received data is expected to be in the form of records containing up to 80 data characters, or up to 144 data characters with an optional feature. Each record is printed on one line; line spacing is initiated by a two-character sequence (see Table V).
- Punch Mode — Received data is expected to be in the form of records containing up to 80 data characters; each record is punched into one card.
- Off-Line Mode — Data read from punched cards is transcribed to a printed listing. One line is printed for each card; printing is single-spaced.
- Receive Mode — Received data records are punched or printed according to the selection character in the data record. Cards are punched in IBM card code. Single-, double-, or triple-line spacing or multi-line skipping can be performed after printing each line. Spacing or skipping is initiated by a vertical format control code included in the data record (see Table V). Multi-line skipping halts when a hole is sensed in the specified channel of the vertical format control tape loop.
- Transmit Mode — Data is read from cards and data records are transmitted. When transmission is completed, the terminal is automatically prepared to receive data and print it.
- Transmit Transparent Mode — Operates the same as the Transmit Mode, except that any EBCDIC bit pattern can be transmitted; control character recognition is inhibited (see Paragraph .35). This mode requires the EBCDIC Transparency optional feature.

Figures 2 and 3 show the operations of the 2780 in the Transmit and Receive modes. The possible modes of operation are restricted by the complement of input/output devices included in the various models. The Print and Punch modes are inoperable if the Multipoint Line Control feature is installed.

A number of optional features are available for the 2780 Terminal, including:

- Multipoint Line Control — Allows a number of 2780 Terminals to communicate in a multistation arrangement over a single leased line with a System/360 computer. All communications are initiated by the computer by polling or addressing the terminals. Individual 2780 Terminals cannot communicate directly with one another in this arrangement. See Paragraph .35 for additional information on the control character sequences used in this arrangement.
- Printer Horizontal Format Control — Allows the 2780 terminal to store a horizontal format record containing horizontal tab (HT) characters in specified positions; remaining data positions are filled with space characters. The HT characters in the format record identify the beginning of printed data fields. When an HT character is received in an incoming message, the next data field will be printed beginning with the next horizontal tab position as defined by the HT character in the stored format record. The format record remains stored until a card is read or punched, a new format record is received, or the power is removed from the terminal. Card reading or punching has no effect on the stored format record when SBT code is used. A format record is identified by the prefix ESC HT. This feature cannot be used when the 2780 is operating off-line, or when operating in the Transparent mode.
- Synchronous Clock — Allows the 2780 Terminal to operate with data sets that do not supply clocking pulses, such as the Bell System Data Set 202C or 202D. The Synchronous Clock provides clocking for operation at a specified data rate of 1200, 2000, or 2400 bits per second. The sync pattern at the beginning of each transmission is expanded from three to seven SYN characters when using the Synchronous Clock.
- Auto Answer — Allows the 2780 Terminal to automatically answer calls from another 2780 Terminal or a System/360 computer. Calls are accepted only when either the reader, punch, or printer is ready. The initial mode of operation (i.e., Transmit or Receive) must be anticipated by the operator. A 20-second timer is started when a call is answered. If no data is received during this period, the terminal is automatically disconnected. A timed-out call is not considered an error condition. A

(Text continued on page 6457:07)

TABLE I: USASCII DATA TRANSMISSION CODE

Bit Positions b7 b6 b5 →	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b4 b3 b2 b1 ↓								
0 0 0 0	NUL	DLE	SP	0	@	P	`	p
0 0 0 1	SOH	DC1	!	1	A	Q	a	q
0 0 1 0	STX	DC2	"	2	B	R	b	r
0 0 1 1	ETX	DC3	#	3	C	S	c	s
0 1 0 0	EOT	DC4	$	4	D	T	d	t
0 1 0 1	ENQ	NAK	%	5	E	U	e	u
0 1 1 0	ACK	SYN	&	6	F	V	f	v
0 1 1 1	BEL	ETB	'	7	G	W	g	w
1 0 0 0	BS	CAN	(	8	H	X	h	x
1 0 0 1	HT	EM	)	9	I	Y	i	y
1 0 1 0	LF	SUB	*	:	J	Z	j	z
1 0 1 1	VT	ESC	+	;	K	[	k	{
1 1 0 0	FF	FS	,	<	L	\	l	|
1 1 0 1	CR	GS	-	=	M	]	m	}
1 1 1 0	SO	RS	.	>	N	^ ①	n	~
1 1 1 1	SI	US	/	?	O	_	o	DEL

Reprinted from IBM 2780 Data Transmission Terminal — Component Description, Form A27-3005, published by IBM.

① IBM 2780 uses a ¬ (Logical NOT) in place of the Circumflex.

TABLE II: IBM SYSTEM/360 EBCDIC CODE

Bit Positions 4,5,6,7	00 00	00 01	00 10	00 11	01 00	01 01	01 10	01 11	10 00	10 01	10 10	10 11	11 00	11 01	11 10	11 11
0000	NUL	DLE	DS		SP	&	-									0
0001	SOH	DC1	SOS				/		a	j			A	J		1
0010	STX	DC2	FS	SYN					b	k	s		B	K	S	2
0011	ETX	DC3							c	l	t		C	L	T	3
0100	PF	RES	BYP	PN					d	m	u		D	M	U	4
0101	HT	NL	LF	RS					e	n	v		E	N	V	5
0110	LC	BS	ETB	UC					f	o	w		F	O	W	6
0111	DEL	IL	ESC	EOT					g	p	x		G	P	X	7
1000		CAN							h	q	y		H	Q	Y	8
1001		EM							i	r	z		I	R	Z	9
1010	SMM	CC	SM		¢	!		:								
1011	VT				.	$	,	#								
1100	FF	IFS		DC4	<	*	%	@								
1101	CR	IGS	ENQ	NAK	(	)	_	'								
1110	SO	IRS	ACK		+	;	>	=								
1111	SI	IUS	BEL	SUB		¬	?	"								

Note: ETB = EOB, ESC = PRE } Duplicate Assignments

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(Contd.)

TABLE III: IBM SIX-BIT TRANSCODE (SBT) DATA TRANSMISSION CODE

Bit Positions	2,1			
6,5,4,3	0 0	1 0	0 1	1 1
0000	SOH	&	-	0
1000	A	J	/	1
0100	B	K	S	2
1100	C	L	T	3
0010	D	M	U	4
1010	E	N	V	5
0110	F	O	W	6
1110	G	P	X	7
0001	H	Q	Y	8
1001	I	R	Z	9
0101	STX	SPACE	ESC	SYN
1101	.	$	,	#
0011	<	*	%	@
1011	BEL	US	ENQ	NAK
0111	SUB	EOT	ETX	EM
1111	ETB	DLE	HT	DEL

Reprinted from IBM 2780 Data Transmission Terminal — Component Description, Form A27-3005, published by IBM.

TABLE IV: SPECIAL CHARACTERS AVAILABLE WITH EACH IBM 2780 PRINTER CHARACTER SET

CHARACTER SET					
USASCII	EBCDIC			Six-BIT Transcode	
63*	63	52*	39	47*	39
¬ ! " :	¬ ! " :				
. $ ' #	. $ ' #	. $ ' #	. $ ' #	. $ ' #	. $ ' #
< * % @	< * % @	¤ * % @		¤ * % @	
( ) ⌐ '	( ) ⌐ '	( ) '			
+ ; = ⌊	+ ; = ¢	+ =			
⌋ ? & -	? & -	& -		& -	
/ > \	/ > |	/		/	

* Standard type-bar.

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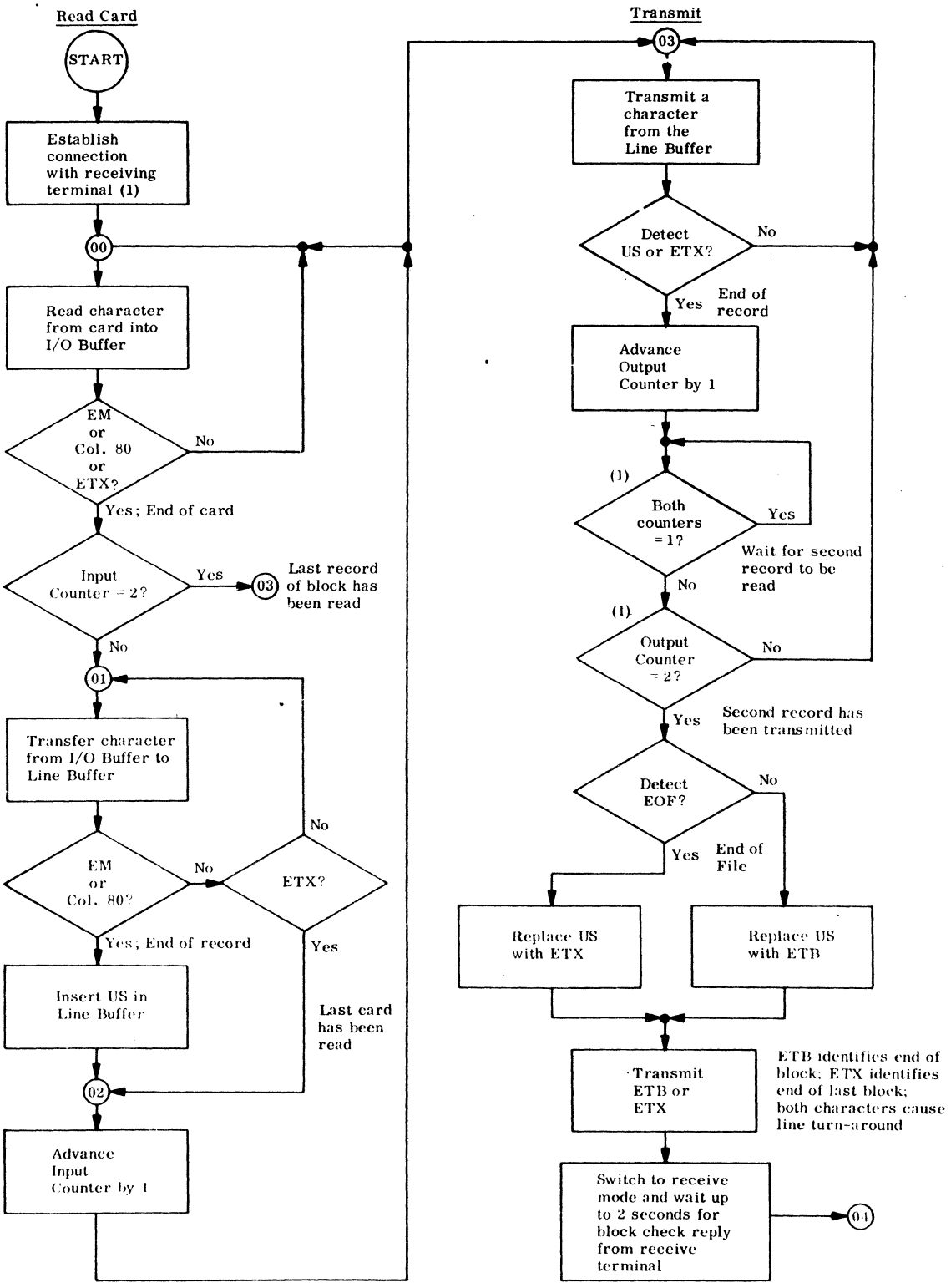
TABLE V: IBM 2780 PRINTER VERTICAL FORMAT CONTROL CODES

USASCII	EBCDIC and Six-Bit Transcode	Carriage Operation after Printing
ESC Q	ESC /	Single Space
ESC R	ESC S	Double Space
ESC S	ESC T	Triple Space
ESC A	ESC A	Skip to Channel 1
ESC B	ESC B	Skip to Channel 2
ESC C	ESC C	Skip to Channel 3
ESC D	ESC D	Skip to Channel 4
ESC E	ESC E	Skip to Channel 5
ESC F	ESC F	Skip to Channel 6
ESC G	ESC G	Skip to Channel 7
ESC H	ESC H	Skip to Channel 8

Reprinted from IBM 2780 Data Transmission Terminal — Component Description, Form A27-3005, published by IBM.



(1) Connection is established by manually dialing or signaling, or by addressing or polling operation when Multipoint Line Control feature is used.

Figure 2. IBM 2780 Transmit Mode

(Contd.)

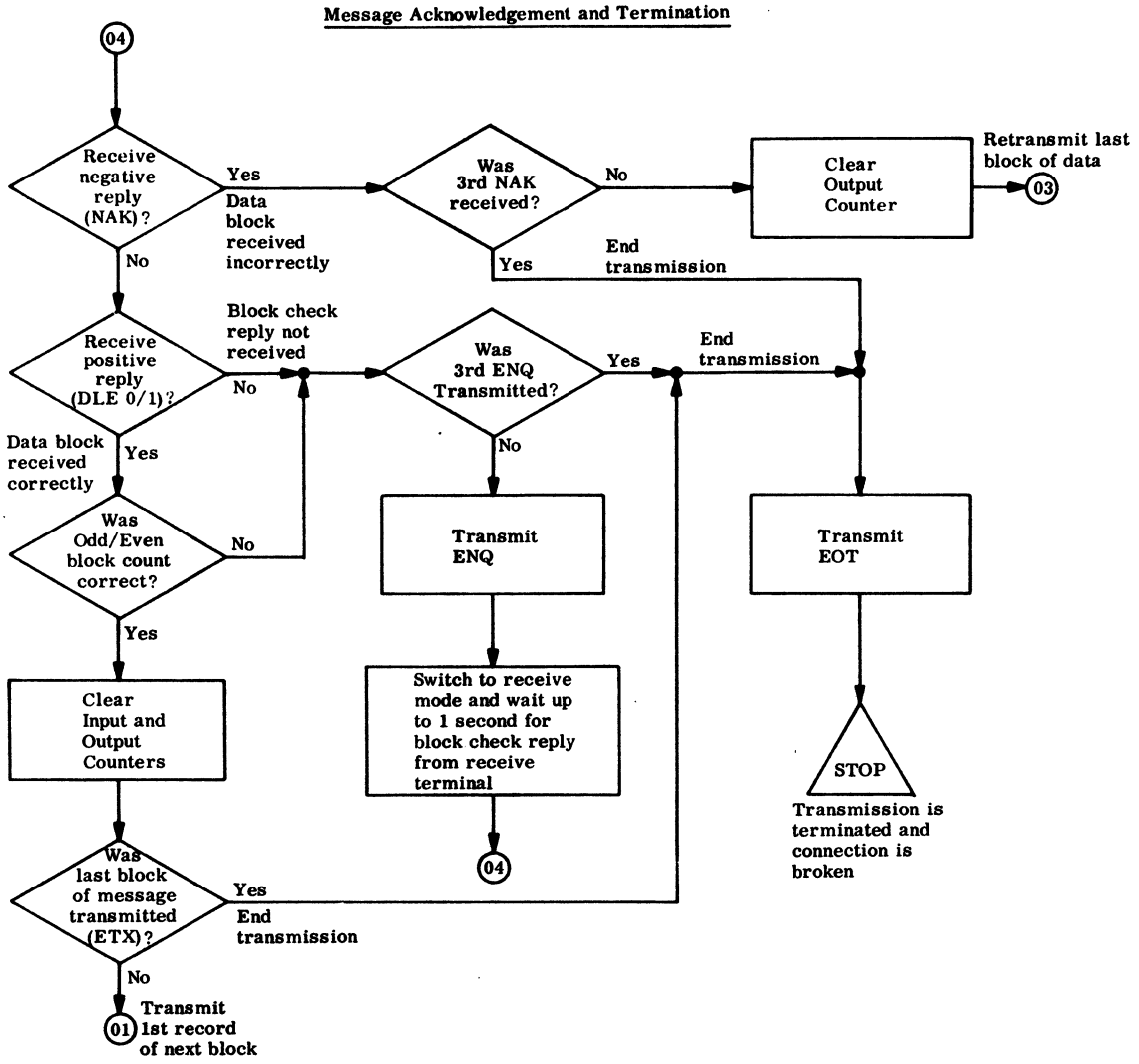
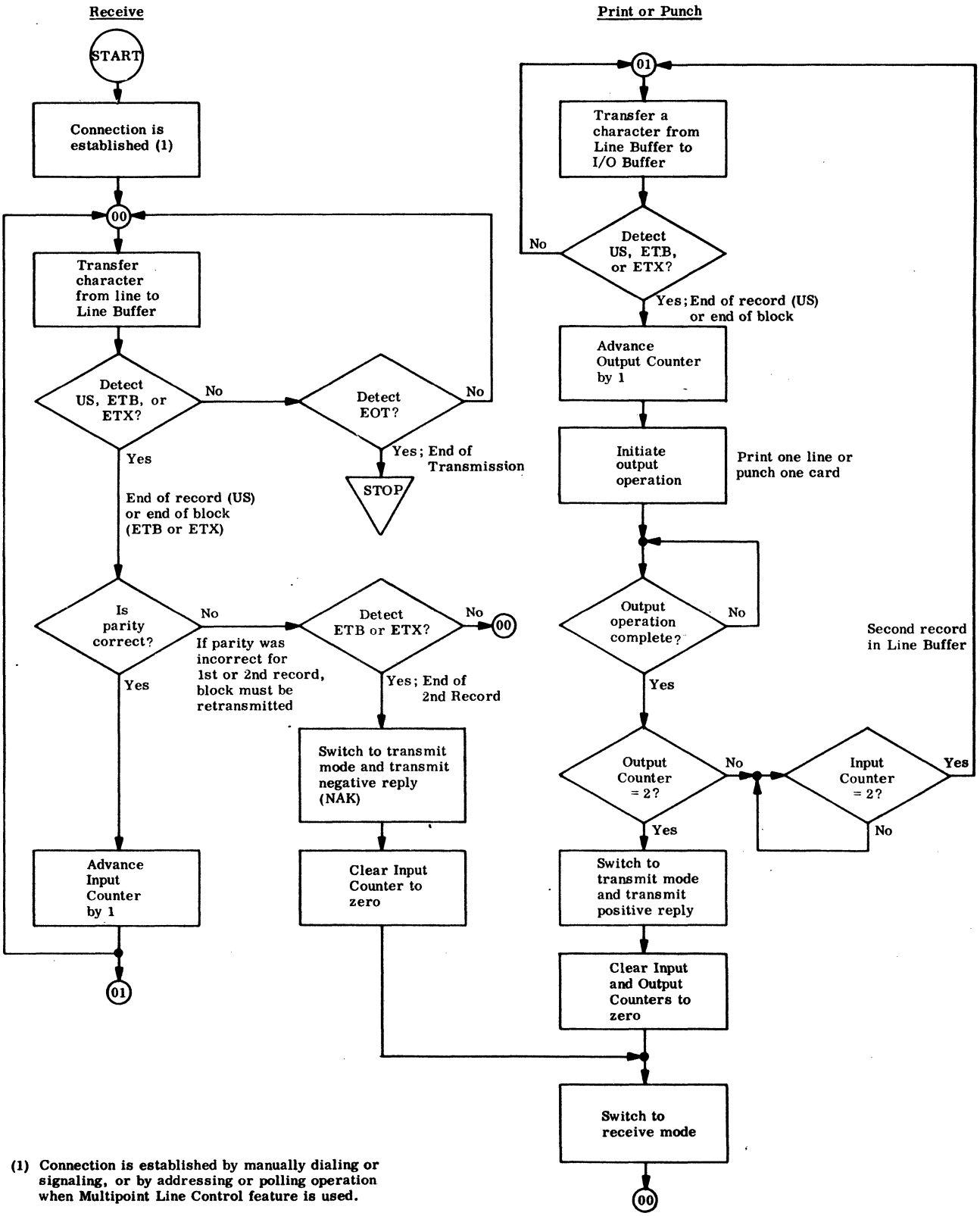


Figure 2. IBM 2780 Transmit Mode (Contd.)

completed call is ended when the calling terminal sends a two-character DLE EOT sequence which causes the called terminal to automatically disconnect. When the 2780 is communicating with another 2780 on a point-to-point basis, there is a 20-second delay between reception of the EOT character and disconnection.

- Multiple Record Transmission — Allows the 2780 Terminal to use all 400 positions of the line buffer and to transmit or receive up to seven records per block. A line-buffer overrun will occur if more than seven records or 400 characters have been read or received.
- Auto Turnaround — Allows the 2780 Terminal to switch automatically to Receive mode, with punch ready, following the transmission of a message. Punch-ready status is established when the reader senses a blank card following a series of data cards. The blank card causes transmission of an ETX character. The punch must be selected by the remote terminal by a component selection sequence.
- 120- or 144-Character Print Line — Allows the 2780 Terminal to print a total of 120 or 144 positions per line at 10 characters per inch. This feature is useful only when communicating with a System/360 computer, because another 2780 can only transmit 80-character records.



(1) Connection is established by manually dialing or signaling, or by addressing or polling operation when Multipoint Line Control feature is used.

Figure 3. IBM 2780 Receive Mode

(Contd.)

- EBCDIC Transparency — Allows unrestricted transfer of all bit patterns within the EBCDIC code; see Paragraph .35. The optional Printer Horizontal Format Control feature and component selection codes are void when the 2780 is in Transparency mode. The optional Multiple-Record feature can be used with Transparency, but record length is fixed at 80 characters.
- Selective Character Set — Allows the operator to replace the printer type-bar with one containing a different character set than the standard EBCDIC or SBT type-bar. This feature allows the use of a 39- or 63-character EBCDIC character set or a 39-character SBT character set. This feature is a prerequisite when using the USASCII code.

.2 CONFIGURATION

The IBM 2780 Data Transmission Terminal is available in four models having different combinations of input/output capabilities as follows:

- 2780 Model 1 — provides punched card input and printed output.
- 2780 Model 2 — provides punched card input and output in addition to printed output.
- 2780 Model 3 — provides printed output only.
- 2780 Model 4 — provides punched card input and output.

The standard communications facilities that can be accommodated and the associated data sets are listed in Paragraph .72.

The optional features available for each model of the 2780 Terminal are described in Paragraph .15.

.3 INPUT

.31 Prepared Input

Card Read Punch (2780 Models 1, 2, and 4) —

Input medium:	standard IBM 80-column punched cards.
Input code:	standard Hollerith card code.
Quantity of data:	up to 80 characters per card.
Character set:	depends on transmission code; see Tables I, II, and III.
Rated input speed:	400 cards/min.
Effective speed:	see Table VII.

.32 Manual Input: no provision.

.33 Fixed Input: no provision.

.34 Transaction Code Input: no provision.

.35 Message Configuration

Data is transmitted and received by a 2780 Terminal in blocks of two records for a standard configuration. If the optional Multiple-Record Transmission feature is included, a data block can contain up to seven data records. A data record normally consists of up to 80 data characters plus control characters. Records received from a System/360 computer can contain up to 120 or 144 data characters to utilize the optional expanded print line features.

Data-Link Control Characters

Nine data-link control characters are automatically encoded by the control circuitry in the 2780. The data-link control characters are stripped from the data at the receiving terminal. Table VI describes the function of each data-link control character.

Message Format

A Start-of-Message (STX) character is used at the beginning of each block; the text contained in the first record of the block follows the STX character. Each record is terminated by a US, ETB, or ETX character and is followed by one or two error-checking characters and one

.35 Message Configuration (Contd.)

sync (SYN) character. A Unit Separator (US) terminates each record of a block except the final record, which is terminated by an End-of-Transmission Block (ETB) character. The final record in the last block of a message is terminated by an End-of-Text (ETX) character. The receiving terminal will accept an SOH character in place of the STX character; however, the 2780 cannot transmit an SOH. A block of data is not accepted by the receiving terminal if the STX or SOH character is missing.

Terminal Status Interrogation

Before transmitting a message to a remote terminal, the transmitting terminal must determine the status of the receiving terminal. The 2780 interrogates the receiving terminal by sending an enquiry message consisting of four SYN characters followed by an ENQ character. The receiving terminal must respond to the enquiry with a positive reply indicating that the terminal is ready to receive or a negative reply indicating the terminal is not ready because of an existing contingency. If a reply is not received from the remote terminal within a predetermined period of time, a second enquiry message is sent. An EOT character is sent and disconnect procedure initiated after four unsuccessful attempts to interrogate the terminal. The data message is transmitted when the 2780 receives a positive reply to an enquiry.

End-of-Block Response

The receiving terminal responds to an ETB or ETX character designating the end of a block or end of the final block in a message, respectively. The terminal responds to a correctly received block by sending a positive reply to the transmitting terminal; a negative reply is sent in response to an incorrectly received block.

A positive reply to an ETX character causes the transmitting terminal to send an EOT which terminates the transmission.

The transmitting terminal will retransmit an incorrectly received block up to three times (when transmitting from 2780 to 2780) before operator intervention is required. When communication is between a 2780 and a System/360 computer, the number of retransmissions is specified by the stored program in the computer. A negative reply to a final retransmission causes the transmitting terminal to send an End-of-Transmission (EOT) character, followed by disconnection.

Block Sequence Check

The 2780 Terminal employs an odd/even block count to insure the correct sequencing of data blocks within a message. The first block in a message is identified as an odd block. Block checking is performed at both the transmitting and receiving terminals. The odd/even count is toggled at the receiving terminal in response to a correctly received block, and a positive reply containing the toggled block count is sent to the transmitting terminal, where it is compared to the transmitter block count. When the compared block counts do not agree, the transmitting terminal sends an ENQ requesting that the receiving terminal retransmit the positive reply. Up to three enquiries can be sent before the transmitting terminal terminates the call with EOT.

Output Selection

Selection between the printer or punch for output in a 2780 Model 2 in the Receive mode is controlled by a two-character sequence: ESC plus a component-selection code. The sequence must follow an STX or US end-of-record character, in the first record of the transmitted message. Selection is sustained until the next selection code is received. The punch is selected by the digit "4" following an ESC; the printer, by any printer-control character following an ESC. Invalid codes are either ignored or cause an erroneous print operation to be performed.

EBCDIC Transparency

When the EBCDIC Transparency feature is used, message Transparency is entered through a DLE STX sequence and exited through a DLE followed by a US, ETB, or ETX character, two sync characters, a second US character, and one or two check characters. Transparency can be entered or exited only after a record check sequence. Record length is fixed at 80 characters; EM or ETX characters read from the card are ignored. Control character recognition

(Contd.)

TABLE VI: IBM 2780 DATA-LINK CONTROL CHARACTERS

Control Character	Function	Character Transmitted
Sync	To establish and maintain synchronization.	SYN
Enquiry	To interrogate remote terminal as to readiness (a request to transmit).	ENQ
Start-of-Text	To alert remote terminal as to the beginning of a block of text.	STX
Unit Separator	To end record and initiate error checking.	US
End-of-Transmission Block	To initiate error checking at end of last record in a block; initiates line turn-around to allow remote terminal to respond with a positive or negative reply.	ETB
End-of-Text	To initiate error checking at end of last record in a message; initiates line turn-around to allow remote terminal to respond with a positive or negative reply.	ETX
Data-Link Escape	To acknowledge an enquiry from the transmitting terminal, DLE is followed by a zero which indicates the receiving terminal is ready to receive data. To inform the transmitting terminal that the last block of data was received without error, a DLE is followed by an even or odd block designation. * To enter into or exit from the EBCDIC Transparency mode, a DLE is followed by an STX or an ETB respectively; to identify a control character when in transparency, a DLE precedes the control character; to be accepted as data, a DLE is followed by another DLE automatically inserted at the transmitting terminal and stripped at the receiving terminal.	DLE
Negative Acknowledgement	To acknowledge an enquiry from the transmitting terminal, NAK indicates that the receiving terminal is not ready to receive data; to inform the transmitting terminal that the last block of data transmitted was received in error.	NAK
End-of-Transmission	To inform the receiving terminal that the message is completed and transmission is to be terminated; to abort transmission when sent from the receiving terminal; to indicate that the polled terminal does not have data to transmit.	EOT

* The following odd/even block designations are for USASCII, SBT, and EBCDIC codes:

USASCII: 1 (odd); 0 (even)
SBT: T (odd); - (even)
EBCDIC: 61 (odd); 70 (even)

The EBCDIC designations are hexadecimal code representations and have no corresponding graphic characters.

TABLE VII: EFFECTIVE DATA TRANSMISSION RATES OF IBM 2780 TERMINAL

Component and Record Size (1)	Data Transmission Rate, records per minute (2)			
	Half-duplex, 2000 bits/sec (3)		Full-duplex, 2400 bits/sec (4)	
	SBT (5)	USASCII or EBCDIC (6)	SBT (5)	USASCII or EBCDIC (6)
Card Reader —				
24 char/record	215	196	390	370
40 char/record	199	171	355	310
80 char/record	143	118	237	182
Card Punch —				
25 char/record	165	155	190	190
40 char/record	138	130	145	145
80 char/record	91	89	91	91
Printer —				
25 char/record	180; 195	160; 171; 184	240; 300	199; 240; 300
40 char/record	168; 182	147; 157; 167	240; 300	199; 240; 277
80 char/record	145	117	218; 233	177; 183, 183
120 char/record	113	90	170	130
144 char/record	98	78	145	110

(1) Record size includes HT horizontal format characters and ESC sequences controlling vertical spacing but excludes all other control characters.

(2) A record corresponds to one card or one line of print. The data transmission rates include transmission of all control characters, turnaround times, and the transmission of acknowledgement messages. The blocking used is two records per block; slightly higher transmission rates may be achieved in some cases if the Multiple-Record Transmission feature is installed and more than two records are transmitted per block. The actual rate when communicating between two 2780's will be the lower of the card reader and printer or punch rates, depending on which is receiving.

(3) This transmission mode is normally used over the public telephone network.

(4) This transmission mode is normally used with a full-duplex leased voice-band line.

(5) Where two sets of figures are shown for the printer, the first corresponds to the 47-character type-bar, and the second to the 39-character type-bar. When only one figure is shown, the rate is the same for both arrangements.

(6) Where three sets of figures are shown for the printer, the first corresponds to the 63-character type-bar, the second to the 52-character type-bar, and the third to the 39-character type-bar. When only one figure is shown, the rate is the same for all three arrangements.

.35 Message Configuration (Contd.)

is established by preceding a control character with a DLE character. A second DLE character is automatically inserted following a DLE read from a card; the receiving terminal treats this sequence as one DLE data character. When the printer is receiving in Transparent mode from a System/360 computer, the record length must be equal to the number of print positions plus a two-character vertical forms-control sequence if other than single-line spacing is desired.

Multipoint Line Control

When the 2780 Terminal is part of a multi-station configuration using the Multipoint Line Control feature, component selection differs from the basic operation. The computer polls or addresses one of the remote terminals using a three-character address sequence. The first character identifies the terminal, the second identifies the component (reader, punch, or

(Contd.)

printer), and the third character is an ENQ which ends the sequence. The printer, punch, or reader is selected by the character "3", "4", or "6", respectively. Any character can be selected for terminal identification. An addressing sequence which contains a "3" or "4" is defined as a selection sequence; a "6" defines a polling sequence.

The 2780 Terminal responds to a polling sequence with a negative response (EOT) or a positive response (STX). A negative response indicates that the terminal is not ready to transmit; a positive response indicates that data will follow. No response is returned if the polled terminal is in the off-line mode.

The 2780 Terminal responds to a selection sequence with a negative response, which indicates that the selected component is not ready to receive, or a positive response. No response is returned if the selected terminal is in the off-line mode.

The basic terminal component selection sequence (ESC plus selection code) is inoperative when the Multipoint Line Control feature is installed. All ESC sequence codes, when used in the first two character positions of data, are interpreted as vertical or horizontal format-control sequences. The 2780 Terminal, when initially switched on, remains in a non-addressable receive-text mode until a sync pattern followed with an EOT is received. The terminal is then switched to control mode and will recognize a polling or selection sequence. An STX following a sync pattern returns the terminal to its initial mode.

.36 Operating Procedure

(1) Operator establishes connection by dialing or signaling, coordinates the transmission with the remote operator, checks that the data set is ready for transmission, and switches to data mode.

(2) Operator verifies that synchronization between terminals has been established and that all components are in a ready condition by observing the control panel lights.

(3) Operator selects proper operation mode and loads data cards if transmitting or readies the card read punch or printer if receiving. The transmitting terminal operator then presses the Start key.

The exchanges of data messages and control signals are under the control of the terminals. Further intervention by the operator is required only when errors are repeatedly detected in retransmission of the same data block, when reading, punching, or printing component malfunctions or errors are detected, and when the call is terminated.

The Auto Answer option permits transmission or reception of messages by an unattended IBM 2780 Terminal.

Two special control characters, Bell (BEL) and End-of-File (EOF), can be transmitted, under certain conditions, by manually depressing a key. A BEL character can be sent in response to polling, in place of a block-checking response, at any time between messages, or in place of data. The BEL character lights an indicator and sounds an audible alarm at the receiving terminal. Depressing the EOF key causes an ETX data-link control character to be transmitted after the last card has been read. An STX ENQ sequence is normally sent after the last card when the EOF key is not depressed.

.37 Entry of Time and Date: . . . . . no provisions.

.4 OUTPUT

.42 Output to Punched Cards

Card Read Punch (2780 Models 2 and 4) —

Card type and size: . . . . . standard IBM 80-column punched cards.
Card code: . . . . . standard Hollerith card code.
Rated punching speed: . . . . . 160 columns/sec; 91 to 355 cards/minute, depending on number of columns punched.
Effective speed: . . . . . see Table VII.
Format control: . . . . . none except capability for punching records of less than 80 characters.

.44 Output to Printer

Printer (2780 Models 1, 2, and 3) —

Output medium:	pin-fed continuous fanfold forms from 4.00 to 16.75 inches in width; 80, 120 (optional), or 144 (optional) printing positions; 10 characters per inch horizontal spacing and 6 or 8 lines per inch vertical spacing.
Character set:	47 or 39 (optional) with SBT code; 52, 39 (optional), or 63 (optional) with EBCDIC code; 63 with USASCII code.
Rated printing speed —	
With 39-character set:	300 lines/min.
With 47- or 52-character set:	240 lines/min.
With 63-character set:	200 lines/min.
Effective speed:	see Table VII.
Format control:	vertical forms spacing is initiated by a 2-character control sequence (see Table V); skips of over 3 lines are controlled by punches in carriage control loop; horizontal tab (optional) is initiated by HT character in data and controlled by prestored format control record.
Comments:	the Selective Character Set feature is required to use an optional character set or the USASCII code.

.5 ERROR DETECTION AND CORRECTION

IBM has introduced a polynomial checking technique, referred to as Cyclic Redundancy Checking (CRC), for use with Binary Synchronous Communications. The CRC technique uses a checking polynomial to generate a 12-bit (SBT code) or 16-bit (EBCDIC code) block check character which is appended to each block of data transmitted. The received block check character is compared with a block check character generated from the received data. Comparison of the block check characters determines the validity of the received message block. Both EBCDIC and SBT transmission codes use the CRC error checking technqiue. Transmissions using USASCII are not checked by the CRC technique, but employ an odd-parity check bit for each character and a longitudinal redundancy check character at the end of each record.

.51 Data Entry Errors

Type of checking:	character validity checks, card registration, card column count, and photo-transistor check.
Error indication:	terminal halts, a lamp is lighted, and an audible alarm is sounded.
Correction procedure:	manual intervention.

.52 Data Transmission Errors

Type of checking:	cyclic redundancy checking (CRC) for EBCDIC and SBT; character parity (odd) and longitudinal redundancy check for USASCII.
Error indication:	receiving terminal returns a negative acknowledgement (NAK) at the end of a block.
Correction procedure:	automatic retransmission of block received in error; terminal halts, a lamp is lighted, and an audible alarm is sounded if three retransmissions fail when two 2780 Terminals are communicating; computer controls number of retransmissions when a 2780 is transmitting to a System/360 computer.

.53 Data Recording Errors

Type of checking:	echo check to verify that correct dies have been activated in card punch; character parity checking on data sent to printer, but no direct check on printed output.

(Contd.)

Error indication: . . . . . a lamp is lighted and an audible alarm is sounded.
Correction procedure: . . . . . operator intervention.

.54 Buffer Errors

Type of checking: . . . . . odd character parity checking on USASCII and SBT; USASCII is checked on entering or exiting the buffers; SBT character parity is generated on entering the buffers and checked on exiting; even longitudinal parity is generated for each EBCDIC record entering and exiting the buffers, and entrance and exit parity characters are compared for accuracy; buffer is checked when transmitting or receiving to insure buffer capacity is not exceeded and/or that no more than two records per block are received (overrun).
Error indication: . . . . . when a buffer error is detected, the transmitting terminal sends an ENQ code, the receiving terminal responds with NAK, and the transmitting terminal sends an EOT which terminates the transmission; the receiving terminal replies to a block-checking sequence with a NAK response (line buffer overflow) or with an EOT which terminates the transmission; a lamp is lighted and the audible alarm is sounded.
Correction procedure: . . . . . operator intervention.
Comments: . . . . . the transmitting terminal immediately sends an ENQ code to the receiving terminal if a line buffer parity error or overflow condition is detected; an STX ENQ sequence is sent following a correct response to a block check to indicate an I/O buffer error condition; the receiving terminal responds to the STX ENQ sequence with NAK, and the transmitting terminal sends an EOT code which terminates the transmission.

.55 Line Malfunctions

Detection: . . . . . failure to receive data or a response within a 1, 2, or 3 second period, depending on operation and whether the terminal is transmitting or receiving.
Action: . . . . . up to three enquiry sequences are automatically transmitted; if an enquiry sequence or response is still not received, the terminal halts and operator intervention is required. In addition the Data Set Ready lamp is lighted.

.6 CONDITION INDICATORS

A comprehensive array of lamps and switches on the main operator panel, which is located on the Card Read Punch in Models 1, 2, and 4 and on the Printer in Model 3, displays the flow of data through the buffers, the mode of operation, the status of each component, and transmission errors. The operator panel on the Model 3 (receive-only printer) is an abbreviated version of the operator panels used on the other models.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed: . . . . . 1200, 2000, or 2400 bits/sec.
Transmission method: . . . . . serial by bit.
Transmission code: . . . . . 8-level USASCII, EBCDIC, or 6-bit SBT; see Tables I, II, and III.

.71 Basic Characteristics (Contd.)

Transmission mode: . . . . . half-duplex.
Order of bit transmission: . . . . . low-order bit first.
Synchronization: . . . . . synchronous; a special character (SYN) is transmitted between terminals prior to data transmission.

.72 Connection to Communications Lines

Communications Line	Data Set*
Common-carrier leased voice-band line operating at the following speeds:	
Up to 1200 bits/sec:	Bell System Data Set 202C or 202D or Western Union 1200 Baud Data Modem.
2000 bits/sec:	Bell System Data Set 201A or Western Union 2400 Baud Data Modem.
2400 bits/sec:	Bell System Data Set 201B or Western Union 2400 Baud Data Modem.
Public telephone network operating at the following speeds:	
Up to 1200 bits/sec:	Bell System Data-Phone Data Set 202C.
2000 bits/sec:	Bell System Data-Phone Data Set 201A.

.73 Transmission Control

Call initiation: . . . . . manual dialing or signaling.
Call reception: . . . . . capable of unattended transmit or receive operation with optional Auto Answer feature.
Functional operations: . . . . . Model 2 punch or printer can be selected by control codes; vertical form spacing or skipping and horizontal tabulation on printer; audible alarm can be initiated by Bell character.

.74 Multistation Operation: . . . . . the optional Multipoint Line Control feature enables the 2780 to respond to polling or addressing by the controlling System/360 computer when a number of 2780 Terminals are connected in a multistation arrangement; see Paragraph .15.

.8 PHYSICAL SPECIFICATIONS

Component	IBM 2780 Data Transmission Terminal			
	Model 1	Model 2	Model 3	Model 4
Width (inches)	86	86	86	43
Depth (inches)	56	56	56	24
Height (inches)	49	49	49	49
Weight (pounds)	1700	1700	1500	600
Power (KVA)	1.9	2.2	1.5	1.4
Voltage	208/230	208/230	208/230	208/230
Frequency (cps)	60	60	60	60
Phases	1	1	1	1
Temperature Range (°F.)	60 to 90	60 to 90	60 to 90	60 to 90
Humidity Range (%)	8 to 80	8 to 80	8 to 80	8 to 80
Heat (BTU/hr)	5300	6200	4200	4000

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

(Contd.)

.9 PRICE DATA

Component or Feature	Monthly Rental $	Purchase Price $	Monthly Maintenance $
2780 Data Transmission Terminal			
Model 1 (card read and print)	875	38,410	215.00
Model 2 (card read, card punch, and print)	970	42,680	260.00
Model 3 (print only)	725	32,010	200.00
Model 4 (card read and punch)	680	29,875	180.00
Optional Features			
Auto Answer	15	660	1.00
Auto Turnaround	10	440	1.00
Multiple Record Transmission	15	660	2.00
Printer Horizontal Format Control	29	925	1.00
Print Line			
120-character	82	3,630	6.00
144-character	44	1,920	3.00
Selective Character Set	25	1,065	3.50
Synchronous Clock	25	1,065	1.00
EBCDIC Transparency	15	660	0.50
Multipoint Line Control	25	1,065	2.50

IBM MAGNETIC TAPE SELECTRIC TYPEWRITER WITH REMOTE RECORD

.1 GENERAL

.11 Identity: . . . . . IBM Magnetic Tape Selectric Typewriter (MT/ST) with Remote Record.

.12 Manufacturer: . . . . . International Business Machines Corp.
Office Products Division
590 Madison Avenue
New York, New York 10022

.13 Basic Function: . . . . . two-way recorded- or typed-message communication at 14.8 char/sec over the public telephone network.

.14 Basic Components

Name: . . . . . IBM MT/ST with Remote Record.
Model number: . . . . . Model II.
Function: . . . . . data entered from keyboard or received from communications line is recorded on a magnetic tape and printed; recorded data can be transmitted.

Name: . . . . . IBM MT/ST with Remote Record.
Model number: . . . . . Model IV.
Function: . . . . . same as Model II, but includes two tape units and has the capability for transmitting or receiving using either tape; one tape can be updated using corrections recorded on the second tape; data from the two tapes can be merged and the result printed locally or transmitted.

.15 Description

The IBM Magnetic Tape Selectric Typewriter (MT/ST) with Remote Record is designed to provide half-duplex typed- or recorded-message data communications at up to 14.8 characters per second over the public telephone network to a second MT/ST with Remote Record. The MT/ST employs a 6-level code; odd parity and unity start and stop bits, each character transmitted. Table I presents the MT/ST transmission code.

The MT/ST with Remote Record is an extension of the MT/ST originally designed for a typing station in an office environment.

The MT/ST with Remote Record is available in two different models; each model contains an IBM Selectric typewriter and a magnetic tape console. MT/ST Model II contains a single magnetic tape station; MT/ST Model IV contains two magnetic tape stations.

Each tape station of the MT/ST magnetic tape console contains one (Model II) or two (Model IV) incremental tape recorders that employ a 35- or 100-foot reel of half-inch wide, 9-channel magnetic tape enclosed in a plastic container (cartridge) measuring 4-1/4 inches by 4-1/4 inches. Up to 23,240 characters can be stored in each cartridge; recording density is 20 characters per inch.

The MT/ST can be operated in two modes: local and remote. Data can be entered on the magnetic tape from the keyboard when in local mode; a printed copy is produced while recording. The recorded tape can be read back and edited from the keyboard; a typed copy is produced while editing the recorded message. Recorded data can be updated when using the dual-tape Model IV MT/ST; again, a typed copy is produced during this operation. When operating in the remote mode, a recorded message can be transmitted to a second MT/ST with Remote Record over a communications line. A typed copy of all transmissions is also produced.

Editing is flexible; a complete line, word, or character can be added to or deleted from text by simple keyboard operations. The text recording is automatically compensated for these changes by expanding to insert data or by closing up when deleting data. Data updating can be performed on the Model IV MT/ST by placing a clean tape on the left tape station and the tape to be updated

Figure 1. IBM MT/ST Model IV with Remote Record.

.15 Description (Contd.)

on the right tape station. After placing the Model IV in the proper mode, data is read from the right tape and recorded on the left; a typed copy of the recorded data is produced concurrently. Updating data is entered from the keyboard, which overrides the magnetic tape data and permits data to be entered in any line, word, or character location on the updated page.

A search operation can also be performed to locate data at any desired location. Prior to the search operation, the operator must enter a search code at specified locations while recording data. To search, the operator dials the search code and initiates the search operation. The MT/ST automatically searches the tape for the dialed code at 900 characters per second, halting at the desired location.

When it is desired to transmit a recorded message to another MT/ST with Remote Record, the operator establishes the connection by dialing the remote MT/ST. Once the connection is established, the operator places the data switch on the data set in the data mode and depresses the Start key on the magnetic tape console to initiate data transmission. The Start key automatically generates a bid character on the line which places the remote MT/ST in the receive mode and locks its keyboard. Data can be transmitted from tape or keyboard by selecting the proper mode. When operating with the Model IV, left or right tape stations can be manually selected.

A typed copy of the transmitted data is produced concurrent to the transmission at both transmit and receive stations.

The receiving operator can interrupt the transmission when desired, by switching his data set to voice, thereby halting tape action at both transmitting and receiving stations and locking the keyboard at the transmitting station. Voice coordination is then required.

Messages of greater length than 23,240 characters can be transmitted by replacement and/or manual selection (Model IV only) of tape cartridges at both transmit and receive stations. This procedure requires voice coordination at the end of each cartridge.

(Contd.)

TABLE I: IBM MT/ST TRANSMISSION CODE

Lower Case	Bit Position							Upper Case
	1	2	3	4	5	6	7 (P)	
.	1	0	0	0	0	1	1	.
;	0	1	0	1	1	1	1	:
,	1	1	0	1	1	1	0	;
'	0	1	0	0	0	1	1	"
!	0	0	0	0	0	1	0	°
=	1	0	0	0	1	1	0	+
-	1	1	1	0	1	1	0	—
/	0	1	1	1	1	1	0	?
1/]	0	0	0	1	0	0	0	[/±
2	1	0	0	0	0	0	0	@
3	1	0	0	1	0	0	1	#
4	0	1	1	1	0	0	0	$
5	0	1	0	0	0	0	0	%
6	1	1	0	0	0	0	1	¢
7	0	1	0	1	0	0	1	&
8	1	1	0	1	0	0	0	*
9	1	1	1	0	0	0	0	(
0	0	1	1	0	0	0	1	)
a	1	1	0	1	0	1	1	A
b	1	1	1	0	1	0	1	B
c	1	1	0	1	1	0	1	C
d	0	1	0	1	1	0	0	D
e	0	1	0	0	1	0	1	E
f	1	0	0	1	1	1	1	F
g	0	0	0	1	1	1	0	G
h	0	1	1	0	1	0	0	H
i	1	1	0	0	0	1	0	I
j	0	0	0	0	1	1	1	J
k	1	1	0	0	1	0	0	K
l	0	1	1	1	1	0	1	L
m	0	0	0	1	0	1	1	M
n	1	0	0	0	1	0	1	N
o	0	1	1	1	0	1	1	O
p	0	1	0	0	1	1	0	P
q	1	1	0	0	1	1	1	Q
r	0	1	0	1	0	1	0	R
s	0	1	1	0	0	1	0	S
t	0	0	0	0	1	0	0	T
u	1	0	0	1	1	0	0	U
v	1	0	0	1	0	1	0	V
w	1	1	1	0	0	1	1	W
x	0	0	0	1	1	0	1	X
y	0	1	1	0	1	1	0	Y
z	0	0	0	0	0	0	1	Z
Function Codes (non-printing)								**Meaning**
CR	0	0	1	0	0	0	0	New Line (Carriage Return and Line Feed)
TAB	0	0	1	0	0	1	1	Horizontal Tab
SPACE	0	0	1	0	1	1	0	Space
BKSP	0	0	1	1	0	1	0	Backspace
STOP (1)	1	0	1	1	0	0	0	Stop
FEED (1)	1	0	1	0	1	0	0	Line Feed
AUTO SEARCH (1)	1	0	1	0	0	1	0	Automatic Search
SWITCH (1)	1	0	1	0	0	0	1	Switch
STOP TRANSFER (1)	1	0	1	1	1	1	0	Stop Transfer
UC (2)	0	0	1	1	0	0	1	Upper-Case Shift
LC (2)	0	0	1	1	1	0	0	Lower-Case Shift
D (2)	0	0	1	0	1	1	0	Bid

(1) Tape codes not transmitted on line.

(2) Line codes not recorded on tape.

(P) Odd parity bit.

.16 First Delivery: . . . . . April 1968.

.17 Availability:. . . . . 4 months.

.2 CONFIGURATION

The IBM Magnetic Tape Selectric Typewriter with Remote Record consists of a manual input keyboard, a printing component, a magnetic tape station, and a data set. The Model II MT/ST includes a single tape station; the Model IV MT/ST includes two tape stations.

.3 INPUT

.31 Prepared Input

Magnetic Tape —

Input medium: . . . . . 0.5 inch magnetic tape recorded at 20 char/inch.
Input code: . . . . . 7-level IBM Magnetic Tape Selectric Typewriter Code; see Table I.
Quantity of data:. . . . . variable; up to 23,240 characters.
Character set: . . . . . 44 distinct codes, in conjunction with upper and lower case control codes, provide 88 upper and lower case alphabetic, numeric, and special characters.
Rated input speed: . . . . . 14.8 char/sec.
Effective speed: . . . . . tape is synchronized with typewriter; see .44.
Comments: . . . . . each tape cartridge has a 23,240 character storage capacity; left or right tape stations can be manually selected on Model IV to provide an effective capacity of any multiple of 23,240 characters.

.32 Manual Input

Keyboard —

Method of entry:. . . . . via 44-key keyboard; additional keys provide special functions such as backspace, carriage return, horizontal tab, etc.
Quantity of data:. . . . . variable, up to 23,240 characters.
Character set: . . . . . 44 distinct character codes, in conjunction with upper and lower case control code, provide 88 upper and lower case alphabetic, numeric and special characters.

.33 Fixed Input:. . . . . data entered from keyboard is recorded directly on magnetic tape when terminal is in local mode; several keyboard arrangements are available.

.34 Transaction Code Input:. . . . . no provision.

.35 Message Configuration: . . . . . Bit character (" D ") followed by up to 23,240 text characters; message is terminated when receiving terminal switches to voice; bid character is automatically transmitted by depressing Start key.

.36 Operating Procedure

(1) Establish connection by dialing.
(2) Depress Data button data set.
(3) Depress Start key on magnetic tape console.

If the magnetic tape console is in the Play mode, data is transmitted from the magnetic tape; if data transmission from keyboard is desired, mode switches must not be in Play mode or tape must be removed.

(4) Key in message (if applicable).
(5) Switch to voice (coordinate message with receiving operator).
(6) Hang up to terminate call.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.43 Output to Magnetic Tape

Tape size: . . . . . 0.5-inch recorded at 20 char/inch.
Tape code: . . . . . 7-level IBM Selectric Typewriter Code; see Table I.
Rated output speed: . . . . . 14.8 char/sec.
Effective speed: . . . . . synchronized with typewriter; see .44; speed dependent upon typing rate when entering data via keyboard.
Format control: . . . . . several types of function codes can be recorded.
Comments: . . . . . each tape cartridge has a 23,240-character storage capacity; left or right tape stations can be manually selected on Model IV to provide an effective capacity of any multiple of 23,240 characters.

.44 Output to Printer

Output medium: . . . . . friction-fed or pin-fed (optional) roll paper or fanfold forms up to 15.5 inches wide (13-inch writing width).
Character set: . . . . . 88 printable characters; see Table I.
Rated printing speed: . . . . . 14.8 char/sec.
Effective speed: . . . . . less than rated speed due to carriage return, line feed, or other format operations.
Format control: . . . . . controlled by function codes in incoming data or manually by operator. Controls include line feed, carriage return, case shift, backspace, and horizontal tab.
Comments: . . . . . horizontal spacing is 10 char/inch (12 char/inch optional) vertical spacing is 6 lines/inch (8 lines/inch optional).

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors: . . . . . no provision.

.52 Data Transmission Errors

Type of checking: . . . . . character parity is checked for each character received from communications line.
Error indication: . . . . . indicator lamp lights.
Correction procedure: . . . . . receiving operator switches to voice on data set, interrupting data transmission; (transmitting tape is automatically halted; voice coordination is required; transmitting operator performs line return function and retransmits data.

.53 Data Recording Errors

Type of checking: . . . . . read-after-write character parity check.
Error indication: . . . . . indicator lamp lights, operation halts, and keyboard is locked.
Correction procedure: . . . . . operator keys backspace and re-enters data.

.55 Line Malfunctions

Detection: . . . . . line malfunctions are interpreted as incorrect parity or no response.
Action: . . . . . indicator lamp lights; operation halts; operator attention is required.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed: . . . . . 14.8 char/sec (134.5 bits/sec).
Transmission method: . . . . . serial by bit.
Transmission code: . . . . . 7-level IBM Selectric Typewriter Code (6 bits plus parity); unity start and stop bits are added to each character (total of 9 bits/char); see Table I.
Transmission mode: . . . . . half-duplex.
Order of bit transmission: . . . . . high-order bit of each character is transmitted first.
Synchronization: . . . . . start-stop.

.72 Connection to Communications Lines

Communications Line or Service	Data Set*
Public telephone network:	Bell System Data-Phone Data Set 103A2.

.73 Transmission Control

Call initiation: . . . . . manual dialing or signaling.
Call reception: . . . . . operator attention is recommended although terminal is capable of auto answer.
Functional operations: . . . . . different control codes perform a variety of functions such as line feed, carriage return, case shift, horizontal tab, backspace, etc.

.74 Multistation Operation: . . . . . no provision.

.8 PHYSICAL SPECIFICATIONS

Component	MT/ST Typewriter and Desk	MT/ST Magnetic Tape Console
Width (inches)	45	15
Depth (inches)	30	34.5
Height (inches)	29.5	36
Weight (pounds)	62*	242
Power (KVA)	Power is derived	0.4
Voltage	from magnetic tape	115
Frequency (Hz)	console	60
Phases		
Temperature Range (°F)	33-85	33-85
Humidity Range (%)	8-80	8-80
Heat (BTU/hr)	—	1,100

* Weight of typewriter only

.9 PRICE DATA

Component or Feature	Monthly Rental $	Purchase Price $	Monthly Maintenance $
Magnetic Tape Selectric Typewriter with Remote Record			
Model II (single-tape station)	275	10,750	45.60
Model IV (double-tape station)	333	13,135	53.50

* In some cases, equivalent data sets can be used; see Sections 4620 and 4640 for a current list of modems available from independent manufacturers of telephone equipment.

IBM 2265 DISPLAY STATION

.1 GENERAL

.11 Identity: . . . . . 2265 Display Station; 2845 Display Control, and 1053 Model 4 Printer.

.12 Manufacturer: . . . . . International Business Machines Corp.
Data Processing Division
112 East Post Road
White Plains, New York

.13 Basic Function: . . . . . visual display, via a cathode ray tube, of data to be transmitted between a 2265 and a remote IBM System/360 computer; data can be entered via a keyboard; printed output is optional.

.14 Basic Components

Name: . . . . . 2265 Display Station.
Model number: . . . . . 1.
Function: . . . . . display of alphanumeric data.

Name: . . . . . 2845 Display Control.
Model number: . . . . . 1.
Function: . . . . . provides basic control and buffer storage for one 2265 Display Station and 1053 Printer.

Name: . . . . . 1053 Printer (optional).
Model number: . . . . . 4.
Function: . . . . . provides printed output; maximum of one per 2845 Control.

.15 Description

The IBM 2265 Display Station is designed to facilitate rapid access to data stored in an IBM System/360 computer, under control of a stored program in the computer. The 2265 displays data on the face of a cathode ray tube and can include a keyboard for data entry by the operator.

The 2845 Control can be connected directly to a Multiplexor or Selector Channel of an IBM System/360 Model 25, 30, 40, 44, 50, 65, 67, 75, or 85 computer, or it can be connected remotely via a common-carrier leased voice-band line, appropriate data sets, and a 2701 Data Adapter Unit incorporating an IBM Terminal Adapter Type III (see Report 8442). The 2265 Display Station can be located up to 50 cable-feet from the 2845 Control.

The data transmission rate between a directly-connected 2265/2845 station and the computer is 2560 character per second. When the 2265/2845 is connected remotely, the data transmission rate is 120 or 240 characters per second (1200 or 2400 bits per second, respectively). The 2265/2845 station can operate in a multi-station environment. Up to 16 2265/2845 stations can be connected to a single communications line.

The functional operation of the 2265 when connected to a System/360 computer is similar to its operation when connected remotely. The remainder of this report reflects the 2265 Display Station operating remotely, as a communications terminal device, except where specifically stated.

Basic Operation

The 2265 Display Station and associated 2845 Display Control operate in a half-duplex mode. All communication between the display complex and the remote computer is initiated by the computer.

Displayed data is received from the remote computer or is keyed into the 2265 by the operator. When data is to be entered, the operator keys in the data and depresses the Enter key. The displayed data will be transmitted to the computer the next time the computer requests a transfer.

Figure 1. IBM 2265 Display Station.

.15 Description (Contd.)

Except when an error is detected in a command sequence, all data messages are acknowledged to indicate correct or incorrect reception by both the 2845 Control and the remote computer.

The 7-level USASCII transmission code is employed, with an eighth bit added for character parity. A total of 10 bits are transmitted for each character, including start and stop bits. The remote System/360 computer automatically converts the seven-level code into an eight-level code by adding a bit; see Table I. These converted codes do not correspond to the internal EBCDIC code of a System/360 computer. If extended internal computation or output at the computer site is desired, data received from a 2265 Display Station will need to be converted to the internal code by the stored program in the System/360 computer.

Display Complex

A display complex consists of the following components:

- One 2845 Display Control, Model 1;
- One 2265 Display Station, Model 1; and
- One 1053 Model 4 Printer (optional).

The 2845 Display Control contains the basic control logic, buffer storage, character generator, and communications interface for the 2265 Display Station. The stroke technique is employed to generate the display characters. A Data Set Adapter is required to interface the 2845 Control with a data set. Two Data Set Adapters are available for operation at 1200 and 2400 bits per second. An interval clock is provided for 1200 bit-per-second operation; an external clocking signal is required for the higher speed operation.

(Contd)

TABLE I: IBM 2265 DISPLAY STATION USASCII DATA TRANSMISSION CODE (6)

Bits	B_7 B_6 B_X B_5		0 0 0 0	0 0 0 1	0 1 0 0	0 1 0 1	1 0 1 0	1 0 1 1	1 1 1 0	1 1 1 1
	B_4 B_3 B_2 B_1	Col→ Row↓	0	1	2	3	4	5	6	7
	0 0 0 0	0	Note 1 / Note 2		SP	0		P	?	P
	0 0 0 1	1	SOH			1	A	Q	A	Q
	0 0 1 0	2	STX			2	B	R	B	R
	0 0 1 1	3	ETX		#	3	C	S	C	S
	0 1 0 0	4	EOT		$	4	D	T	D	T
	0 1 0 1	5		NAK	%	5	E	U	E	U
	0 1 1 0	6	ACK		&	6	F	V	F	V
	0 1 1 1	7			'	7	G	W	G	W
	1 0 0 0	8		CAN	(	8	H	X	H	X
	1 0 0 1	9			)	9	I	Y	I	Y
	1 0 1 0	10	LF		*	:	J	Z	J	Z
	1 0 1 1	11			+	;	K	Note 4 ↓	K	Note 5
	1 1 0 0	12	Note 3 ↑		,	<	L		L	¬
	1 1 0 1	13			-	=	M		M	
	1 1 1 0	14			.	>	N		N	|
	1 1 1 1	15			/	?	O	_	O	

Note 1. Displayed and printed as the EOM (—) symbol.

Note 2. Displayed and printed as the Check (▌) symbol.

Note 3. Displayed on 2265's as the New Line (◢) symbol. Causes a carriage return and line feed on the 1053 Model 4 Printer.

Note 4. Displayed and printed as the SOM (▶) symbol.

Note 5. The codes represented by the characters within the dotted outline are the USASCII-8 codes for the lower-case alphabetic characters. These codes are converted to upper case by the 2845 and displayed as upper-case characters. If retrieved by a read operation, the codes will be in the upper-case bit configuration.

Note 6. The 8-bit codes shown in this table are the codes as they appear in the core memory of the remote IBM System/360 computer. The USASCII transmission code is obtained by deleting bit X. This conversion is performed by the 2701 Data Adapter Unit prior to transmitting data to a 2265 Display Station and after receiving data from a 2265.

Note 7. Graphic representations are undefined for the bit patterns outside the heavily outlined portions of the chart. These bit patterns are referred to as undefined graphic bit patterns. If an undefined graphic bit pattern is sent from channel to the device, the graphic that will be displayed or printed by the device is not specified.

Note 8. IBM reserves the right to change at any time the graphic displayed or printed by this device for an undefined graphic bit pattern.

.15 Description (Contd.)

The Display Station consists of a 14-inch cathode ray tube and an optional alphanumeric keyboard that can be directly attached to the display unit or located up to five feet away.

One of two display formats can be specified:

- 15 rows with 64 characters per row, or
- 12 rows with 80 characters per row.

A total of 960 characters can be displayed using either format.

The 1053 Model 4 Printer is a modified version of the IBM Selectric Typewriter and is similar to the printers used in IBM 1050 Data Communications Systems. Only one 1053 Model 4 Printer can be connected to a 2845 Display Control via an optional 1053 Adapter. The buffered Adapter accepts computer messages of up to 240 characters or data entered via the 2265. A print operation can be initiated by the remote computer, as described later; a Display Station operator can also cause the station display to be printed.

Commands

The IBM 2265 Display Station, in combination with a 2845 Display Control, is capable of responding to eight commands transmitted by the remote computer.

There are four read commands for transmitting data from the Display Station to the computer:

- Specific Poll to 2265 Station — initiates transfer of data displayed by a specific station to the computer, provided that the SOM symbol is displayed and the Enter key has been depressed.
- Specific Poll to Printer — initiates transmission of printer status to computer (e.g., busy, ready, not ready).
- General Poll — initiates transfer of Printer status and/or displayed data to computer from the addressed 2845 Display Control. The message from a 2265 Station is transferred if the SOM symbol is displayed and the Enter key has been depressed. Messages are accompanied by the address of the corresponding Display Station.
- Read Addressed Full Display Station Buffer — initiates unconditional transfer to the computer of the entire buffer for the addressed station.

Selected portions of the display can be transmitted in response to a Specific or General Poll; see the paragraphs under Editing Facilities.

There are four write commands for transferring data to a Display Station or Printer:

- Write Addressed Display Station — conditions the 2845 Control and the addressed station for reception and display of the associated message.
- Erase/Write Addressed Display Station — causes the display of the addressed station to be erased and the cursor to be positioned at the first displayable position.
- Write Printer — conditions the 2845 Control and the 1053 Printer for reception and printing of the associated message. A positive indication of status is returned if the printer is ready and not busy.
- Write Display Line Address — same as Write Addressed Display Station except that the display is started on the indicated line instead of on the first line. The Line Addressing Feature is required in the 2845 Display Control for the use of this command.

Editing Facilities

The 2265 Display Station provides a flexible set of edit functions incorporating a high degree of cursor mobility. A non-destructive cursor is standardly used; a destructive cursor can be specified at no additional cost.

Cursor controls include:

- Advance — advances cursor one character position. The destructive cursor causes a blank to be stored in the cursor position.

(Contd.)

.15 Description (Contd.)

- Backspace — backspaces cursor one character position. If cursor occupies first character position on line it is moved to the last character position of the previous line.
- Space/Erase — advances the cursor one character position erasing the position occupied by the cursor. A blank is stored in the cursor position when the destructive cursor is used.
- Down — positions the cursor down one line; cursor occupies same location in line. The cursor "wraps-around;" i.e., moves from the last line to the first line.
- Up — positions the cursor up one line; cursor occupies same location in line. The cursor "wraps-around"; i.e., moves from the first line to the last line.

The cursor is moved at a rate of nine characters per second when the Advance or Backspace keys are held down. The destructive cursor erases each character location occupied by the cursor.

Either cursor can be advanced to the first position of the next line by depressing the New Line key. This operation also causes the New Line symbol to be displayed in the position occupied by the cursor prior to initiating the New Line function. The cursor moves to the first position of the first line when the cursor occupies a position on the last line prior to the New Line function (wrap-around).

When transmitting in response to a Specific Poll or General Poll command, data located between the New Line symbol and the end of that line is not transferred. When receiving, a New Line code in the text data causes the display to jump to the beginning of the next line; data between the New Line symbol and the end of the line is not erased. This "split-screen" capability allows fixed information such as table or entry headings to be continuously displayed without the need for retransmitting them each time.

The Line Addressing Feature permits the cursor, under program control, to be positioned to the first character position of any line.

Other edit functions include:

- Erase Display — erases entire display, relocating cursor to the first displayable character location.
- Erase to End of Line — erases entire line beginning with the character location following the cursor; the cursor is not moved.
- Erase to End of Screen — erases all data following the cursor to the last displayable character location.

Error Checking and Correction

Character and longitudinal parity checking is performed on all data received by the 2845 Control from the remote computer; character parity bits and longitudinal check characters are generated and transferred with all data transmitted from the 2845 Control. If the remote computer returns a negative acknowledgement indicating that an error was detected at the computer site, the 2845 Control automatically retransmits the message.

The 2845 Control also checks the parity and validity of each command sequence received from the computer. If errors are detected, the 2845 does not make a response of any kind.

Programming Support

IBM states that the software support for the 2701 Data Adapter Unit is extended to cover 2265 Display Stations as remote terminals under BTAM and QTAM for the Operating System/360 and under BTAM for the Disk Operating System; see Paragraph 8442.4 in the report on the 2701.

.16 First Delivery: . . . . . April 1969.

.17 Availability: . . . . . ?

.2 CONFIGURATION

The 2265 Display Station includes:

- One 2845 Display Control, Model 1,
- One 2265 Display Station, Model 1, and
- One 1053 Model 4 Printer if desired.

Up to 16 2265/2845 Stations can be connected to the same communications line (multi-station operation).

The 2265 Display can be located up to 50 feet from the 2845 Display Control.

The 2845 Control and 2265 Display Station network can communicate over a common-carrier leased voice-band line with an IBM System/360 Model 25, 30, 40, 44, 50, 65, 67, 75, or 85 computer system incorporating an IBM 2701 Data Adapter Unit. The transmission speed is 1200 or 2400 bits per second, depending on the Data Set Adapter selected. Once installed, the transmission speed is fixed; i.e., the operator cannot select between the two speeds. See Paragraph .72 for the communications facilities that can be accommodated and the data set required for each.

The 2845 Control can also be connected directly to a control unit position of an input/output channel of an IBM System/360 Model 25, 30, 40, 44, 50, 65, 67, 75, or 85 computer system.

In addition to the capability to connect a 1053 Printer, two other optional features are available: Line Addressing and Destructive Cursor.

.3 INPUT

.31 Prepared Input: . . . . . no provision.

.32 Manual Input

Alphanumeric Keyboard —

Method of entry: . . . . . via optional 50-key keyboard.
Quantity of data: . . . . . up to 960 characters.
Character set: . . . . . 64 characters, including digits, upper-case letters, and special symbols; see Table I.
Comments: . . . . . 6 of the 50 keys provide control functions only and do not produce a displayable symbol; 5 keys to the right of the keyboard provide edit and control functions.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration

Communication between the remote computer and a 2265 Display Station or 1053 Printer is initiated when the computer transmits a four-character addressing sequence to the 2845 Display Control. This sequence consists of the following characters: EOT (poll or read) or SOH (write), Control address, device address, and command character. The command character specifies one of the eight commands discussed in Paragraph .15.

When a poll command addressed to a Display Station is received, the appropriate 2265 Station responds with a text message consisting of the following characters: STX, Station address, text, ETX, and LRC (longitudinal redundancy check). If a parity error is detected in the buffer when transmitting, the CAN character is inserted just prior to the ETX character. If the computer receives the message without detecting an error, an ACK character is transmitted to the 2265. If an error is detected, the NAK character is transmitted and the 2845 Control automatically retransmits the message.

After the message has been correctly received and the acknowledgement transmitted, the computer can transmit one or more messages to the Display Station. Each message from the computer consists of the following characters: STX, text, ETX, and LRC. Each message is acknowledged with an ACK or NAK character.

(Contd.)

.35 Message Configuration (Contd.)

If the command is a General Poll, Printer status is first interrogated (if 1053 Adapter is installed) to determine that the Printer is waiting for a computer message and is not busy (ready status). A positive response to printer status is provided by the 2845 Control which responds: STX, printer address, ETX, and LRC. The required response to this sequence is: STX, text, ETX, and LRC. After accepting the Printer message, the 2845 responds with ACK. Another message may be received by the Printer or the operation is terminated by SOH or EOT.

The General Poll must be reinitiated after a printer operation to interrogate the 2265 Display status, or if a negative response to printer status was transmitted by the 2845, the 2265 Display status is interrogated.

If the command is a write command, the 2845 responds with an ACK character if it receives the command correctly and a NAK if not. The computer then transmits one or more messages to the addressed station in the same format as above. Each message is acknowledged with an ACK or NAK by the 2845. If the command is a Line Address Write, the line address is inserted following the STX character in the computer text message.

The 2845 Control will make no response if it detects a parity error or an invalid command or address in the addressing sequence.

A one-character response of EOT or NAK from the 2845 Control is transmitted to indicate: a negative response to a polling command, end of transmission to a read command, data lost condition to a write command, buffer overflow, or printer busy when addressed. The EOT character normally terminates communication.

The text can contain up to 960 characters. Except for data following a New Line symbol, all displayed characters and symbols are included in the text, excluding the cursor. The displayed data between a New Line symbol and the end of the line is not transmitted when a 2265 is polled, and will not be over-written or erased during a write operation.

.36 Operating Procedure

A message to be transmitted from a 2265 Display Station is composed by positioning the cursor at the desired starting position, depressing the Shift key and Start key(which enters the SOH symbol in the cursor position), and keying the data using New Line symbols where applicable. Controls are provided to space forward or backward, move up or down a line at a time, and to return the cursor to the beginning of the next line. The cursor identifies the next display position to be entered. When the optional destructive cursor is moved to a position already containing a display character, that position is erased. The standard non-destructive cursor can be moved freely without erasing data.

To transmit a message, Enter key is depressed; this action locks the keyboard and puts the Display Station in a wait condition. When the station is polled by the remote computer, the data stored in the buffer will be transmitted to the computer. A successful transmission causes the SOH symbol to be erased and the keyboard unlocked. If a transmission error is detected at the remote computer, an automatic retransmission can be requested. For certain types of errors, other correction techniques may be used, as controlled by the stored program in the remote computer.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.44 Output to Printer

1053 Model 4 Printer —

Output medium: . . . . . friction-fed forms up to 15 inches in width; pin-feed platen is optional; 13-inch maximum print line; printing is 6 or 8 lines per inch vertically and 10 or 12 characters per inch horizontally.
Character set: . . . . . 63 characters plus space; see Table I.
Rated printing speed: . . . . . 14.8 char/sec.
Effective speed: . . . . . somewhat below rated speed due to carriage return and line feed operations.

.44 Output to Printer (Contd.)

Format control: . . . . . controlled by function codes in the data message; SOM and EOM cause an SOM and EOM symbol to be printed, respectively; the New Line code causes a carriage return, and line feed.

Comments: . . . . . printing mechanism is similar to IBM Selectric Typewriter.

.46 Output to Visual Display Device

2265 Display Station —

Output medium: . . . . . cathode ray tube; displays green characters against gray background.

Character set: . . . . . digits 0-9, upper-case letters A-Z, and 28 punctuation and special symbols; see Table I.

Character size: . . . . . depends on display format specified; 0.16 inch wide and 0.32 inch high* or 0.13 inch wide and 0.26 inch high; see Comments.

Display size: . . . . . depends on display format specified; 10.4 inches wide by 4.8 inches high* or 10.4 inches wide by 3.12 inches high; see Comments.

Characters per line: . . . . . depends on display format specified; 64* or 80; see Comments.

Lines per display: . . . . . depends on display format specified; 15* or 12; see Comments.

Characters per display: . . . . . 960.

Buffer capacity: . . . . . 960 characters.

Format control: . . . . . each space position on the display occupies one character position in the buffer; cursor can be moved one space at a time horizontally or vertically in either direction; automatic cursor wrap-around from last position to first when advancing or first position to last when backspacing; Destructive Cursor is optional; a portion of each line can be fixed and not transmitted; entire display except for fixed portion is transmitted each time.

Rated output speed: . . . . . 2560 char/sec when connected directly to a System/360 channel; 120 or 240 char/sec over a voice-band line.

Effective output speed: . . . . . lower than rated speed due to exchange of control messages and presence of header characters.

Comments: . . . . . two display formats are available; all entries marked by asterisk belong to first display format; those entries that are not marked belong to second display format.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors: . . . . . visual checking only; depression of a key representing a non-existent character causes the Check symbol to be displayed on the screen.

.52 Data Transmission Errors

Type of checking: . . . . . character and longitudinal parity checks.

Error indication: . . . . . negative response (NAK) if parity error is detected in text or if LRC character is not correct; no response if parity error is detected in address sequence; character parity errors are displayed as a Check symbol in place of the character in error.

Correction procedure: . . . . . automatic retransmission by 2845, or as programmed in computer.

(Contd.)

.53 Data Recording Errors: . . . . . no checking, except visual.

.54 Buffer Errors

Type of checking: . . . . . character parity is checked prior to transmission from 2845 buffer; because of buffer structure, character pairs are checked for parity when refreshing display from buffer; character parity is checked on each character transferred from 2845 buffer to print buffer.

Error indication: . . . . . inclusion of CAN character just prior to ETX in transmitted message; internal parity errors are indicated by two Check ( ) characters displayed approximately one-half screen apart; each Check character is displayed in the character position immediately following each possible parity error and overwrites previous data; a Check symbol is printed as the last character of a printer operation and precedes the EOM symbol if the error was detected in the display buffer, or follows the EOM symbol if the error was detected in the print buffer; a space is substituted in place of the erroneous character if the error was detected in the print buffer.

Correction procedure: . . . . . response to the CAN character is anticipated as a NAK character, which initiates retransmission; attempted keyboard entry following the displayed Check characters causes the keyboard to lock; depressing the Reset key unlocks the keyboard.

Comments: . . . . . if a Read Buffer command is received prior to a keyboard restoration, a CAN character is transmitted.

.55 Line Malfunctions: . . . . . no provisions for checking.

.6 CONDITION INDICATORS: . . . . . message status, data set status and power.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed: . . . . . 120 or 240 char/sec (1200 or 2400 bits/sec, respectively).

Transmission method: . . . . . serial by bit.

Transmission code: . . . . . 7 data bits plus parity bit and unity start-stop bits; a total of 10 bits are transmitted for each character.

Transmission mode: . . . . . half-duplex.

Order of bit transmission: . . . . . low-order bit (B1) is transmitted first, parity bit last.

Synchronization: . . . . . unity start and stop bits are transmitted with each character.

.72 Connection to Communications Lines

Communications Line or Service	Data Set*
Bell System leased line Type 3002-C1 Data Channel (1200 bits/sec):	Bell System Data Set 202D.
Bell System leased line Type 3002-C2 Data Channel (2400 bits/sec):	Bell System Data Set 201B.

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

.73 Transmission Control

Call initiation:	only when polled or addressed by remote computer.
Call reception:	normally a 2265 complex operates over a dedicated line and a permanent connection maintained.
Functional operations:	line feed and carriage return operations can be initiated by control characters in the text of a message.

.74 Multistation Operation

Polling:	up to 16 2845/2265 stations can be attached to a communications line; units attached to a 2845 control can be polled individually (Specific Poll) or all units connected to a 2845 Control can be polled (General Poll).
Addressing:	2845/2265 stations cannot communicate directly with one another; the remote computer can selectively communicate with each terminal.

.8 PHYSICAL SPECIFICATIONS

Component	2265 Display Unit		2845 Display Control	1053 Model 4 Printer
	Without Keyboard	With Keyboard		
Width (inches)	18.375	18.375	15	14
Depth (inches)	17.375	26	26	14
Height (inches)	16.375	16.375	27	17
Weight (pounds)	75	90	195	40
Power (KVA)	—	—	—	0.1
Voltage	115	115	115	115
Frequency (Hz)	60	60	60	60
Phases	1	1	1	1
Temperature Range (°F)	50-110	50-110	50-110	60-90
Humidity Range (%)	8-80	8-80	8-80	20-80
Heat (BTU/hr)	—	—	—	335

.9 PRICE DATA

Component or Feature	Monthly Rental $	Purchase Price $	Monthly Maintenance $
2265 Display Station, Model 1	170	5,430	40.00
Alphanumeric Keyboard	20	900	5.00
2845 Display Control, Model 1	170	8,295	28.25
1053 Model 4 Printer	49	1,940	10.00
Pin-Feed Platen	—	59.25	—
Special Features for 2845			
Destructive Cursor	NC	NC	NC
Line Addressing	10	450	NC
1053 Adapter	73	3,275	2.25

NC — No charge

KLEINSCHMIDT 300 SERIES TELEPRINTERS

.1 GENERAL

.11 Identity: . . . . . Kleinschmidt Model 311 Electronic Data Printer and Model 321 High Speed Automatic Data Set (ADS).

.12 Manufacturer: . . . . . Kleinschmidt Division of SCM Corporation Deerfield, Illinois

.13 Basic Function: . . . . . transmit data from paper tape (Model 321) or keyboard over a narrow-band or voice-band line at transmission rates up to 37.5 char/sec; receive data from a narrow-band or voice-band line at transmission rates up to 37.5 char/sec and punch it into paper tape (Model 321) and/or print data on paper form.

.15 Description

The Model 311 Electronic Data Printer and the Model 321 High Speed Automatic Data Set are included in the SCM Kleinschmidt 300 Series of teleprinters. These units serve as data communications terminals when connected to a communications line or as input-output devices when interfaced with a computer system.

Model 311 is available as a receive-only page printer, or as a send-receive set equipped with a keyboard.

Model 321 is an automatic send-receive set consisting of a keyboard, page printer, and paper tape reader and punch. The set can provide printed copy and/or punched paper tape copy from received messages, and can transmit messages automatically from the tape reader or manually from the keyboard.

All models and configurations require an Electronic Logic Module.

The Electronic Logic Module for Model 321 is enclosed in the table (Figure 1). Model 311 Printers can have three different module configurations: a separate package, a "bustle" behind the printer, or a table-mounted arrangement similar to the Model 321. These three logic packages are utilized according to the specific equipment requirements.

Both models can be equipped with a 32-key (3-row) keyboard for operation with conventional 5-level Baudot code. Alternatively, either model can be equipped with a 53-key or 52-key (4-row) keyboard for operation with a 6-level code (6 data bits per character) or 8-level ASCII code (7 data bits per character plus odd parity) respectively.

The keyboard is self-contained and does not require key pressure to drive the key-lever mechanism. Model 321 keyboards are equipped with an end-of-line indicator and a character counter.

The page printer used in both models employs a type drum containing the character set required by the keyboard type used. A double-hammer printing mechanism allows the printer to operate at a peak speed of 37.5 characters per second by processing two characters simultaneously. Many previously-sold models use a single-hammer printing mechanism that limits the transmission rate to a maximum of 20 characters per second. A single-hammer printer is now offered as an option for compatibility with previous Kleinschmidt single-hammer printers. Single-hammer printers are not available with the Model 321.

Printed line length is 72 characters, spaced at 10 characters per inch, or an optional 76, 78, or 80 characters per line with the same spacing. Vertical spacing is 6 lines per inch.

Rolls of paper or fanfold forms can be used by the printers, with paper widths of 8 inches for 72- or 76-character line lengths or 9 inches for 80-character line lengths. The printer sprocket pins can be retracted by the operator when friction feed is desired. The sprocket pins will feed the original and up to three copies, but only a single copy can be fed by friction feed.

Figure 1. Kleinschmidt Model 311 Electronic Data Printer (left) and Model 321 High Speed Automatic Data Set (right)

.15 Description (Contd.)

The paper tape reader and punch, (Model 321) are provided with adjustable tape guides to permit using standard 11/16-, 7/8-, or 1-inch paper tape with 5, 6, 7, or 8 code levels. Partially-punched (chadless) or fully-punched paper tape can be used on the readers; the punch produces fully-punched tape.

A wide range of serial-by-bit transmission rates is available when Models 311 and 321 are used as data communications terminals. The Kleinschmidt devices in this report use an 8-unit or 11-unit code structure (see Table I) as standard; however, Teletype-compatible unit-code structures of 7.0, 7.42, and 7.5 units at standard transmission rates from 45 to 75 bits per second are available. Unit-code structures of 9, 10, and 10.5 units are also available over a wide range of transmission rates. To change unit-code structures or transmission rates, it is only necessary to interchange a few printed-circuit boards in the Electronic Logic Module.

A two-position switch is provided to select one of two customer-selected transmission rates.

TABLE I: BASIC TRANSMISSION RATES

Code Level	Code Structure, Units*	Transmission Rate	
		Bits/Sec	Char/Sec
5	8.00	150 300	18.8 37.5
6	8.00	110 150	13.8 18.8
8	11.00	150 300	13.6 27.3

* Total number of bits per data character, including start and stop bits used for synchronization.

(Contd.)

Both models can be used on narrow-band communications lines when transmitting at the lower transmission rates; a voice-band communications line is required for transmission at 300 bits per second.

Models 311 and 321 can be used as input-output equipment interfaced with a computer system. Data transmission rates of up to 40 characters per second (parallel by bit) are obtainable. An 8-level (7 data bits plus odd parity) ASCII code is usually employed with this configuration.

Parallel data transmission can be used for data communications terminal applications, but is not recommended.

The Electronic Logic Module, contained in both models, provides logic circuits necessary for control of the page printer, tape reader and punch, and transmission rate regulation. Space is available in the module for optional features including Form Feed, Vertical Tab, etc.

Optional features available for Models 311 and 321 include:

- Choice of 5-, 6-, 7-, or 8-level code,
- Low paper alarm,
- Combined carriage return and line feed,
- Automatic carriage return and line feed,
- Various multistation operation control features,
- Extended print line length from 72 characters to 76, 78, or 80 characters, and
- Horizontal and vertical tabulation.

The keyboard page printer, paper tape reader, and punch contained in the Model 321 can be operated in various combinations to perform a variety of functions. For example, the keyboard and punch can be used for direct, off-line perforation of tape while the page printer remains free to receive incoming messages or to monitor messages transmitted from the tape reader.

.16 First Delivery: . . . . . Model 311: August 1964; Model 321: January 1966.

.17 Availability: . . . . . 5 to 10 months, depending on configuration.

.2 CONFIGURATION

Model 311, when used as a receive-only set, contains a page printer and Electronic Logic Module; when used as a send-receive set, it contains a page printer, keyboard, and Electronic Logic Module.

Model 321 contains a page printer, keyboard, paper tape reader and punch, and Electronic Logic Module.

Connection to standard communications facilities and the data set required, if any, are described in Paragraph .72.

.3 INPUT

.31 Prepared Input

Model 321 Paper Tape Reader —

Input medium:	11/16-, 7/8- or 1-inch fully-punched or partially-punched paper tape.
Input code:	5-level Baudot, 6-level code, or 8-level ASCII; see Tables II, III and IV. Optionally, any 5-, 6-, 7-, or 8-level code can be used.
Quantity of data:	variable.
Rated input speed:	40 char/sec.
Effective speed:	somewhat less than rated speed; depends on transmission rate and block length.
Comments:	holes are pin sensed; movement of the sensing pins is photoelectrically sensed.

TABLE II: KLEINSCHMIDT BAUDOT 5-LEVEL TRANSMISSION CODE

BIT 5 →					LETTERS		FIGURES	
					0	1	0	1
b_4	b_3	b_2	b_1	COLUMN → / ROW ↓	0	1	2	3
0	0	0	0	0	(BLANK)	T	(BLANK)	5
0	0	0	1	1	E	Z	3	"
0	0	1	0	2	(LINE FEED)	L	(LINE FEED)	)
0	0	1	1	3	A	W	(HYPHEN)	2
0	1	0	0	4	(SPACE)	H	(SPACE)	#
0	1	0	1	5	S	Y	(BELL)	6
0	1	1	0	6	I	P	8	0
0	1	1	1	7	U	Q	7	1
1	0	0	0	8	(C.R.)	O	(C.R.)	9
1	0	0	1	9	D	B	$	?
1	0	1	0	10	R	G	4	&
1	0	1	1	11	J	(FIGS)	'	(FIGS)
1	1	0	0	12	N	M	,	.
1	1	0	1	13	F	X	!	/
1	1	1	0	14	C	V	:	;
1	1	1	1	15	K	(LTRS)	(	(LTRS)

TABLE III: KLEINSCHMIDT 6-LEVEL TRANSMISSION CODE (1)

BITS 6, 5 →					00	01	10	11
b_4	b_3	b_2	b_1	COLUMN → / ROW ↓	0	1	2	3
0	0	0	0	0	†† @	T	†† 9	5
0	0	0	1	1	E	Z	3	"
0	0	1	0	2	(LINE FEED)	L	†† h	)
0	0	1	1	3	A	W	(HYPHEN)	2
0	1	0	0	4	(SPACE)	H	†† J	†† #
0	1	0	1	5	S	Y	†† k	6
0	1	1	0	6	I	P	8	0
0	1	1	1	7	U	Q	7	1
1	0	0	0	8	(C.R.)	O	†† /	9
1	0	0	1	9	D	B	$	?
1	0	1	0	10	R	G	4	&
1	0	1	1	11	J	†† '	(APOSTROPHE)	†† m
1	1	0	0	12	N	M	,	.
1	1	0	1	13	F	X	!	/
1	1	1	0	14	C	V	:	;
1	1	1	1	15	K	†† (	(	†† n

(1) This code is the same as the 5-level Baudot code in Table I with the addition of a sixth bit to indicate Letters or Figures shift.

†† Invalid code; the indicated symbol is printed if the code is received, but the code cannot be transmitted from the keyboard.

.32 Manual Input

Model 311 and Model 321 Keyboard —

Method of entry:	33-, 52-, or 53-key keyboard.
Quantity of data:	variable.
Character set:	64 or 96 (ASCII) characters, including upper-case letters, digits, special characters and functions; see Tables II, III, and IV.
Comments:	there is no mechanical linkage between keyboard keys and printing mechanism.

.33 Fixed Input: ..... no provision.

.34 Transaction Code Input: ..... no provision.

.35 Message Configuration: ..... 1 to N data characters with control characters interspersed; control characters are keyed in or are in the paper tape input (Model 321 only).

.36 Operating Procedure

The operating procedure can vary greatly depending on the application and the optional control features installed.

.37 Entry of Time and Date: ..... no provision.

.4 OUTPUT

.41 Output to Punched Tape

Model 321 Paper Tape Punch —

Tape size:	11/16-, 7/8, or 1-inch paper tape.
Tape code:	5-level Baudot, 6-level code, or 8-level ASCII; see Tables II, III, and IV. Optionally, any 5-, 6-, 7-, or 8-level code can be used.
Rated punching speed:	40 char/sec.
Effective speed:	somewhat less than rated speed; depends on speed of transmitting device, block length, and grade of transmission line used.
Format control:	none.

(Contd.)

TABLE IV: KLEINSCHMIDT ASCII TRANSMISSION CODE

BITS 7, 6, 5 →				000	001	010	011	100	101	110	111
b_4 ↓	b_3 ↓	b_2 ↓	b_1 ↓	COLUMN → / ROW ↓ 0	1	2	3	4	5	6	7
0	0	0	0	NULL	DLE	(SPACE)	0	`	P		
0	0	0	1	SOH	DC1	!	1	A	Q		
0	0	1	0	STX	DC2	"	2	B	R		
0	0	1	1	ETX	DC3	#	3	C	S		
0	1	0	0	EOT	DC4	$	4	D	T		
0	1	0	1	ENQ	NACK	%	5	E	U		
0	1	1	0	ACK	SYNC	&	6	F	V		
0	1	1	1	BELL	ETB	'	7	G	W		
1	0	0	0	BS	CNCL	(	8	H	X		
1	0	0	1	HT	EM	)	9	I	Y		
1	0	1	0	LF	SS	*	:	J	Z		
1	0	1	1	VT	ESC	+	;	K	[		
1	1	0	0	FF	FS	, (COMMA)	<	L	~		
1	1	0	1	RETURN	GS	- (HYPHEN)	=	M	]		
1	1	1	0	SO	RS	.	>	N	^		
1	1	1	1	SI	US	/	?	O	_ (UNDERLINE)		DEL
						TYPE WHEEL SYMBOLS					

NOTES:

(1) Odd parity bit b_8 is generated.
(2) Shift key inverts b_5 and b_8.
(3) Control key (CTRL) changes b_7 from 1 to 0 and inverts b_8.
(4) Shift and control keys invert b_5 and change b_7 from 1 to 0.
(5) ▭ is nonprint symbol in space position.
(6) Incoming codes from columns 0 and 1 will be discarded except for Bell, LF and Return.
(7) Incoming codes for columns 6 and 7 will be printed as corresponding characters in columns 4 and 5. The DEL code will not cause printing.
(8) All control characters appear on keys and can be transmitted from keyboard.

.44 Output to Printer

Model 311 and 321 Page Printer —

Output medium: . . . . . friction-fed or pin-fed roll or fanfold forms, 8 inches wide (72- or 76-position line) or 9 inches wide (78- or 80 position line.

Character set: . . . . . upper-case alphabetics, numerics, specials and punctuation marks; see Tables II, III, and IV.

Rated printing speed: . . . . . 37.5 char/sec.

Effective speed: . . . . . somewhat less than rated speed, depends on transmission speed, block length, and operations such as carriage return, line feed, etc.

Format control: . . . . . through the use of special control codes in the received data.

Comments: . . . . . horizontal spacing is 10 char/inch; vertical spacing is 6 char/inch.

.5 ERROR DETECTION AND CORRECTION: no detection facilities other than visual verification of manual input. A character parity bit is generated and transmitted with each character when using the ASCII keyboard arrangement. Parity error detection is available by request for ASCII models 311 and 321.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed: . . . . . up to 300 bits/sec; see Table I.

Transmission method: . . . . . serial by bit.

Transmission code: . . . . . 5-level Baudot, 6-level code, or 8-level ASCII; see Tables II, III, and IV. Optionally, any 5-, 6-, 7-, or 8-level code can be used.

.71 Basic Characteristics (Contd.)

Transmission mode:	half-duplex or full-duplex.
Order of bit transmission:	low-order bit of each character is transmitted first.
Synchronization:	start and stop bits are transmitted with each character; see Table I for code structure.

.72 Connection to Communications Lines

Communications Line or Service	Data Set*
Common-carrier leased telegraph-grade line (up to 75 bits/sec)	none required.
Bell System Schedule 3A Narrow-Band Data Channel (up to 150 bits/sec)	Bell System Data Set 103F.
Western Union Class D Data Channel (up to 180 bits/sec):	Western Union 180 Baud Data Modem.
Public switched telephone network (up to 300 bits/sec):	Bell System Data-Phone Data Set 103A.
Common-carrier leased voice-band line (up to 300 bits/sec):	Bell System Data Set 103F, or Western Union 1200 Baud Data Modem.

.73 Transmission Control

Call initiation:	manual.
Call reception:	manual.
Functional operations:	carriage return, line feed, bell, horizontal tab, and vertical tab are initiated by special control codes.

.74 Multistation Operation: various control units and additional Model 311 or 321 modifications allow multistation operation; e.g., selective polling and addressing. This feature is based on specific customer requirements.

.8 PHYSCIAL SPECIFICATIONS

Component	Model 311 R/O Printer	Model 311 S/R Printer	Model 321 ADS
Width (inches)	17	17	21
Depth (inches)	20.6	24.75	25.6
Height (inches)	9.75	9.75	35.9
Weight (pounds)	56	64	130
Power (KVA)	0.150	0.150	0.250
Voltage	115	115	115
Frequency (cps)	50* or 60	50* or 60	50* or 60
Phases	1	1	1
Temperature Range (°F)	32 to 132	32 to 132	40 to 122
Humidity Range (%)	up to 95	up to 95	up to 95
Heat (BTU/hr)	NA	NA	NA

* Pulley change is required for 50-cycle operation.

NA — Information not available from Kleinschmidt.

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

(Contd.)

.9 PRICE DATA

Kleinschmidt states that a complete price list would be impractical due to the great number of options and special arrangements possible. Price ranges for units equipped for bit-serial data communications are listed below.

Component or Feature	Purchase Price Range, $*
Model 311 Electronic Data Printer:	
Receive-Only Page Printer	2,370 to 3,355
Send-Receive Set	3,790 to 4,470
Model 321 Automatic Data Set	5,748 to 6,401
Options	
Extended Print Line:	
76 Character Positions	7
78 Character Positions	10
80 Character Positions	15
Horizontal Tab	100 to 235
Vertical Tab	105 to 165

* The price ranges reflect the use of different transmission codes and keyboards. The first figure is for a 5-level Baudot arrangement; the second is for an 8-level ASCII arrangement. Information on quantity discounts, lease rates, and maintenance charges can be obtained from Kleinschmidt for specific equipment arrangements.

MOHAWK 1100 SERIES DATA-RECORDERS

1. GENERAL

1.1 Identity: ..... 1100 Series Data-Recorders; see Table I for a list of the current models in the line.

1.2 Manufacturer: ..... Mohawk Data Sciences Corporation
P.O. Box 630
Herkimer, New York 13350

1.3 Basic Function: ..... transmission of computer-compatible magnetic tape data over a voiceband line; source tape can be recorded and verified via keyboard.

1.4 Basic Units: ..... see Table I

1.5 Description

The Mohawk 1100 Series Data-Recorders are designed to reduce or eliminate the need for punched cards as an input medium for computer installations. The 1100 Series Data-Recorders record data directly on magnetic tape in a format compatible with the IBM 729 Series Magnetic Tape Units; this format has become a virtual industry standard for 7-track recording. The units used to record data can also be used to verify previously recorded records.

TABLE I. MOHAWK 1100 SERIES DATA-RECORDERS

Data-Recorder Model (1)	Auxiliary Input/Output Device	Pooling Control (2)	Communications Interface	Standard Features (3)	Optional Features (3)
1101	None	No	No	None	All except 705, 707
1102	None	Yes	No	100	All except 705, 707
1103	None	No	Yes	100	All except 705, 707
1104	3021 Adding Machine	No	No	703	All except 707
1105	3005 Paper Tape Reader	No	No	703	All except 705, 707
1106	3011 or 3051 Punched Card Reader	No	No	703	All except 401-407, 705
1109	3011 or 3051 Punched Card Reader	No	Yes	100, 703	All except 401-407, 705
1112	3021 Adding Machine	No	Yes	100, 703	All except 707
1115	3005 Paper Tape Reader	No	Yes	100	All except 705, 707
1118	3013 Printer	No	No	703	All except 401-407, 705, 707
1122	None	Yes	No	100	All except 500, 501, 503, 705, and 707
902	None	Yes	No	100, 600	110 only
1181 (4)	3013 Printer	No	No	709	503 only
1183	3013 Printer	No	Yes	100, 703	All except 401-407, 705, 707

Notes:

(1) See text for additional details about the capabilities of individual models.

(2) Pooling control is the capability for transcription of data from one magnetic tape to another on a different unit.

(3) These numbers refer to the Special Feature numbers; see Paragraph .9, Price Data.

(4) Data is entered directly from the typewriter keyboard; the standard Data-Recorder keyboard is not included.

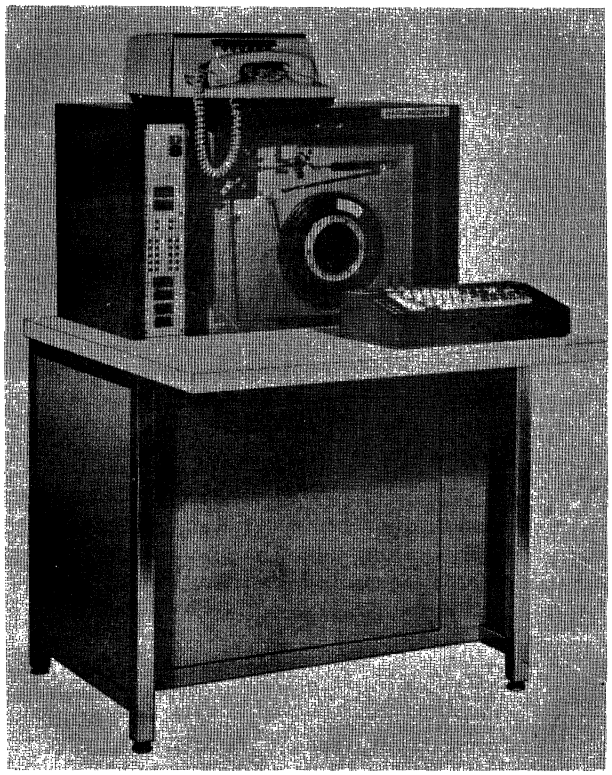


Figure 1. Mohawk 1103 LDC Data-Recorder

Different models of the 1100 line provide limited capabilities for data input or output using a variety of devices other than a keyboard; some models are equipped with a communications interface for transmitting and receiving data over a voiceband line.

Only those models of the 1100 Series that are equipped with a communications interface are described in this report. For a detailed analysis of the 1100 Series Data-Recorders as used for input preparation, see AUERBACH Data Handling Reports, Report 2550.

Mohawk Data Sciences Corporation was formed in September 1964. Its first product, the 1101 Keyed Data-Recorder, was announced shortly afterward, and initial deliveries were made in April 1965. Through the addition of auxiliary input or output units, special controls, and communications interfaces to the basic 1101, the product line has been expanded to include some 13 devices within the 1100 Series. In addition, Mohawk produces several units designed for sale to computer manufacturers for inclusion in computer systems.

The 1101 Keyed Data-Recorder is the basic member of the 1100 Series. It permits data entered via a keyboard to be recorded directly on magnetic tape in a format suitable for input to a computer. The same unit, operating in a different mode, can be used to verify a tape previously recorded by itself or by another 1101. The 1101 Data-Recorder provides the same general facilities for preparation and verification of magnetic tape records that a conventional keypunch and verifier provide for punched cards, as well as some unique capabilities.

The models contained in the current 1100 Series line are listed in Table I along with the distinctive features of each device; additional details on each model with a communications interface are contained later in this section. All models (except the 902, which records in a 9-track format)

TABLE II. AUXILIARY INPUT/OUTPUT DEVICES

Device	Mohawk Model Number	Original Manufacturer and Designation
Adding Machine	3021	Victor Digit-Matic Premier
Paper Tape Reader	3005	NCR EM-A4
Punched Card Reader	3011 (80-column); 3051 (51-column)	NCR EM-D2 (PE)
Printer	3013	IBM Model 735 I/O Typewriter

can be used to prepare or verify data in the same way as an 1101. Models with communications interfaces transmit data from a previously prepared tape; manual or auxiliary input operations cannot be performed during transmission.

The 1103 LDC Data-Recorder

The 1103 LDC Data-Recorder is essentially an 1101 Keyed Data-Recorder with a communications interface added. Other 1100 Series members that include a communications interface are simply expanded versions of the 1103 LDC incorporating various input/output devices.

In addition to the basic functions of the 1101, the 1103 LDC is designed to provide buffered, synchronous communications in a half-duplex mode with a remote 1100 Series communications terminal over the public telephone network at 1200 or 1,600 (optional) bits per second, or over a leased voiceband line at 2,400 or 4,800 (optional) bits per second. Speeds above 1,600 bits per second require the optional High-Speed Communications Interface. Data transfer between terminals is under control of the programs stored in the sending and receiving buffers.

The central component of the 1103 is the core storage unit which acts as a buffer. The buffer holds the keyed-in or received data when recording and the record to be checked when verifying. The use of the buffer eased Mohawk's task of designing a unit for recording tape in a format compatible with the magnetic tape drives used with computers.

The core storage unit adds greatly to the ease and flexibility of preparing and verifying magnetic tape records. This unit permits a program to be stored for defining the format of the tape records and for automatically initiating certain operations; it also provides buffer storage for data prior to recording or comparison. The basic 1101 contains 100 positions of core storage, of which 80 are used. Usable storage can optionally be increased, in discrete amounts, up to 180 characters.

The Basic Program storage area contains three bits of storage for each character position of the record. Codes stored in the program area are used to delimit fields within a record and to define such operations as automatic duplication or verification of common information, automatic skipping, manual keying, and alphabetic (lower) or numeric (upper) shift. The Alternate Program storage area (a standard feature on the 1103 LDC) provides an additional three bits of program storage per character position.

The Basic and Alternate program storage areas allow two different record formats to be defined; e.g., both a transmit and receive program could be stored for interchanging data between terminals. Control can be freely switched between the basic program and the alternate program by the Program Revert switch located on the operator panel. Program memory can be loaded from a strip of magnetic tape or by manual entry.

A separate bit, common to both the basic and alternate programs, is provided for each character position. This bit is set during a verifying operation when the character read from a record is not the same as that in data storage for the previous record. This technique permits manual initiation of automatic verification of data fields duplicated in consecutive records.

Operating Modes

There are five principal modes of operation for the 1103 LDC Data-Recorder, of which two are used for data communications. The five principal modes, as selected by the operator, are Entry, Verify, Search, Send, and Receive.

Data is recorded on magnetic tape in the Entry mode. Data entered via the keyboard is stored in the core storage unit. Fixed data can be automatically retained from record to record. When a complete record has been assembled, the recording action can be initiated automatically or manually. Data is written on the tape along with the character parity bits and the longitudinal parity check character. Then the tape is automatically backspaced and read, and the recorded data is compared bit for bit with the data stored in memory. The recorded character parity bits and the longitudinal check character are also checked.

A magnetic tape previously recorded on an 1103 can be checked in the Verify mode. A record is read into the unit's data storage area. Duplicate information in a series of records can be verified automatically as specified by the program. The operator can also initiate automatic verification of a data field by depressing the Dup key. Character and longitudinal parity are checked as the record is read in.

If a discrepancy is detected while data is being keyed in to verify a tape record, the keyboard is interlocked and the operator is alerted by indicator lamps and an audible alarm. The operator can determine whether there is an error in the tape record by making repeated attempts to key in the character or by observing and interpreting the one-character binary data display. Corrections are easily made by depressing a special key and then keying the correct character. A separate control key permits correction of an entire field. If a correction is made, the tape is automatically backspaced. After completing the verification and correction of a record containing errors, the operator must reverify the entire corrected record. The record is written on tape, backspaced, and checked as when recording.

The recorded and verified data is transmitted to the receiving terminal by placing the sending and receiving terminals in the Send and Receive mode, respectively. Both operations are discussed in the following paragraphs.

Data is transmitted in fixed-length records as specified by the send and receive programs. Record size can vary from a single character up to the 80-character capacity of the standard buffer. A record can contain as many as 180 characters when the available buffer options are employed at both the sending and receiving terminals.

Before a record can be transmitted, the sending terminal must read the record from tape, check each character read for correct parity, and load the entire record into the core buffer. Transmission begins when the core buffer contains the complete record and a ready status is received from the receiving terminal. Each 6-bit character read from the core buffer during transmission is translated to a 4-bit or an 8-bit character, serialized, and transmitted to the receiving terminal.

The receiving terminal performs a validity check on each received character, translates the 4- or 8-bit character to the internal 6-bit code, and stores each of the translated characters in the core buffer. In addition to the validity check performed on each character, the receiving terminal performs a longitudinal parity check at the end of the received record. After each character of the record has been correctly received (i.e., no transmission errors), the record is written on tape and the written data is checked for data recording errors. When the received record is successfully written on tape, the receiving terminal acknowledges the transmitting terminal via

the reverse-channel technique. Transmission of the next record begins when the acknowledge is received from the receiving terminal and the sending terminal is ready to transmit (i.e., when the next record is stored in its core buffer).

In the Search mode, a particular record can be located on the tape if it contains a unique identifying code or field. The identifying data is keyed into memory in the same position it occupies in the record. The tape halts when a match is found or when blank tape is encountered. The Search mode can be used to locate the beginning point of an interrupted recording or verifying operation, or to locate a specific record for modification or correction.

TABLE III. MOHAWK 1100 SERIES
NUMERIC TRANSMISSION CODE

Numeric to Be Transmitted	Representation in Buffer and on Magnetic Tape*	Transmission Code**
	B A 8 4 2 1	8 4 2 1
0	0 0 0 0 0 0	1 0 1 0
1	0 0 0 0 0 1	1 0 1 1
2	0 0 0 0 1 0	0 0 1 0
3	0 0 0 0 1 1	0 0 1 1
4	0 0 0 1 0 0	0 1 0 0
5	0 0 0 1 0 1	0 1 0 1
6	0 0 0 1 1 0	0 1 1 0
7	0 0 0 1 1 1	1 1 0 1
8	0 0 1 0 0 0	1 1 0 0
9	0 0 1 0 0 1	1 0 0 1

*Each numeric includes a parity bit, which accompanies the numeric when recorded on tape or in the buffer.

**The transmission code configuration provents more than two sequential identical bits per numeric and permits a limited validity check.

Codes and Error Control

Internal 6-bit character codes are translated to one of two specific transmission codes. Buffer positions designated as numeric locations by the stored program are translated from a 6-bit code to a 4-bit transmission code. Alphanumeric buffer positions are translated from a 6-bit code to an 8-bit transmission code. Table III shows the relationship between the numeric internal code and the transmission code. Alphanumeric characters are encoded as follows:

Internal code 1 2 4 8 A B

Transmission code 1 2 $\bar{2}$ 4 8 A $\bar{A}$ B

The barred numbers indicate the two's complement of the preceding bit. Table IV shows the transmission code for alphanumerics.

The numeric and alphanumeric transmission codes permit a limited means for checking character validity. The stored program at the receiving terminal designates specific buffer positions as numeric or alphanumeric codes. If an alphanumeric character is received in a position programmed for a numeric character, a character error results. A numeric character received in a position programmed for an alphanumeric character does not cause a character error.

TABLE IV. MOHAWK 1100 SERIES ALPHANUMERIC TRANSMISSION CODE

Symbol	Bit Position	
	B Ā A 8	4 2̄ 2 1
SYNC*	0 0 0 0	1 1 1 1
ODD*	0 0 1 0	1 1 1 1
EVEN*	0 1 0 0	1 1 1 1
(NOT USED)	0 1 0 0	0 1 0 0
1	0 1 0 0	0 1 0 1
2	0 1 0 0	0 0 1 0
3	0 1 0 0	0 0 1 1
4	0 1 0 0	1 1 0 0
5	0 1 0 0	1 1 0 1
6	0 1 0 0	1 0 1 0
7	0 1 0 0	1 0 1 1
8	0 1 0 1	0 1 0 0
9	0 1 0 1	0 1 0 1
0	0 1 0 1	0 0 1 0
#	0 1 0 1	0 0 1 1
@	0 1 0 1	1 1 0 0
'	0 1 0 1	1 1 0 1
=	0 1 0 1	1 0 1 0
"	0 1 0 1	1 0 1 1
SPACE	0 0 1 0	0 1 0 0
/	0 0 1 0	0 1 0 1
S	0 0 1 0	0 0 1 0
T	0 0 1 0	0 0 1 1
U	0 0 1 0	1 1 0 0
V	0 0 1 0	1 1 0 1
W	0 0 1 0	1 0 1 0
X	0 0 1 0	1 0 1 1
Y	0 0 1 1	0 1 0 0
Z	0 0 1 1	0 1 0 1
≠	0 0 1 1	0 0 1 0
,	0 0 1 1	0 0 1 1
%	0 0 1 1	1 1 0 0
—	0 0 1 1	1 1 0 1

Symbol	Bit Position	
	B Ā A 8	4 2̄ 2 1
>	0 0 1 1	1 0 1 0
?	0 0 1 1	1 0 1 1
-	1 1 0 0	0 1 0 0
J	1 1 0 0	0 1 0 1
K	1 1 0 0	0 0 1 0
L	1 1 0 0	0 0 1 1
M	1 1 0 0	1 1 0 0
N	1 1 0 0	1 1 0 1
O	1 1 0 0	1 0 1 0
P	1 1 0 0	1 0 1 1
Q	1 1 0 1	0 1 0 0
R	1 1 0 1	0 1 0 1
!	1 1 0 1	0 0 1 0
$	1 1 0 1	0 0 1 1
*	1 1 0 1	1 1 0 0
)	1 1 0 1	1 1 0 1
;	1 1 0 1	1 0 1 0
	1 1 0 1	1 0 1 1
&	1 0 1 0	0 1 0 0
A	1 0 1 0	0 1 0 1
B	1 0 1 0	0 0 1 0
C	1 0 1 0	0 0 1 1
D	1 0 1 0	1 1 0 0
E	1 0 1 0	1 1 0 1
F	1 0 1 0	1 0 1 0
G	1 0 1 0	1 0 1 1
H	1 0 1 1	0 1 0 0
I	1 0 1 1	0 1 0 1
¢	1 0 1 1	0 0 1 0
.	1 0 1 1	0 0 1 1
<	1 0 1 1	1 1 0 0
(	1 0 1 1	1 1 0 1
+	1 0 1 1	1 0 1 0
|	1 0 1 1	1 0 1 1

*ODD or EVEN message codes precede data block for block count protection; see Paragraph 1.5. SYNC, ODD, and EVEN codes are unique and are not generated from a character code by the method described in Paragraph 1.5.

An odd/even message code (8-bits) precedes each transmitted record to ensure against the loss or duplication of records. The odd/even message code is generated at both sending and receiving terminals. A message code error results when the two codes do not agree.

Error signaling in response to incorrect message codes or data transmission errors is performed via the reverse-channel technique. The inherent value of this technique is that it eliminates the time required for line turnaround to allow the receiver to transmit an acknowledge code.

An interrupted signal on the reverse channel during data transmission is interpreted by the sending terminal as a request for retransmission. The signal on the reverse channel is normally interrupted at the end of a transmission (i.e., after the last character is received correctly) and

is not returned until the currently received record has been successfully written on magnetic tape. Once the signal is returned, the sending terminal, if ready, begins to transmit the next record to the receiving terminal.

If the reverse-channel signal is not returned within a 20-second period, initiated at the start of the last record, transmission is halted and operator intervention is required. For a further description of the reverse-channel technique, see Report 6221, Digitronics Reverse-Channel Dial-o-Verter Line.

Other 1100 Series Models

Other models in the 1100 Series line, which contain a communications interface, are described in the following paragraphs. All these units can be operated as an 1101 Keyed Data-Recorder when not in the send or receive modes. In appearance, the other models are identical with the 1103 LDC except for the addition of an auxiliary input or output device, which is usually located on the desk to the left of the operator.

Model 1109 DPC Data-Recorder (Punched Card Input) — This unit is similar to the 1103 and includes a 3011 (80-column) or 3051 (51-column) Punched Card Reader. Data is read photoelectrically from cards and can be entered into memory for recording on the magnetic tape in addition to keyed-in data. The punched card reader is controlled from the 1109 keyboard and by program codes in memory. Cards can be read continuously at 75 cards per minute for transcription of data from the punched cards to magnetic tape. Cards can also be fed one at a time. The capacity of both the input hopper and output stacker is 500 cards. The 1109 is normally used to transfer prepunched data contained in turnaround cards to magnetic tape as part of the total record.

Model 1112 Data-Recorder (Adding/Listing) — This unit is similar to the 1103 and includes a Model 3021 14-column, net balance, adding/listing machine that can be operated from the 1104 keyboard. Data keyed into the fields specified by program codes is entered into memory and transferred to the adding machine, where it is printed and added to the machine accumulator. Non-add, identifying numbers, and negative numbers (subtraction) can also be entered. Printing of a total can be initiated from either the keyboard or the adding machine; the total, however, is not entered into the 1112's memory or recorded on the magnetic tape. A subtotal key is provided on the adding machine keyboard with Feature 705. The adding machine can be used independently of the 1112 for conventional functions. The 1112 provides a convenient method for accumulating proof or hash totals when preparing a large number of records for input to further processing.

Model 1115 Data-Recorder (Paper Tape Input) — This unit is similar to the 1103 and includes a Model 3005 Paper Tape Reader. Data can be read from paper tape and entered into data memory for recording on the magnetic tape in addition to keyed-in data. The Paper Tape Reader is controlled from the 1115 keyboard and by program codes in memory and codes in the data from paper tape. The 3005 Tape Reader can accommodate 11/16-, 7/8-, or 1-inch paper tape punched in any 5- to 8-level code. The rated reading speed is 400 characters per second. Mohawk states that the unit will read a minimum of 100 80-character records per minute and typically averages 120 to 130 records per minute.

Model 1183 Data-Recorder (Typewriter Output) — This unit is similar to the 1103 and includes a MOdel 3013 Printer. Data previously recorded on magnetic tape can be printed in a separate pass. Data within a record can be selectively printed as specified by the program codes in memory. Horizontal tabulation can be initiated by a specific program code and controlled by the tab stops set up in the printer. Printing can be initiated automatically for each record in a continuous run or initiated manually for selected records (located, perhaps, by search operations). The 3013 Printer is the IBM 735 Input/Output Typewriter; it can be used as a conventional electric typewriter when not being used with the 1183.

Model 1320 Buffered Line Printer — This unit consists of a line printer with a rated printing speed of 250 lines per minute (using full character set) or 375 lines per minute (all numeric) and a 132-character buffer. The printer can be connected to any 1100 Series Data-Recorder and can receive data directly from a communications line or from magnetic tape; both operations are controlled by the program stored in the Data-Recorder buffer. The printer is capable of printing up to 132 characters per line and can handle pin-fed fanfold forms up to 20 inches wide.

The printer can operate in one of two modes: the edit mode or the non-edit mode. Format control operations, including horizontal tabulation, spacing, and line feed, are initiated by control characters when the printer is in the edit mode. The non-edit mode is used for tape listing operations; format control functions are not provided.

1.6 First Delivery: . . . . . May 1966.

1.7 Availability: . . . . . 4 to 6 weeks

2. CONFIGURATION

The 1103 LDC Data-Recorder includes:

- A magnetic tape drive.
- A magnetic core buffer.
- A keyboard for entering data.
- A communications interface.

Other 1100 Series models that include a communications interface and an input or output device include:

- 1109 DPC Data-Recorder — includes a punched card reader.
- 1112 DPA Data-Recorder — includes an adding/listing machine.
- 1115 DPT Data-Recorder — includes a paper tape strip reader.
- 1183 DPP Data-Recorder — includes an output typewriter.

Any 1100 Series Data-Recorder can also include a Model 1320 Buffered Line Printer. The 1320 Printer can be used to receive data from a communications line directly or can operate a data transcription device to print data previously recorded on magnetic tape.

All auxiliary input/output devices included with Mohawk Data-Recorders except the 1320 Printer can be used only for data transcription purposes or in the preparation of a tape; they cannot interface directly with a communications line. The adding/listing device included with the 1112 Data-Recorder is operated from the 1112 keyboard concurrently with entering data in the 1112 buffer; data cannot be transferred from the buffer to the adding/listing device.

3. INPUT

3.1 Prepared Input

Magnetic tape drive (with all 1100 Series Data-Recorders) —

Input medium: . . . . . 0.5-inch magnetic tape recorded at 200 bits/in. compatible with IBM 729 Series tape format.

Input code:	6-bit BCD (even parity) or binary (odd parity); see Tables III and IV.
Quantity of data:	80 characters; optionally 84, 90, 100, 120, 140, 160 or 180 characters.
Character set:	64 characters; alphanumerics plus special and record format characters.
Rated input speed:	6,250 char/sec.
Effective speed:	limited by block length and transmission speed.

Punched card reader (with 1109 DPC Data-Recorder) —

Input medium:	standard 80-column punched cards.
Input code:	standard Hollerith card code.
Quantity of data:	up to 80 characters per card.
Character set:	64 characters.
Rated input speed:	100 chards/min.
Effective speed:	75 cards/min.
Comments:	Hollerith card code is translated to IBM BCD code when data is transcribed on magnetic tape; data is recorded on magnetic tape via the core buffer.

Paper tape reader (with 1115 DPT Data-Recorder) —

Input medium:	fully punched 11/16-, 7/8-, or 1-inch strips of paper tape; tape widths are selectable by switch.
Input code:	any 5-, 7-, or 8-level code; parity can be selected as odd or even when using 7- or 8-level codes or can be ignored.
Quantity of data:	variable up to buffer capacity.
Rated input speed:	400 char/sec.
Effective speed:	limited by record length.
Comments:	paper tape data is transcribed to magnetic tape via the core buffer.

3.2 Manual Input

Keyboard (with all 1100 Series Data-Recorders except 1181) —

Method of entry:	47-key keyboard; optional 64-key keyboard available.
Quantity of data:	up to capacity of buffer.
Character set:	47 characters; 26 alpha, 10 numeric, and 11 special.
Comments:	64 code combinations can be produced when the Multiple Code key is used; 13 of the 47 keys are used to initiate special functions; keyboard data is entered on tape via the core buffer.

3.3 Fixed Input: a data field can be entered into the buffer and automatically or manually duplicated in all subsequent records.

3.4 Transaction Code Input: no provision.

3.5 Message Configuration: ..... messages are transmitted in fixed-length records as specified by program; record size can be from 1 to 80 data characters, or up to 180 characters optionally; each record is preceded by a minimum of 3 sync characters followed by an odd/even message code; each record contains a longitudinal parity character at the end.

3.6 Operating Procedure

Before a message is transmitted, predetermined programs and time of transmission should be established between the communicating terminals. Programs should be on program tapes and ready for immediate use.

(1) Load program into memory.

(2) Mount tape reel.

(3) Set control punch and keyboard switches.

(4) Establish connection by dialing or manually signaling.

(5) Depress Data key on data set.

3.7 Entry of Time and Date: ..... no provision.

4. OUTPUT

4.3 Output to Magnetic Tape

Magnetic tape drive (with all 1100 Series Data-Recorders) —

Tape size:	0.5-inch magnetic tape recorded at 200 bits/in. compatible with IBM 729 Series tape format.
Tape code:	6-bit BCD (even parity) or binary (odd parity).
Rated output speed:	6,250 char/sec.
Effective speed:	limited by block length and transmission speed.
Format control:	extensive tape format control is provided by stored program; see Paragraph 1.5 for description.
Comments:	records are recorded in fixed-length format; an 80-character record is standard; with options, records can be 84, 90, 100, 120, 140, 160 or 180 characters in length.

4.4 Output to Printer

Output typewriter (with 1183 DPP Data-Recorder) —

Output medium:	friction-fed or pin-fed (optional) fanfold forms up to 15.5 inches wide (13-inch writing width).
Character set:	64 characters, including uppercase alphabetics, numerics, punctuation marks, and special characters; see Tables III and IV.
Rated printing speed:	15 char/sec.
Effective speed:	limited by carriage return, line feed, and other format control functions.

Format control:	controlled by horizontal and vertical tab function codes.
Comments:	horizontal spacing is 10 char/in.; vertical spacing is 6 lines/in.; printer can operate in either of 2 selectable modes; edit mode allows format control; non-edit mode lists tape data; data is transcribed from magnetic tape via the core buffer.

1320 Buffered Line Printer (with any 1100 Series Data-Recorder) —

Output medium:	printed fanfold forms up to 20 inches in width.
Character set:	64 characters including alphabetic, numeric and special symbols; see Tables III and IV.
Rated printing speed:	250 lines/min (with full character set); 375 lines/min (all numeric).
Effective speed:	limited by character sequence, spacing, and number of char/line.
Format control:	controlled by horizontal and vertical tab function codes.
Comments:	horizontal spacing is 132 char/line; vertical spacing is 6 or 8 lines/in.; printer can operate in either of 2 selectable modes; edit mode allows format control; non-edit mode lists data; data can be received from remote terminal or transcribed from magnetic tape via the core buffer.

5. ERROR DETECTION AND CORRECTION

5.1 Data Entry Errors

Type of checking:	character parity and longitudinal parity are checked when each record is read from magnetic tape.
Error indication:	audible alarm sounds; lamp is lighted.
Correction procedure:	tape is automatically backspaced and read a second time; operator intervention is required when an error is detected a second time.

5.2 Data Transmission Errors

Type of checking:	character validity and longitudinal parity.
Error indication:	indicator lamp is lighted; reverse-channel signal is interrupted.
Correction procedure:	automatic retransmissions continue for up to 20 seconds; after this time period, transmission halts, audible alarm sounds, lamp is lighted, and operator intervention is required.

5.3 Data Recording Errors

Type of checking:	each record is reread and checked bit for bit with the buffer contents; character and longitudinal parity are also checked.

Error indication:	keyboard is locked, tape halts, lamp is lighted, and audible alarm is sounded.
Correction procedure:	tape is automatically backspaced and data is written a second time; operator intervention is required when error occurs a second time.

5.5 Line Malfunctions

Detection:	absence of signal on reverse channel for 20 seconds.
Action:	operation halts.

6. CONDITION INDICATORS

A one-character binary data display, consisting of a group of lamps, is a standard feature of the 1100 Series Data-Recorders. The data character stored in the active memory position is displayed in 6-bit BCD code. The contents of the controlling program memory for that position are also displayed, in 3-bit binary fashion. A separate lamp indicates whether the base or alternate program is controlling. The number of the active memory position is displayed in decimal fashion by two groups of ten lamps.

A comprehensive array of indicator lamps provides error status, transmission status, and verification status displays. An audible alarm is included in conjunction with the error status indicators.

7. DATA TRANSMISSION

7.1 Basic Characteristics

Rated transmission speed:	1,200 or 1,600 (optional) bits/sec over the public telephone network; 3,400 or 4,800 (optional) bits/sec over a leased voice-band line.
Transmission method:	serial by bit.
Transmission code:	modified BCD code; see Paragraph 1.5.
Transmission mode:	half-duplex.
Order of bit transmission:	low-order data bit first.
Synchronization:	synchronous; each record is preceded by a minimum or three sync characters.

7.2 Connection to Communications Lines

Communications Line or Service	Data Set*
Public telephone network operating at the following speeds:	
1,200 bits/sec:	Bell System Data-Phone Data Set 202C
1,600 bits/sec:	Bell System Data-Phone Data Set 201A
Common-carrier leased voiceband line operating at the following speeds:	
2,400 bits/sec:	Bell System Data Set 201B or Western Union 2400 Baud Data Modem
4,800 bits/sec:	Bell System Data Set 203 or Western Union 2481A Data Modem

*In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant; also see Sections 4600, 4620 and 4640 for a current list of data sets available from the common carriers and independent manufacturers.

7.3 Transmission Control

Call initiation: . . . . . manual dialing or signaling.
Call reception: . . . . . operator must establish voice communication and then switch to data mode.
Functional operations: . . . . . under control of stored program; see Paragraph 1.5 for description.

7.4 Multistation Operation: . . . . . no provision.

8. PHYSICAL SPECIFICATIONS

Component	1100 Series Data-Recorders, all models (1)	3021 Adding Machine (1112)	3011 or 3051 Card Reader (1109)
Width (in.)	31 or 43	10	18
Depth (in.)	29.25	15	10
Height (in.)	43	8.25	8.25
Weight (lb.)	260	30	25
Power (kva)	0.31	0.06	0.07 (2)
Voltage	115	115	—
Frequency (Hz)	60	60	—
Phases	1	1	—
Temperature Range (°F)	50-100	35-120	59-98
Humidity Range (%)	20-88	Up-95	20-75
Heat (BTU/hr)	900	160	190

Component	3031 Printer (1183)	3005 Paper Tape Reader (1115)	1320 Buffered Line Printer
Width (in.)	21.75	20	39
Depth (in.)	15.75	10.5	24
Height (in.)	9.75	10	48
Weight (lb.)	61	35	500
Power (kva)	0.12	0.07	?
Voltage	115	—	115
Frequency (Hz)	60	—	60
Phases	1	—	1
Temperature Range (°F)	?	60-90	60-95
Humidity Range (%)	?	20-80	40-80
Heat (BTU/hr)	350	200	?

Notes:
(1) This column applies to the basic keyed recording unit for all 1100 Series Data-Recorders. Auxiliary input or output devices are listed separately. The reading table extension is 12 inches wide; this feature is standard on all models except the 1101, 1102, and 1103.

(2) Power for these devices is supplied from the basic 1100 Series unit.

9. PRICE DATA

Component or Feature	Monthly Rental $	Purchase Price $	Monthly Maintenance $	Field Installation $
1103 LDC Data-Recorder	195.00	9,750	30.00	—
1109 DPC Data-Recorder	335.00	13,300	55.00	—
1112 DPA Data-Recorder	255.00	11,025	45.00	—
1115 DPT Data-Recorder	305.00	13,000	52.00	—
1183 DPP Data-Recorder	315.00	13,000	60.00	—
1320 Buffered Line Printer	420	21,000	80.00	—
Optional Features**				
100 Block Counter (incrementing)	Std	Std	Std	—
110 In Lieu of Feature 100	5.00	200	0.50	50.00
132 Data-Recorder/1320 Interface for Second Data-Recorder	7.00	280	2.00	FO
150 Takeup Reel	10.00	400	2.50	50.00
200 Alternate Program	6.00	240	0.50	20.00
300 Self Check Digit (Mod 10)	20.00	990	5.00	FO
302 Self Check Digit (Mod 11-IBM Standard)	20.00	990	5.00	FO
305 Universal Check Digit	25.00	1,200	5.00	FO
310 Programmed Left Zero	150.00 OTC	—	—	FO
311 Letters Shift Lock	1.00	40	NC	25.00
400 64-Character Keyboard (IBM)	3.00	120	0.50	10.00
401 64-Character Keyboard (NCR)	NC	120	0.50	FO*
402 64-Character Keyboard (Honeywell)	NC	120	0.50	FO*
403 64-Character Keyboard (RCA-compatible)	3.00	120	0.50	FO*
404 64-Character Keyboard (Burrough's 5000)	3.00	120	0.50	FO*
405 64-Character Keyboard (GE)	3.00	120	0.50	FO*
407 64-Character Keyboard (XS3-1050)	3.00	120	0.50	FO*
408 64-Character Keyboard (RCA 381, 382 MTH)	3.00	120	0.50	FO*
500 90-Character Memory	5.00	200	0.50	18.00
501 84-Character Memory	5.00	200	0.50	18.00
502 Selective Record Limit	2.00	100	NC	40.00
503 100-Character Memory	10.00	300	NC	FO
504 120-Character Memory	20.00	600	NC	FO
505 140-Character Memory	30.00	900	NC	FO
506 160-Character Memory	40.00	1,200	NC	FO
507 180-Character Memory	50.00	1,500	NC	FO
600 Odd Parity	NC	NC	NC	NC
601 Odd/Even Parity Switch (Toggle)	75.00 OTC	—	—	—

Component or Feature	Monthly Rental $	Purchase Price $	Monthly Maintenance $	Field Installation $
602 Odd/Even Parity Switch (Momentary)	75.00 OTC	—	—	—
605 1,600-bps Transmission Rate	NC	—	NC	15.00
606 Remote End of Transmission Alarm	50.00 OTC	—	—	—
608 High Speed 4-Wire Interface for 1103	30.00	1,200	NC	35.00
609 End of File Recognition Single Character	50.00 OTC	—	—	90.00
609-A EOF Recognition Single Character and Full Block	50.00 OTC	—	—	90.00
630 Timing for Transatlantic Communications	10.00 OTC	—	NC	15.00
631 Western Union 2121B Interface	25.00 OTC	—	NC	30.00
632 ITT 2002 Interface	30.00 OTC	—	NC	35.00
633 Data Rate Selection GPO Modem	20.00 OTC	—	NC	35.00
634 Data Rate Select 1200/1800	20.00 OTC	—	NC	25.00
635 International/Domestic Comm Adapter	5.00	300	1.00	30.00
700 Stroke Counter	5.00	200	0.50	10.00
702 End of Record Warning Light	50.00 OTC	—	—	—
703 Reading Table Extension w/o panel insert	5.00	50	NC	NC
704 Reading Table Extension w/panel insert	6.00	57	NC	NC
708 RCA Compatible Hub	30.00 OTC	—	—	—
710 Document Holder	8.00 OTC	—	—	—
720 Memory Check	—	NC	—	Installed at customer engineer request only
2105 GPO Modem Adapter	10.00	400	NC	NC
8641 ± Phase Translator	—	NC	NC	15.00

Notes:

NC — No charge
OTC — One-time charge
FO — Factory only
*Field changes will be made by exchanging machines, at MDS discretion, for $25 maximum freight charge.
**See Table I for the features included or available with each 1100 Series model.

ADVANCE REPORT
MOHAWK 4200 TTT DATA RECORDER SYSTEM

.1 GENERAL

.11 Identity: . . . . . 4200 TTT Data Recorder System.

.12 Manufacturer: . . . . . Mohawk Data Sciences Corporation
P.O. Box 630
Herkimer, New York 13350

.13 Basic Function: . . . . . translates and records data received from a Touch-Tone Telephone; can also consolidate several tapes and convert between 7-channel and 9-channel format.

.15 Description

The Mohawk 4200 TTT Data Recorder System, announced in early 1968, includes two Type 4201 magnetic tape units and a pooler control or a Type 902 interface. The 4200 TTT is functionally similar to the other Mohawk Data Recorders discussed in Report 6540, but is packaged in a different cabinet and is arranged for receiving data from a conventional Touch-Tone telephone.

The information presented in this Advance Report was obtained from preliminary documentation. A complete report on the Mohawk 4200 TTT Data Recorder System will be published in AUERBACH Data Communications Reports when detailed information becomes available.

The Type 4201 Unit is basically a 7-channel Data Recorder that includes a 64-character BCD keyboard, an 80-character buffer, and an interface compatible with the Bell System Data-Phone Data Set 403E3 for receiving the tones generated by a Touch-Tone Telephone set. The Touch-Tone telephone is discussed in Report 6040.

Data can be entered into the 4201 buffer via the keyboard or from a remote Touch-Tone telephone set. The Touch-Tone signals received by the Type 4201 Unit are translated to the BCD code prior to buffer entry.

A single data set can be shared by both Type 4201 Units when the Type 4202 Electronic Switch feature is incorporated.

A pooler control can be connected to the Type 4201 Units to enable consolidating several short tapes on a single tape for more efficient computer input.

A Type 902 interface can be used in place of the pooler control to permit data recorded at 200 bits per inch on 7-channel tapes to be pooled and converted to a 9-channel, 800-bit-per-inch format.

All calls placed to the 4200 TTT System are automatically answered. Originating devices include: a dial telephone with a 12-key Touch-Tone pad, a 12-key Touch-Tone telephone, or a Touch-Tone Card Dialer.

Initial deliveries of the 4200 TTT Data Recorder System are expected in the fourth quarter of 1968. The price of a typical 4200 TTT System is $430 per month. It can be purchased for approximately $25,800. A maintenance contract is available for $70 per month.

MOHAWK 6403 DATA-RECORDER

1. GENERAL

1.1 Identity . . . . . 6403 Data-Recorder.

1.2 Manufacturer . . . . . Mohawk Data Sciences Corporation
P.O. Box 630
Herkimer, New York 13350

1.3 Basic Function . . . . . transmission and reception of data over a voice-band line; input is from magnetic tape recorded in 9-channel, IBM-compatible format; source tape can be recorded and verified via keyboard.

1.5 Description

The Mohawk 6400 Series Data-Recorders are functionally identical to the 1100 Series discussed in Report 6540. In the 6400 Series data is recorded on magnetic tape at 800 bits per inch in a 9-channel format. Tapes prepared on a 6400 Series Data-Recorder are recorded in IBM EBCDIC code and are compatible with IBM 2400 Series Magnetic Tape Units.

The basic function of a data-recorder is to record data entered from a keyboard; i.e., it is intended as a replacement for keypunches. Various models in the 1100 Series provide auxiliary input or output devices to add flexibility to the data preparation operation. The 6400 Series includes a wide range of models corresponding to the models in the 1100 Series line.

The 6403 is designed to provide buffered, synchronous communications in a half-/full-duplex mode with a remote 6403 or 1100 Series communications terminal over the public telephone network at 1,200 or 1,600 bits per second, or over a leased voiceband line at 2,400 or 4,800 bits per second. The higher speeds of 2,400 and 4,800 bits per second require the optional 8608 High-Speed Communications Interface. Data transfer between terminals is under control of the programs stored in the sending and receiving buffers.

Mohawk also provides a line of adapters that permit the 6403 to be used over international common-carrier facilities, including ITT, RCA, Western Union, and the British Government Post Office. These adapters include timing for Transatlantic Communication, Western Union 2121B Interface, ITT 2002 Interface, and the Data Rate Selection GPO Modem. A one-time charge of $10 to $30 applies for each of the adapters; and they can be installed only at the factory when the 6403 Data-Recorder is ordered. The central component of the 6403 is the core storage unit, which acts as a buffer. The buffer holds the keyed-in or received data when recording and the record to be checked when verifying. Use of the buffer eased Mohawk's task of designing a unit for recording tape in a format compatible with the magnetic tape drives used with computers.

The core storage unit adds greatly to the ease and flexibility of preparing and verifying magnetic tape records. This unit permits storage of a program for defining the format of the tape records and for automatically initiating certain operations; it also provides buffer storage for data prior to recording or comparison. The standard 6403 contains 100 positions of core storage; an 80- or 90-character buffer can be incorporated in place of the 100-character buffer at no additional cost. A 180-character buffer with the selective block length device is also available at additional cost. This option permits dialing any block length from 10 to 180 characters.

The Basic Program storage area contains four bits of storage for each character position of the record. The alternate storage area (a standard feature on the 6403) provides an additional four bits of program storage per character position. Codes stored in the program areas are used to delimit fields within a record and to define operations such as automatic duplication or verification of common information, automatic skipping, manual keying, and alphabetic (lower) or numeric (upper) shift.

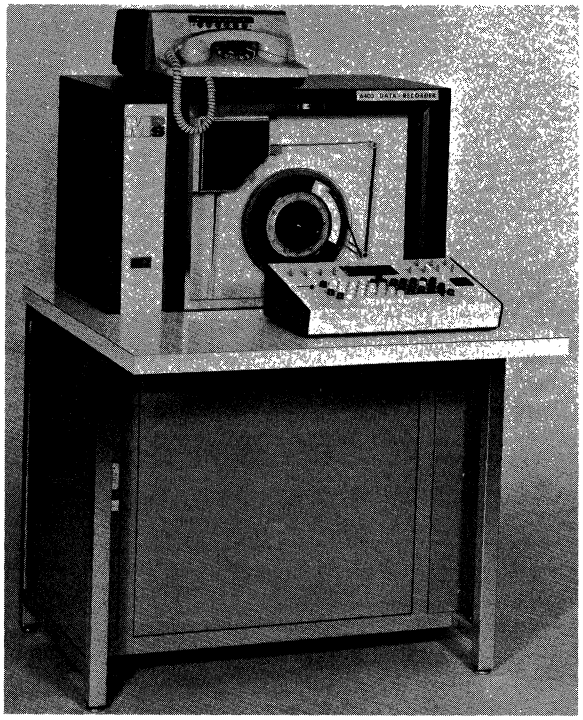


Figure 1. Mohawk 6403 Data-Recorder.

The Basic and Alternate program storage areas allow two different record formats to be defined, e.g., both a transmit and receive program could be stored for interchanging data between terminals. Control can be freely switched between the basic program and the alternate program by a Program Select key located on the keyboard. Program memory can be loaded from a strip of magnetic tape or by manual entry.

A separate bit, common to both the basic and alternate programs, is provided for each character position. This bit is set during a verifying operation when the character read from a record is not the same as that in data storage for the previous record. This technique permits manual initiation of automatic verification of data fields duplicated in consecutive records.

The 6403 incorporates a translator for translating the EBCDIC internal code to a modified EBCDIC or modified BCD transmission code. The translator also translates the received BCD transmission code to the internal EBCDIC code. In addition to the character set defined in Table II, the translator translates between BCD and EBCDIC plus zeros, minus zeros, and record marks. It also translates EBCDIC right and left brackets to BCD plus and minus zeros, respectively, and an EBCDIC colon to a BCD record mark.

Operating Modes

There are five principal modes of operation for the 6403 Data-Recorder, two of which are used for data communications. The five principal modes, selected by the operator, are Entry, Verify, Search, Send, and Receive.

Data is recorded on magnetic tape in the Entry mode. Data entered via the keyboard is stored in the core storage unit. Fixed data can be automatically retained from record to record.

When a complete record has been assembled, the recording action can be initiated automatically or manually. Data is written on the tape along with character parity bits and the longitudinal parity check character. The tape is then automatically backspaced and read, and the recorded data is compared bit for bit with the data stored in memory. The recorded character parity bits and the longitudinal check character are also checked.

A magnetic tape previously recorded on a 6403 can be checked in the Verify mode. A record is read into the unit's data storage area. Duplicate information in a series of records can be verified automatically as specified by the program. The operator can also initiate automatic verification of a data field repeated in successive records by depressing the Dup key. Character and longitudinal parity are checked as the record is read in.

If a discrepancy is detected while data is being keyed in to verify a tape record, the keyboard is interlocked and the operator is alerted by an indicator lamp. The operator can determine whether there is an error in the tape record by making repeated attempts to key in the character or by observing and interpreting the one-character binary data display. Corrections are easily made by depressing a special key and then keying the correct character. A separate control key permits correction of an entire field. If a correction is made, the tape is automatically backspaced. After completing the verification and correction of a record containing errors, the operator must reverify the entire corrected record. The record is written on tape, backspaced, and checked as when recording.

The recorded and verified data is transmitted to the receiving terminal by placing the sending and receiving terminals in the Send and Receive mode, respectively. Both operations are discussed in the following paragraphs.

Data is transmitted in fixed-length records as specified by the send and receive programs; record size can vary from a single character up to the capacity of the buffer. A record can contain as many as 180 characters when the available buffer options are employed at both the sending and receiving terminals.

Before a record can be transmitted, the sending terminal reads the record from tape, checks each character read for correct parity, and loads the entire record into the core buffer. Transmission begins when the core buffer contains the complete record and a ready status is received from the receiving terminal. Each 8-bit character read from the core buffer during transmission is translated to the modified BCD or EBCDIC transmission code, serialized, and transmitted to the receiving terminal.

The receiving terminal performs a validity check on each received character, translates the modified BCD or EBCDIC transmission code to the internal 8-bit EBCDIC code, and stores each of the translated characters in the core buffer. In addition to the validity check performed on each character, the receiving terminal performs a longitudinal parity check at the end of the received record. After each character of the record has been correctly received (i.e., no transmission errors), the record is written on tape and the written data is checked for data recording errors. When the received record is successfully written on tape, the receiving terminal acknowledges the transmitting terminal via the reverse-channel technique. Transmission of the next record begins when the acknowledge is received from the receiving terminal and the sending terminal is ready to transmit (i.e., when the next record is stored in its core buffer).

In the Search mode, a particular record can be located on the tape if it contains a unique identifying code or field. The identifying data is keyed into memory in the same position it occupies in the record. The tape halts when a match is found or when blank tape is encountered. The Search mode can be used to locate the beginning point of an interrupted recording or verifying operation, or to locate a specific record for modification or correction.

Codes and Error Control

The specific codes transmitted are determined by both the Image Mode switch on the keyboard and the program stored in the buffer memory.

When operating in the Image mode, the 6403 can transmit and receive any of the 256 code combinations in the EBCDIC code; this mode can only be used when communicating with a remote 6403. When communicating with a remote 1103 LDC, the Image Mode switch must be placed in the Off position to establish translation between EBCDIC and BCD codes. When operating in the BCD mode, data communication between the 6403 and a remote 1103 LDC or another 6403 is limited to the 64 code combinations compatible with the 1100 Series Data-Recorders.

When operating in the Image mode, redundancy is incorporated such that the 8-bit EBCDIC character is encoded as a 12-bit transmission code. As with the 1100 Series Data-Recorders the transmission codes are decoded in 4-bit groups. The following example illustrates the relationship between the internal code and the transmission code:

Internal code: 1 2 4 8 A B C D

Transmission code: 1 2 2 4 8 A $\overline{A}$ B C D $\overline{D}$ O

The barred symbols indicate the complement of the preceding bit; a binary 0 is transmitted in the most significant bit position. EBCDIC codes structured in this format provide a limited means for checking character validity.

When operating in the BCD mode, internal 6-bit character codes are translated to one of two specific transmission codes. Buffer positions designated as numeric locations by the stored program are translated from a 6-bit code to a 4-bit transmission code. Alphanumeric buffer positions are translated from a 6-bit code to an 8-bit transmission code. Table I shows the relationship between the numeric internal code and the transmission code. Alphanumeric characters are encoded as follows:

Internal code: 1 2 4 8 A B

Transmission code: 1 2 $\overline{2}$ 4 8 A $\overline{A}$ B

The barred numbers indicate the complement of the preceding bit.

TABLE I. BCD MODE NUMERIC TRANSMISSION CODE

Numeric to be Transmitted	Representation in Buffer and on Magnetic Tape*	Transmission Code**
	B A 8 4 2 1	8 4 2 1
0	0 0 0 0 0 0	1 0 1 0
1	0 0 0 0 0 1	1 0 1 1
2	0 0 0 0 1 0	0 0 1 0
3	0 0 0 0 1 1	0 0 1 1
4	0 0 0 1 0 0	0 1 0 0
5	0 0 0 1 0 1	0 1 0 1
6	0 0 0 1 1 0	0 1 1 0
7	0 0 0 1 1 1	1 1 0 1
8	0 0 1 0 0 0	1 1 0 0
9	0 0 1 0 0 1	1 0 0 1

*Each numeric is accompanied by a parity bit when recorded on tape or in the buffer.

**The transmission code configuration prevents more than two sequential identical bits per numeric and permits a limited validity check.

The numeric and alphanumeric transmission codes provide a limited means for checking character validity. The stored program at the receiving terminal designates specific buffer positions as numeric or alphanumeric codes. If an alphanumeric character is received in a position programmed for a numeric character, a character error results. A numeric character received in a position programmed for an alphanumeric character does not cuase a character error.

The EBCDIC and BCD transmission codes are shown in Table II.

TABLE II. MOHAWK 6403 LDC TRANSMISSION CODE

Code	BCD		EBCDIC		
Symbol*	Bit Position		Bit Position		
	B $\bar{A}$ A 8	4 $\bar{2}$ 2 1	E $\bar{D}$ D C	B $\bar{A}$ A 8	4 $\bar{2}$ 2 1
SYNC**	0 0 0 0	1 1 1 1			
ODD**	0 0 1 0	1 1 1 1			
EVEN**	0 1 0 0	1 1 1 1			
(NOT USED)	0 1 0 0	0 1 0 0			
1	0 1 0 0	0 1 0 1	0 0 1 1	1 0 1 0	0 1 0 1
2	0 1 0 0	0 0 1 0	0 0 1 1	1 0 1 0	0 0 1 0
3	0 1 0 0	0 0 1 1	0 0 1 1	1 0 1 0	0 0 1 1
4	0 1 0 0	1 1 0 0	0 0 1 1	1 0 1 0	1 1 0 0
5	0 1 0 0	1 1 0 1	0 0 1 1	1 0 1 0	1 1 0 1
6	0 1 0 0	1 0 1 0	0 0 1 1	1 0 1 0	1 0 1 0
7	0 1 0 0	1 0 1 1	0 0 1 1	1 0 1 0	1 0 1 1
8	0 1 0 1	0 1 0 0	0 0 1 1	1 0 1 1	0 1 0 0
9	0 1 0 1	0 1 0 1	0 0 1 1	1 0 1 1	0 1 0 1
0	0 1 0 1	0 0 1 0	0 0 1 1	1 0 1 0	0 1 0 0
#	0 1 0 1	0 0 1 1	0 1 0 1	1 0 1 1	0 0 1 1
@	0 1 0 1	1 1 0 0	0 1 0 1	1 0 1 1	1 1 0 0
'	0 1 0 1	1 1 0 1	0 1 0 1	1 0 1 1	1 1 0 1
=	0 1 0 1	1 0 1 0	0 1 0 1	1 0 1 1	1 0 1 0
"	0 1 0 1	1 0 1 1	0 1 0 1	1 0 1 1	1 0 1 1
SPACE	0 0 1 0	0 1 0 0	0 1 0 1	0 1 0 0	0 1 0 0
/	0 0 1 0	0 1 0 1	0 1 0 1	1 1 0 0	0 1 0 1
S	0 0 1 0	0 0 1 0	0 0 1 1	1 1 0 0	0 0 1 0
T	0 0 1 0	0 0 1 1	0 0 1 1	1 1 0 0	0 0 1 1
U	0 0 1 0	1 1 0 0	0 0 1 1	1 1 0 0	1 1 0 0
V	0 0 1 0	1 1 0 1	0 0 1 1	1 1 0 0	1 1 0 1
W	0 0 1 0	1 0 1 0	0 0 1 1	1 1 0 0	1 0 1 0
X	0 0 1 0	1 0 1 1	0 0 1 1	1 1 0 0	1 0 1 1
Y	0 0 1 1	0 1 0 0	0 0 1 1	0 1 0 1	0 1 0 0
Z	0 0 1 1	0 1 0 1	0 0 1 1	0 1 0 1	0 1 0 1
: (≠)	0 0 1 1	0 0 1 0	0 1 0 1	1 0 1 1	0 0 1 1
,	0 0 1 1	0 0 1 1	0 1 0 1	1 1 0 1	1 1 0 0
%	0 0 1 1	1 1 0 0	0 1 0 1	1 1 0 1	1 1 0 1
_	0 0 1 1	1 1 0 1	0 1 0 1	1 1 0 1	1 0 1 0

TABLE II. (Contd.)

Code	BCD		EBCDIC		
Symbol*	Bit Position		Bit Position		
	B $\bar{A}$ A 8	4 $\bar{2}$ 2 1	E $\bar{D}$ D C	B $\bar{A}$ A 8	4 $\bar{2}$ 2 1
>	0 0 1 1	1 0 1 0	0 1 0 1	1 1 0 1	1 0 1 1
?	0 0 1 1	1 0 1 1	0 1 0 1	1 0 1 1	0 0 1 0
-	1 1 0 0	0 1 0 0	0 1 0 1	1 1 0 0	0 1 0 0
J	1 1 0 0	0 1 0 1	0 0 1 1	0 0 1 0	0 1 0 1
K	1 1 0 0	0 0 1 0	0 0 1 1	0 0 1 0	0 0 1 0
L	1 1 0 0	0 0 1 1	0 0 1 1	0 0 1 0	0 0 1 1
M	1 1 0 0	1 1 0 0	0 0 1 1	0 0 1 0	1 1 0 0
N	1 1 0 0	1 1 0 1	0 0 1 1	0 0 1 0	1 1 0 1
O	1 1 0 0	1 0 1 0	0 0 1 1	0 0 1 0	1 0 1 0
P	1 1 0 0	1 0 1 1	0 0 1 1	0 0 1 0	1 0 1 1
Q	1 1 0 1	0 1 0 0	0 0 1 1	0 0 1 1	0 1 0 0
R	1 1 0 1	0 1 0 1	0 0 1 1	0 0 1 1	0 1 0 1
[(!)	1 1 0 1	0 0 1 0	0 1 0 1	0 0 1 1	0 0 1 1
$	1 1 0 1	0 0 1 1	0 1 0 1	0 0 1 1	1 1 0 0
*	1 1 0 1	1 1 0 0	0 1 0 1	0 0 1 1	1 1 0 0
)	1 1 0 1	1 1 0 1	0 1 0 1	0 0 1 1	1 1 0 1
;	1 1 0 1	1 0 1 0	0 1 0 1	0 0 1 1	1 0 1 0
^(¬)	1 1 0 1	1 0 1 1	0 1 0 1	0 0 1 1	1 0 1 1
&	1 0 1 0	0 1 0 0	0 1 0 1	0 0 1 0	0 1 0 0
A	1 0 1 0	0 1 0 1	0 0 1 1	0 1 0 0	0 1 0 1
B	1 0 1 0	0 0 1 0	0 0 1 1	0 1 0 0	0 0 1 0
C	1 0 1 0	0 0 1 1	0 0 1 1	0 1 0 0	0 0 1 1
D	1 0 1 0	1 1 0 0	0 0 1 1	0 1 0 0	1 1 0 0
E	1 0 1 0	1 1 0 1	0 0 1 1	0 1 0 0	1 1 0 1
F	1 0 1 0	1 0 1 0	0 0 1 1	0 1 0 0	1 0 1 0
G	1 0 1 0	1 0 1 1	0 0 1 1	0 1 0 0	1 0 1 1
H	1 0 1 1	0 1 0 0	0 0 1 1	0 1 0 1	0 1 0 0
I	1 0 1 1	0 1 0 1	0 0 1 1	0 1 0 1	0 1 0 1
](¢)	1 0 1 1	0 0 1 0	0 1 0 1	0 1 0 1	0 0 1 0
.	1 0 1 1	0 0 1 1	0 1 0 1	0 1 0 1	0 0 1 1
<	1 0 1 1	1 1 0 0	0 1 0 1	0 1 0 1	1 1 0 0
(	1 0 1 1	1 1 0 1	0 1 0 1	0 1 0 1	1 1 0 1
+	1 0 1 1	1 0 1 0	0 1 0 1	0 1 0 1	1 0 1 0
!(|)	1 0 1 1	1 0 1 1	0 1 0 1	0 1 0 1	1 0 1 1

*Symbols in parentheses indicate the corresponding symbol for the 1103 LDC.

**Odd or even message codes precede the data block for block count protection; see Paragraph 1.5. Sync, odd, and even codes are unique and are not generated from a character code by the method described in Paragraph 1.5.

An odd/even message code (8 bits) precedes each transmitted record to ensure against the loss or duplication of records. The odd/even message code is generated at both sending and receiving terminals. A message code error results when the two codes do not agree.

Error signaling in response to incorrect message codes or data transmission errors is performed via the reverse channel. The inherent value of this technique is that it eliminates the time required for line turnaround to allow the receiver to transmit an acknowledge code.

An interrupted signal on the reverse channel during data transmission is interpreted by the sending terminal as a request for retransmission. The signal on the reverse channel is normally interrupted at the end of a transmission (i.e., after the last character is received correctly) and is not returned until the currently received record has been successfully written on magnetic tape. Once the signal is returned, the sending terminal, if ready, begins to transmit the next record to the receiving terminal.

If the reverse-channel signal is not returned within a 20-second period, which is initiated at the start of the last record, transmission is halted and operator intervention is required. For a further description of the reverse-channel technique, see Report 6221, Digitronics Reverse-Channel Dial-o-Verter Line.

The Model 1320 Buffered Line Printer has a rated printing speed of 250 lines per minute (using the full character set) or 375 lines per minute (all numeric) and a 132-character buffer. The printer can be connected to any 6400 Series Data-Recorder (except the 6404) operating in the BCD mode and can receive data directly from a communications line or from magnetic tape; both operations are controlled by the program stored in the data-recorder buffer. The printer is capable of printing up to 132 characters per line and can handle pin-fed fanfold forms up to 20 inches wide.

The printer can operate in one of three modes: Full Edit, Line Edit, and List. Format control operations, including horizontal tabulation, spacing, and line feed, are initiated by control characters when the printer is in the Edit mode. The List mode is used for tape listing operations; format control functions are not provided.

Other Options

Other options for the 6400 Series Data-Recorders include:

- Remote End-of-Transmission Alarm — audibly indicates the end of a transmission; the alarm sounds for approximately 20 seconds at the end of transmission. The alarm can be located 50-cable feet from the data-recorder.

- Negative Field Indication/Record Delete — provides two separate and distinct functions. The Negative Field Indication permits entering a minus sign in the zone portion of the last character of a field. The field to be affected must be a programmed left zero field. (Programmed left zero is a standard feature on the 6403.) The Record Delete feature permits erasing a complete record on tape by reading the record into memory and initiating an Erase Backwards operation. This feature is operational during Entry or Verify operations and is provided mainly for correcting operator errors on tape. The Record Delete operation in the Verify mode should be followed by a Release operation, which reads the next record into memory. When deleting in the Verify mode, records can be removed if they were inadvertently entered twice or contain parity errors.

- Data-Recorder/1320 Outerface — provides a 1320 Buffered Line Printer interface for a second data-recorder to be used for backup.

1.6 First Delivery . . . . . April 1968.

1.7 Availability . . . . . 5 months.

2. CONFIGURATION

The 6403 Data-Recorder includes:

- An IBM 2400 Series compatible magnetic tape drive
- A magnetic core buffer
- A keyboard for entering data
- A communications interface

3. INPUT

3.1 Prepared Input

Magnetic tape drive (with all 6400 Series Data-Recorders) —

Input medium	0.5-inch magnetic tape recorded at 800 bits/in.; compatible with IBM 2400 Series tape format.
Input code	8-level EBCDIC plus odd parity; see Table II.
Quantity of data	100 characters; with options, records can be 80, 90, or from 10 to 180 characters in length when the 180-character buffer with the selective block length device is incorporated.
Character set	64 characters; alphanumeric plus special and record format characters. See Tables I and II; any of the possible 256 code combinations can be recorded.
Rated input speed	13,200 char/sec.
Effective speed	limited by block length, transmission speed, and transmission mode; see Table III.

3.2 Manual Input

Keyboard (with all 6400 Series Data-Recorders) —

Method of entry	47-key keyboard.
Quantity of data	up to capacity of buffer.
Character set	64 characters; 26 alpha, 10 numeric, and 28 special.
Comments	256 code combinations can be produced when the Multiple Code key is used; 13 of the 47 keys are used to initiate special functions; keyboard data is entered on tape via the core buffer.

TABLE III : MOHAWK 6403 EFFECTIVE BLOCK TRANSMISSION SPEEDS

Block Size, characters	Mode	Effective Block Transmission Speed, blocks/min			
		Line Transmission Speed, bits/sec			
		1,200	1,600	2,000	2,400
20	Image	140	153	161	168
	BCD, Alpha	152	163	170	176
	BCD, Num.	166	175	181	185
100	Image	45	56	66	74
	BCD, Alpha	60	73	84	94
	BCD, Num.	91	106	117	126
180	Image	28	36	43	50
	BCD, Alpha	39	49	58	66
	BCD, Num	65	78	89	99

3.3 Fixed Input . . . . . a data field can be entered into the buffer and automatically or manually duplicated in all subsequent records. Receiving terminal can substitute fixed fields for fields deleted from transmission; these fields need not have same location as deleted fields.

3.4 Transaction Code Input . . . . . no provision.

3.5 Message Configuration . . . . . messages are transmitted in fixed-length records as specified by program; the actual transmitted record length varies with the program and with buffer size; up to 25 consecutive characters can be deleted; at least 1 character must separate deleted fields; the last position must be transmitted. Fields deleted in the transmission can be automatically filled from constant information preset in the receiving terminal buffer; see Paragraph 3.3. Each record is preceded by a minimum of 3 sync characters followed by an odd/even message code; each record contains a longitudinal parity character at the end.

3.6 Operating Procedure

Before a message is transmitted, predetermined programs and time of transmission should be established between the communicating terminals. Programs should be on program tapes and ready for immediate use.

The operating procedure is as follows:

(1) Load program into memory.

(2) Mount tape reel.

(3) Set control switches on keyboard.

(4) Establish connection by dialing or manually signaling.

(5) Depress Data key on data set.

3.7 Entry of Time and Date . . . . . no provision.

4. OUTPUT

4.3 Output to Magnetic Tape

Magnetic tape unit (with all 6400 Series Data-Recorders) —

Tape size . . . . . 0.5-inch magnetic tape recorded at 800 bits/in.; compatible with IBM 2400 Series tape format.

Tape code . . . . . 8-level EBCDIC plus odd parity.

Rated output speed . . . . . 13,200 char/sec.

Effective speed . . . . . limited by block length, transmission speed, and transmission mode; see Table III.

Format control . . . . . extensive tape format control is provided by stored program; see Paragraph 1.5 for description.

Comments . . . . . records are recorded in fixed-length format; a 100-character record is standard; with options, records can be 80, 90, or from 10 to 180 characters in length when the 180-character buffer with the selective block length device is incorporated.

5. ERROR DETECTION AND CORRECTION

5.1 Data Entry Errors

Type of checking . . . . . character parity and longitudinal parity are checked when each record is read from magnetic tape.

Error indication . . . . . lamp is lighted.

Correction procedure . . . . . tape is automatically backspaced and read a second time; operator intervention is required when an error is detected a second time.

5.2 Data Transmission Errors

Type of checking . . . . . character validity and longitudinal parity.

Error indication . . . . . indicator lamp is lighted; reverse-channel signal is interrupted.

Correction procedure . . . . . automatic retransmissions continue for up to 20 seconds; after this time period, transmission is halted, error indicators are lighted, and operator intervention is required.

5.3 Data Recording Errors

Type of checking . . . . . each record is reread and checked bit for bit with the buffer contents; character and longitudinal parity are also checked.

Error indication . . . . . keyboard is locked, tape is halted, and status indicators are lighted.

Correction procedure . . . . . tape is automatically backspaced and data is written a second time; operator intervention is required when error occurs a second time.

5.5 Line Malfunctions

Detection . . . . . absence of signal on reverse channel for 20 seconds.

Action . . . . . operation halts.

6. CONDITION INDICATORS

A one-character binary data display, consisting of a group of lamps, is a standard feature on 6400 Series Data-Recorders. The data character stored in the active memory position is displayed in 8-bit EBCDIC code. The contents of the controlling program memory for that position are also displayed, in 4-bit binary fashion. A separate lamp indicates whether the basic or alternate program is controlling. The number of the active memory position is displayed in decimal fashion by two groups of ten lamps and one group of two lamps.

A comprehensive array of indicator lamps provides error status, transmission status, and verification status displays.

7. DATA TRANSMISSION

7.1 Basic Characteristics

Rated transmission speed . . . . . 1,200 or 1,600 (optional) bits/sec over the public telephone network; 2,400 or 4,800 (optional) bits/sec over a leased voiceband line.

Transmission method . . . . . serial by bit.

Transmission code . . . . . modified BCD or EBCDIC code; see Paragraph 1.5 and Tables II and III.

Transmission mode . . . . . half-duplex.

Order of bit transmission . . . . . low-order data bit first.

Synchronization . . . . . synchronous; each record is preceded by a minimum of 3 sync characters.

7.2 Connection to Communications Lines

Communications Line or Service	Data Set*
Public telephone network operating at the following speeds:	
1,200 bits/sec	Bell System Data-Phone Data Set 202C.
1,600 bits/sec	Bell System Data-Phone Data Set 201A.
Common-carrier leased voiceband line operating at the following speeds:	
2,400 bits/sec	Bell System Data Set 201B or Western Union 2400 Baud Data Modem.
4,800 bits/sec	Bell System Data Set 203 or Western Union 2481A Baud Data Modem.

7.3 Transmission Control

Call initiation ..... manual dialing or signaling.

Call reception ..... operator must establish voice communication and then switch to data mode.

Functional operations ..... under control of stored program; see Paragraph 1.5.

7.4 Multistation Operation ..... no provision.

8. PHYSICAL SPECIFICATIONS

Component	6403 Data-Recorder
Width (in.)	31.25
Depth (in.)	29.25
Height (in.)	43
Weight (lb.)	270
Power (kva)	0.31
Voltage	115
Frequency (Hz)	60
Phases	1
Temperature Range (°F)	50-100
Humidity Range (%)	20-88
Heat (BTU/hr)	885

* In some cases, equivalent data sets can be used: check with your local common-carrier communications consultant; also see Reports 4600, 4620, and 4640 for a current list of data sets available from the common carriers and independent manufacturers.

9. PRICE DATA

Component or Feature	Monthly Rental $	Purchase Price $	Monthly Maintenance $	Field Installation $
6403 LDC Data-Recorder	220.00	10,550	39.00	—
Optional Features				
2105 GPO Modem Adapter	10.00	400	NC	NC
8110 Block Counter (Decrementing)	5.00	200	0.50	50.00
8132 Data-Recorder/1320 Interface for Second Data-Recorder	7.00	280	2.00	FO
8150 Take-up Reel	10.00	400	2.50	50.00
8300 Self-Check Number Device (Mod 10)	20.00	990	5.00	FO
8301 Self-Check Number Device (Mod 7)	20.00	990	5.00	FO
8302 Self-Check Number Device (Mod 11)	20.00	990	5.00	FO
8305 Universal Self-Check Number Device	25.00	1,200	5.00	FO
8309 Negative Field Indication	NC	—	—	FO
8320 Single Run Entry/Verify	2.00	115	0.50	50.00
8500 90-Character Memory	NC	—	—	18.00
8507 180-Character Memory with Selective Block Length Device	14.50	600	1.00	FO
8508 80-Character Memory	NC	—	NC	18.00
8605 1,600-bit/sec Transmission Rate	NC	—	NC	15.00
8606 Remote End of Transmission Alarm	50.00 OTC	—	—	—
8608 High-Speed Four-Wire Interface for 6403	30.00	1,200	NC	35.00
8630 Timing for Transatlantic Communications	10.00 OTC	—	NC	15.00
8631 Western Union 2121B Interface	25.00 OTC	—	NC	30.00
8632 ITT 2002 Interface	30.00 OTC	—	NC	35.00
8633 Data Rate Selection GPO Modem	20.00 OTC	—	NC	35.00
8634 Data Rate Select 1,200/1,800	20.00 OTC	—	NC	25.00
8635 International Domestic Communications Adapter	5.00	300	1.00	30.00
8640 ± Phase, Record Mark Translator	NC	—	—	15.00
8703 Reading Table Extension without Panel Insert	5.00	50	NC	NC
8704 Reading Table Extension with Panel Insert	6.00	57	NC	NC
8705 Subtotal for 3021 Adding Machine	50.00 OTC	—	NC	FO

NC — no charge
OTC — one-time charge
FO — factory only.

MOTOROLA TP-4000 SERIES TELEPRINTERS

.1 GENERAL

.11 Identity: . . . . . TP-4000 Series Teleprinters.

.12 Manufacturer: . . . . . Motorola Inc.
Government Electronics Division
1450 N. Cicero Avenue
Chicago, Illinois 60651

.13 Basic Function: . . . . . prints data received from a parallel-by-bit source.

.15 Description

A common misconception within computer circles is that the Motorola TP-4000 Series Teleprinter is a data communications device. The Teleprinter has been incorporated in special systems in a data communications environment, but at present, an off-the-shelf TP-4000 Series Teleprinter with a communications interface is not available. Motorola is, however, planning a communication capability for its TP-4000 Series Teleprinters to be available in the near future.

The Motorola TP-4000 Series Teleprinter is a high-speed, desk-top, non-impact printer that uses an electrothermal printing technique similar to the technique used by some facsimile devices. The Teleprinter prints at speeds up to 400 characters per second (4000 words per minute) and features a core-rope translator and integrated circuity in addition to its unique printing technique. Figure 1 shows a typical TP-4000 Series Teleprinter.

The special paper required for the Motorola Teleprinter contains a thin layer of aluminum deposited on a paper base, smoothly surfaced by a light-gray chemical coating. Printing appears as gray characters over the light gray background, with a limited degree of contrast (see Figure 2). Multiple copies cannot be produced by the Teleprinter.

The Teleprinter prints 80 characters per line with a vertical line spacing of six lines per inch. Maximum line length and paper width are 7.2 inches and 8.4 inches, respectively. Friction-fed roll forms are used.

The Teleprinter includes a code translator unit and a printer. The translator unit accepts parallel-by-bit data characters and translates each character into five discrete seven-bit codes required to form a printed character. Up to 11 (or optionally 33) printers can be operated from a single translator unit.

The TP-4000 Series Teleprinter line includes six models ranging in speed from 125 to 400 characters per second. Table I lists the available models together with rated speed and cost information.

TABLE I: TP-4000 SERIES TELEPRINTERS

Model	Speed, char/sec	Printer Cost, $ (1)	Translator Cost, $ (2)
TP-4125	125	5,400	3,900
TP-4200	200	5,400	3,900
TP-4225	225	5,400	3,900
TP-4250	250	5,400	3,900
TP-4300	300	5,000	3,800
TP-4400	400	5,400	3,900

(1) Discounts applying to purchases of printers in quantities exceeding nine are approximately as follows:
10 to 19 printers: 12%
20 to 49 printers: 23%
Discounts apply to all models and refer to base prices shown in table.

(2) Discounts applying to purchases of translators in quantities exceeding nine are approximately as follows:
10 to 19 translators: 5%
20 to 49 translators: 10%
Discounts apply to all models and refer to base prices shown in table.

Figure 1. Typical Motorola TP-4000 Series Teleprinter.

.15 Description (Contd.)

The Teleprinter accepts any customer-specified 6- or 7-level code. Control-character recognition, including Carriage Return/Line Feed and End-of-Transmission (EOT), is performed by the translator unit. A Carriage Return/Line Feed operation is automatic at the end of an 80-character line; an EOT character inhibits further printer action. The character set contains up to 63 printable characters, including upper-case alphabetics, numerics, punctuation marks, and special symbols.

Motorola's printing technique employs four equally-spaced printing heads attached to a continuous belt. The belt, which is slightly inclined from the horizontal, is driven at constant speed across the paper from left to right. A single synchronous motor drives the paper and the belt; both are in constant motion as printing is performed. Print head spacing is such that the departure of a print head from a completed print line coincides with the arrival of the following print head at the beginning of the next line. Figure 3 shows the relationships of the various components.

A single print head is connected to the print circuitry during a line print period; connection is made by seven fingers extending from the print head. When a print head enters the printing zone, its fingers contact a commutator that extends the width of the paper. The fingers ride against the commutator as the head moves across the paper from left to right. Head connection terminates as the print head exits from the print zone and the next print head contacts the commutator to print the next line.

Each of the seven fingers extending from the print head terminates in a print stylus. The seven styli are arranged in a vertical column. Printing is performed by an electrical discharge between a stylus and the platen; the discharge produces a small dark dot on the chemically-treated paper. A printed character appears as a pattern of dots arranged in five columns of seven dots per column. The character is constructed by applying five sequential electrical impulses to selected styli. Selection and sequencing of the print styli is a function of the print control circuits. Figure 2 shows a sample of the printing.

(Contd.)

THERE ARE MANY BUSINESS PROBLEMS THAT CAN BE SOLVED MORE EFFICIENTLY
AND WITH LESS COST BY THE MEANS OF INTEGRATED DATA/COMMUNICATIONS SYSTEMS
CONCEPTS. AMONG THESE ARE THE FOLLOWING:

- OBTAINING ADEQUATE AND TIMELY INFORMATION
  NECESSARY FOR MANAGEMENT DECISIONS

- SPEEDING DISTRIBUTION WITH FAST MOVING PAPERWORK

- COMMUNICATING WITH COMPUTER CENTERS.

Figure 2. Motorola TP-4000 Series Sample Printout.

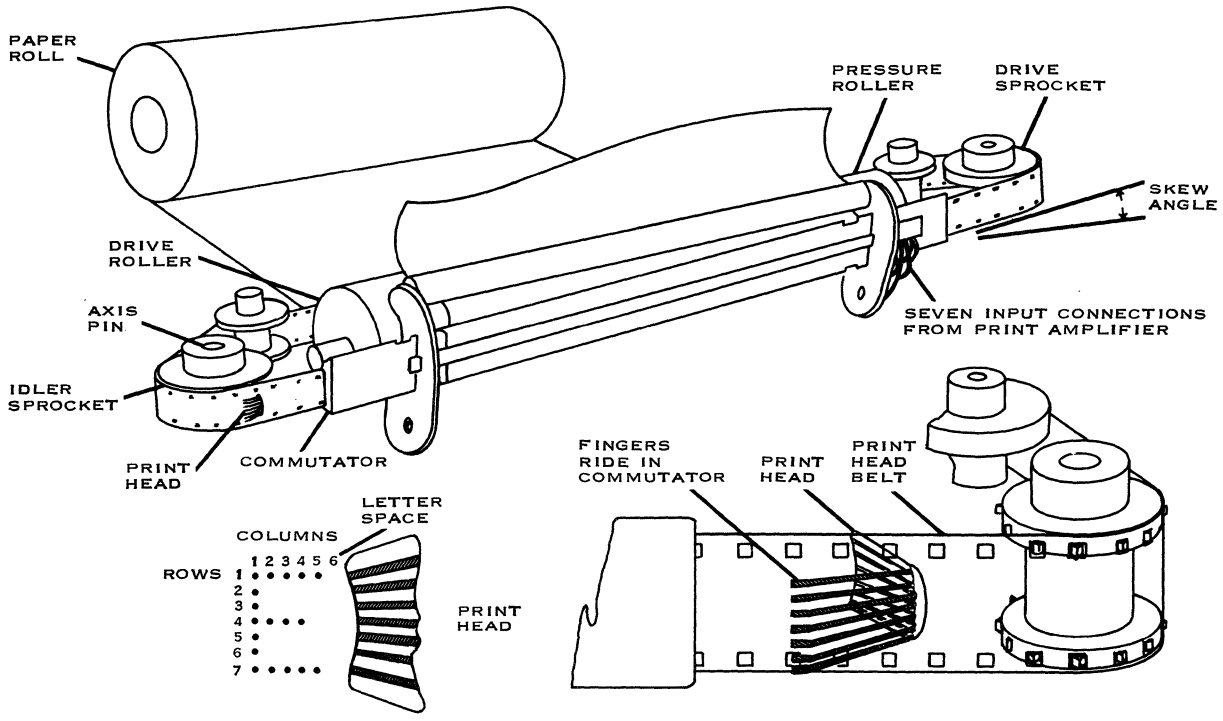


Figure 3. TP-4000 Series Printing Technique.

PHILCO-FORD ALPHANUMERIC COLOR DISPLAY UNIT MODEL D-20

.1 GENERAL

.11 Identity: . . . . . Alphanumeric Color Display Unit Model D-20.

.12 Manufacturer: . . . . . Philco-Ford Corporation
W D L Division
1002 Gemini Avenue
Houston, Texas 77058

.13 Basic Function: . . . . . displays, via cathode ray tube, data received from a remote computer or entered via keyboard; transmits data to a remote computer over the public telephone network or leased voice-band line.

.15 Description

The Philco-Ford Model D-20 Alphanumeric Color Display Unit is designed to communicate with a remote computer over the public telephone network or a leased voice-band line, under control of a stored program in the computer. The D-20 is a self-contained unit and includes a keyboard, cathode ray tube, memory, and communications interface.

Data is transmitted asynchronously in a half-duplex mode at 110 bits per second (10 characters per second).

A modified 7-level USASCII transmission code is employed, with an eighth bit added for character parity; see Table I. One start bit and two stop bits are appended to each character transmitted resulting in an 11-bit character.

The D-20 Color Display Unit contains a 768-character memory module, composed of magnetostrictive delay lines, in addition to editing logic, control logic, color circuits, character generation circuits, and a communications interface that is compatible with the Bell System Data-Phone Data Set 103A2.

The D-20 Color Display Unit provides a 10.4 inch by 7.4 inch image area. The long side of the cathode ray tube (CRT) is mounted horizontally.

The image area is arranged in 24 lines of 32 characters per line. A maximum of 768 characters can be displayed on the screen. The D-20 can display data in three colors: red, green and blue; data can also be displayed in white. Characters and symbols are displayed by a 5-by-7 dot matrix.

The keyboard is attached directly to the Display Unit and has 53 keys arranged in conventional typewriter style plus an array of 12 special function keys located at the right of the keyboard. Of the 12 special function keys, 9 provide control functions that include color selection, local operation, transmit, etc; three of these keys are not used at present.

Editing Facilities

Editing facilities are limited; they include the ability to replace a character with another character or space and to erase the screen by clearing the memory. Repetitive entry of characters or space is provided by the simultaneous depression of the Repeat key and that of the desired character to be repeated. Horizontal and vertical tab functions are not provided.

Cursor Controls

Cursor controls include:

- Skip — advances the cursor one character position. Simultaneous depression of the Repeat and Skip keys causes repetitive cursor movement until the cursor moves off the screen (after the last display position is located).
- Backspace — backspaces the cursor one character position. Simultaneous depression of the Repeat and Backspace keys cause repetitive cursor movement until the first display position is located.

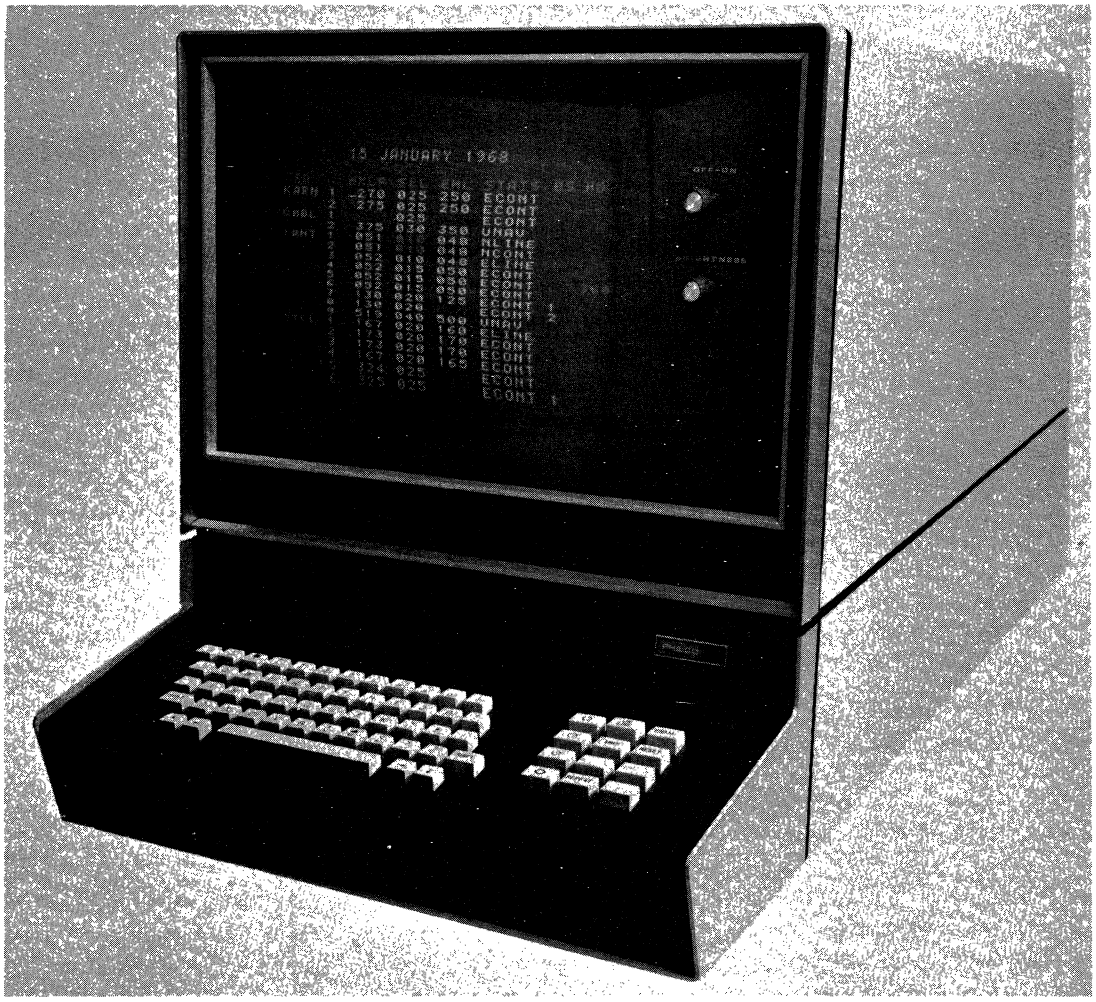


Figure 1. Philco-Ford Alphanumeric Color Display Unit Model D-20.

.15 Description (Contd.)

- Carriage Return/Line Feed Down — establishes a single space between displayed lines with the cursor positioned at the initial character location of the next line. Simultaneous depression of the Repeat key and this key causes repetitive cursor movement until the cursor is positioned at the initial character position of the last line.
- Carriage Return/Line Feed Up — establishes a single space between displayed lines with the cursor positioned at the initial character location of the previous line. Simultaneous depression of the Repeat key and this key causes repetitive cursor movement until the cursor is positioned at the initial character location of the first line.

The non-destructive cursor is displayed as a caret (^) and marks the next data-entry position. The cursor color indicates the color of the next character to be displayed and can be switched between red, green, blue, and white via the keyboard. A data code does exist for the cursor symbol and can be received and displayed but cannot be entered and stored from the keyboard.

.16 First Delivery: . . . . . ?

.17 Availability: . . . . . 3 months.

(Contd.)

TABLE I: PHILCO-FORD D-20 COLOR DISPLAY UNIT USACII TRANSMISSION CODE

Bit Positions				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1	Row	Column 0*	1*	2	3	4	5	6*	7*
0	0	0	0	0	NULL		SP	ø	^	P	NOT DEFINED	
0	0	0	1	1			◊	1	A	Q		
0	0	1	0	2			□	2	B	R		
0	0	1	1	3			#	3	C	S		
0	1	0	0	4			$	4	D	T		
0	1	0	1	5			%	5	E	U		
0	1	1	0	6			&	6	F	V		
0	1	1	1	7			'	7	G	W		
1	0	0	0	8			(	8	H	X		
1	0	0	1	9			)	9	I	Y		
1	0	1	0	10	LF		*	:	J	Z		
1	0	1	1	11			+	;	K	**		
1	1	0	0	12			,	<	L	~		
1	1	0	1	13	CR		-	=	M	▲		
1	1	1	0	14			.	>	N	↑		
1	1	1	1	15			/	?	O	**		

* Codes contained in columns 0, 1, 6, and 7 are not displayed or stored in the buffer memory.

** These codes are displayed as spaces.

Special symbols:

▲ Start-of-Entry symbol

◊ End-of-Entry symbol.

~ Tilde symbol; can be stored in memory and displayed only through keyboard entry.

↑ Up Arrow symbol; can be stored in memory and displayed as | only through keyboard entry.

.2 CONFIGURATION

The D-20 is a self-contained unit and includes a keyboard, cathode ray tube, memory, and communications interface.

The data sets required for connection to standard communications facilities are specified in Paragraph .72.

.3 INPUT

.31 Fixed Input: . . . . . no provision.

.32 Manual Input

Keyboard: . . . . . via a 53-key keyboard.
Quantity of Data: . . . . . up to 768 characters.
Character set: . . . . . 60 characters, including digits, upper-case letters, and special symbols.
Comments: . . . . . 6 keys provide control functions only and do not produce a displayable symbol; 4 keys are blank (no function).

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration

The D-20 accepts commands configured in a two-character sequence. Table II presents the ten commands accepted by the D-20. Messages received by the D-20 must begin with an SOM character sequence. Message transmission from the D-20 is initiated by a Request-for-Data (RFD) character sequence or by depressing the Transmit key on the keyboard. Control characters are stripped from the incoming message and are not entered in the buffer memory. Data received between the Up Arrow and Line Feed characters is also excluded from entering the memory. Control characters can not be transmitted from the D-20 except by entering the desired two-character control sequence via the keyboard; see Table II.

TABLE II: CONTROL CHARACTER SEQUENCES *

Control Characters	Control Codes		Function
~ 0	1011100	0110000	Initiates white color mode
~ 1	1011100	0110001	Initiates green color mode
~ 2	1011100	0110010	Initiates red color mode
~ 3	1011100	0110011	Initiates blue color mode
~ 4	1011100	0110100	Initiates carriage return
~ 5	1011100	0110101	Initiates EOM sequence; unlocks Keyboard at end of received message
~ 6	1011100	0110110	Initiates character skip sequence (same as Skip key)
~ 7	1011100	0110111	Request-for-Data (RFD) sequence — initiates transmit mode
~ 8	1011100	0111000	Start-of-Message (SOM) sequence — when received, positions cursor to upper-left corner, initiates white color mode, and locks keyboard
~ 9	1011100	0111001	Initiates display erase sequence (same as Erase)

* Control character sequences can be entered from the keyboard or received from the communications line.

.36 Operating Procedure

A message to be transmitted from a D-20 Alphanumeric Color Display Unit is composed by depressing the Erase key to clear the screen and position the cursor at the upper left corner of the screen (first position in memory), and then entering the data from the keyboard. Controls are provided to advance or backspace the cursor one or several positions at a time (when using the Repeat key) to move the cursor to the beginning of the next line or to the beginning of the previous line, or to return the cursor to the beginning of the first line. Composition errors can be corrected or changes to existing text can be made by positioning the cursor to the character (s) to be changed and keying new data; existing text can only be erased by entering spaces over the portion of text to be erased.

The message to be transmitted is bracketed by the displayed Start-of-Entry and End-of-Entry symbols which are entered from the keyboard. Once the message has been composed and is ready for transmission, the operator depresses the On Line switch to On Line mode (which locks the keyboard) and either awaits a Request-for-Data (RFD) sequence or depresses the transmit key. Only the bracketed data is transmitted. Specific cursor positioning is not essential prior to transmission. Keyboard entery is inhibited while receiving or transmitting a message.

.37 Entry of Time and Date: . . . . . no provision.

(Contd.)

.4 OUTPUT

.46 Output to Visual Display Device

D-20 A/N Color Display Unit

Output medium: . . . . . cathode ray tube, displays red, green, blue, or white characters against black background.
Character set: . . . . . digits 0-9, upper-case letters A-Z, and 24 punctuation and special symbols; see Table I.
Character size: . . . . . characters are formed by a 5- by 7-dot matrix which is nominally 0.20 inch wide and 0.21 inch high.
Display size: . . . . . 10.4 inches wide by 7.4 inches high.
Characters per line: . . . . . 32.
Lines per display: . . . . . 24.
Characters per display: . . . . . 768.
Buffer capacity: . . . . . 768 characters.
Format control: . . . . . flexible cursor movement controls: see Paragraph .15; each space position on the display occupies one character position in the buffer; horizontal and vertical tab functions are not provided; color selection; carriage return.
Rated output speed: . . . . . 10 char/sec over a voice-band line.
Effective output speed: . . . . . lower than rated speed due to exchange of control sequences.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors: . . . . . no provision except visual checking of displayed data.

.52 Data Transmission Errors

Type of checking: . . . . . character and longitudinal parity.
Error indication: . . . . . special symbol (customer option) is displayed in place of error character.
Correction procedure: . . . . . requires operator intervention.

.53 Data Recording Errors: . . . . . no provision except visual checking of displayed data.

.55 Line Malfunctions: . . . . . no special provisions for checking.

.6 CONDITION INDICATORS: . . . . . none.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed: . . . . . 10 char/sec (110 bits/sec).
Transmission method: . . . . . serial by bit.
Transmission code: . . . . . 7-level USASCII; a start bit, an even parity bit, and two stop bits are added to each character; a total of 11 bits are transmitted per character; see Table I.
Transmission mode: . . . . . half-duplex.
Order of bit transmission: . . . . . low-order bit (b1) is transmitted first, parity bit last.
Synchronization: . . . . . start and stop bits are transmitted with each character.

.72 Connection to Communications Lines

Communications Line or Service	Data Set*
Bell System leased line Type 3002 Data Channel:	Bell System Data Set 103F.
Western Union Class E Data Channel:	Western Union 600 Baud Data Modem.
Public telephone network:	Bell System Data-Phone Data Set 103A2.

* In some cases, equivalent data sets can be used; see your local common-carrier communications consultant.

.73 Transmission Control

Call initiation: . . . . . manual dialing or signaling.

Call reception: . . . . . manual.

Functional operation: . . . . . carriage return, line feed, and the control character sequences listed in Table II.

.74 Multistation Operation: . . . . . no provision.

.8 PHYSICAL SPECIFICATIONS

Component	D-20 Display Unit
Width (inches)	18.25
Depth (inches)	28.5
Height (inches)	19.5
Weight (pounds)	125
Power (KVA)	0.35
Voltage	115
Frequency (cps)	60
Phases	1
Temperature Range (°F)	59 to 95
Humidity Range (%)	10 to 90
Heat (BTU/hr)	?

.9 PRICE DATA

Component or Feature	Purchase* Price, $
Model D-20 Alphanumeric Color Display Unit	7200

* Philco-Ford states that a leasing arrangement and a maintenance contract is available on request.

PHILCO-FORD ALPHANUMERIC DISPLAY UNIT MODEL D-21

.1 GENERAL

.11 Identity: . . . . . Alphanumeric Display Unit Model D-21.

.12 Manufacturer: . . . . . Philco-Ford Corporation
WDL Division
1002 Gemini Avenue
Houston, Texas 77058.

.13 Basic Function: . . . . . displays, via cathode ray tube, data received from a remote computer or entered via keyboard; transmits data to a remote computer over the public telephone network or leased voice-band line.

.15 Description

The Philco-Ford Model D-21 Alphanumeric Display Unit is a stand-alone display unit developed by Philco-Ford from the basic IBM 2260 Display Station and IBM 2848 Display Control. A detailed analysis of the IBM 2260/2848 can be found in Report 6456.

This summary report presents the differences between the equipment marketed by Philco-Ford and IBM and contains the information unique to the D-21 Display Unit. Except where noted in this report, the Philco-Ford D-21 is functionally identical to the IBM 2260 (see Report 6456).

Differences Between Philco-Ford and IBM Equipment

Some major differences exist between the Philco-Ford Model D-21 Alphanumeric Display Unit and the IBM 2260 Display Station/2848 Display Control. The D-21 features:

- Increased memory size,
- Increased viewing area,
- A different display format, and
- A different keyboard arrangement.

Transmission Characteristics

The D-21 Display Unit operates asynchronously over the public telephone network or a leased voice-band line at up to 120 characters per second (1200 bits per second). The D-21 interface is compatible with the Bell System Data-Phone Data Set 202C or Data Set 202D.

A modified 7-level USASCII transmission code, presented in Table I, is used with an eighth bit added for parity. Unity start and stop bits bracket each character transmitted to produce a 10-bit character. The low-order bit (b1) of each character is transmitted first.

Display Unit

The display portion of the D-21 Display Unit is a 14-inch rectangular CRT with a 9-inch high by 10.7-inch-wide viewing surface. The characteristics of the display are presented in Table II. Each character is formed by a 5- by 7-dot matrix. The display can be adjusted for intensity and contrast.

Keyboard

The keyboard included with the D-21 Display Unit contains 65 keys, including cursor and control keys, arranged in a conventional typewriter style.

The non-destructive cursor is displayed as a caret (^) and marks the next data entry position. The cursor can not be entered in the buffer memory from the keyboard, but can be stored as the result of a computer message.

Cursor controls include:

- Skip — advances the cursor one character position. Simultaneous depression of the Repeat and Skip keys causes repetitive cursor movement until the cursor moves off the screen (after the last display position is located).

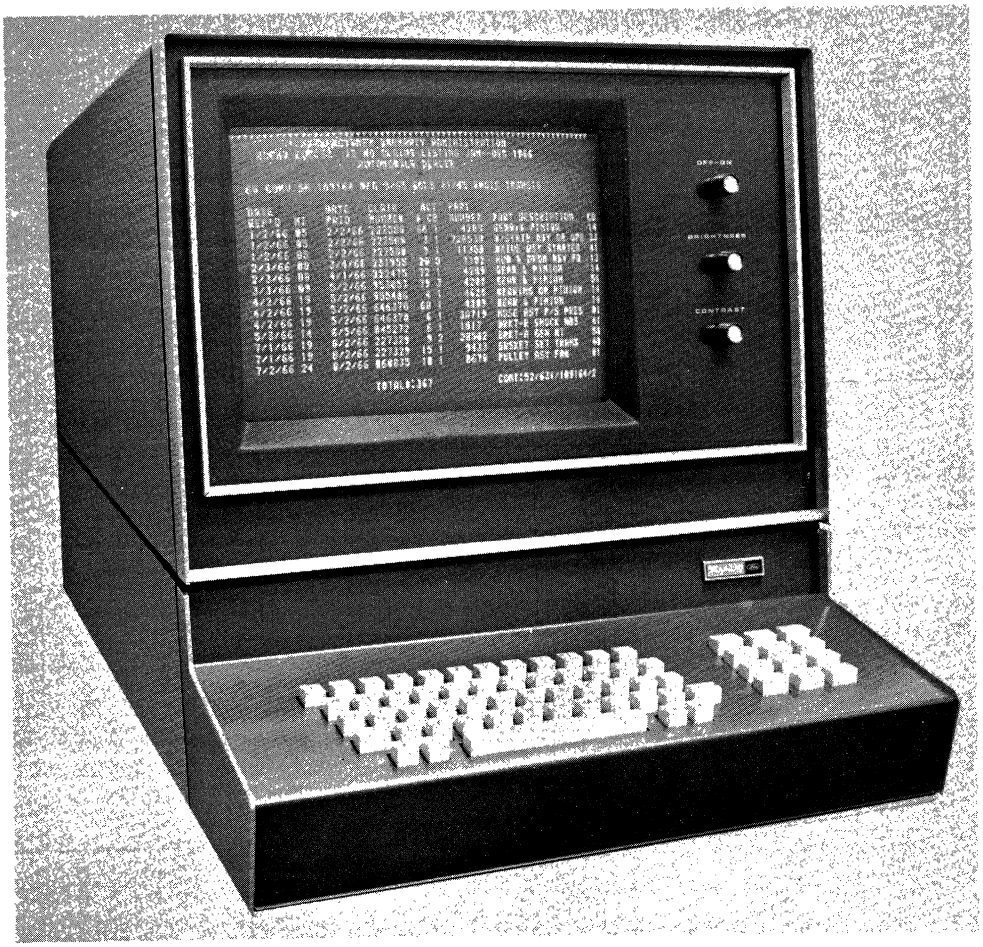


Figure 1. Philco-Ford Alphanumeric Display Unit Model D-21.

.15 Description (Contd.)

- Backspace — backspaces the cursor one character position. Simultaneous depression of the Repeat and Backspace keys cause repetitive cursor movement until the first display position is located.
- Carriage Return/Line Feed Down — establishes a single space between displayed lines with the cursor positioned at the initial character location of the next line. Simultaneous depression of the Repeat key and this key causes repetitive cursor movement until the cursor is positioned at the initial character position of the last line.
- Carriage Return/Line Feed Up — establishes a single space between displayed lines with the cursor positioned at the initial character location of the previous line. Simultaneous depression of the Repeat key and this key causes repetitive cursor movement until the cursor is positioned at the initial character location of the first line.

Editing Facilities

Editing facilities are limited; they include the ability to replace a character with another character or space and to erase the screen by clearing the memory. Repetitive entry of characters or spaces is provided by the simultaneous depression of the Repeat key and the desired character key. Horizontal and vertical tab functions are not provided. When it is desired to retain fixed data, as in a fixed format, a New Line symbol is used at the end of each entry. The New Line symbol causes the cursor to skip all succeeding characters in the line and move to the beginning of the next line, this providing split-screen capability. The New Line symbol (displayed as ~) can be entered from the keyboard or received as part of the computer message.

(Contd.)

TABLE I: MODEL D-21 DISPLAY UNIT USASCII TRANSMISSION CODE*

Bit Positions				b7 b6 b5	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
					Column							
b4	b3	b2	b1	Row	0	1	2	3	4	5	6	7
0	0	0	0	0			SP	0	∧	P		p
0	0	0	1	1	SOH		◊	1	A	Q	a	q
0	0	1	0	2	STX		□	2	B	R	b	r
0	0	1	1	3	ETX		#	3	C	S	c	s
0	1	0	0	4	EOT		$	4	D	T	d	t
0	1	0	1	5		NAK	%	5	E	U	e	u
0	1	1	0	6	ACK		&	6	F	V	f	v
0	1	1	1	7			'	7	G	W	g	w
1	0	0	0	8			(	8	H	X	h	x
1	0	0	1	9			)	9	I	Y	i	y
1	0	1	0	10	~		*	:	J	Z	j	z
1	0	1	1	11			+	;	K		k	
1	1	0	0	12			,	<	L		l	
1	1	0	1	13			-	=	M	△	m	
1	1	1	0	14			.	>	N		n	|
1	1	1	1	15			/	?	O	_	o	

*All characters in columns 2 through 5 inclusive, are displayable; characters in columns 6 and 7 can be received but, are displayed as their upper-case equivalents. The following symbols are displayed:

△ — Start-of-Entry symbol

◊ — End-of-Entry symbol

~ — New Line symbol

∧ — Cursor

.15 Description (Contd.)

A Reset key is provided to initialize the D-21 Display Unit and, when depressed, resets the cursor to the upper-left corner of the display; the memory is not cleared.

Message Configuration

The D-21 Display Unit employs the same message configuration and uses the same polling sequence as the IBM 2260. Its five read and write commands are identical to the 2260; printer commands are not included. Communication between the remote computer and a D-21 Display Unit is initiated when the computer transmits a four-character address to the D-21 Display Unit. This sequence consists of the characters: EOT (poll or read) or SOH (write), the D-21 address, unit address, and command. Because the D-21 Display Unit is a stand-alone display unit, the D-21 address is the only address recognized; the unit address character is converted but not identified. The two general types of commands are poll (or read) and write.

TABLE II: D-21 DISPLAY UNIT CHARACTERISTICS

Characteristic	Description
Output medium	Cathode ray tube; displays white characters against black background.
Character set	62 characters, including upper-case alphabetics, numerics, punctuation marks and special symbols.
Character size	Characters are formed by a 5- by 7-dot matrix which is nominally 0.11 inch wide and 0.26 inch high.
Display size	10.7 inches wide by 9 inches high.
Characters per line	64.
Lines per display	24.
Characters per display	1536.
Buffer capacity	1536 characters.
Format control	Flexible cursor movement controls; each space position on the display occupies one character position in the buffer; horizontal and vertical tab functions are not provided.
Rated output speed	Up to 120 char/sec (1200 bits/sec).
Effective output speed	Limited by message length and communications facility.

.15 Description (Contd.)

There are two read commands for transmitting data from the D-21 Display Unit to the computer and three write commands for transferring data to a Display Unit. These commands include:

- Specific Poll — initiates transfer of a message entered via the keyboard.
- Read Full — initiates transfer of the entire buffer memory contents.
- Write Addressed Unit — conditions the addressed D-21 for reception and display of the associated message.
- Erase/Write Addressed Unit — causes the display of the addressed D-21 to be erased and the cursor to be positioned at the first displayable position.
- Write Line Address — same as Write Addressed Unit except that the display is started on the addressed line instead of on the first line.

When a poll command addressed to the D-21 Display Unit is received, the D-21 responds with a text message consisting of the following characters: STX, D-21 Unit Address, text, ETX, and LRC (longitudinal redundancy check). If the computer receives the message without detecting an error, an ACK character is transmitted. If an error is detected, a NAK character is transmitted and the D-21 Display Unit automatically retransmits the message.

After the message has been correctly received and the acknowledgement transmitted, the computer can transmit one or more messages to the Display Unit. Each message from the computer consists of: STX, text, ETX, and LRC. Each message is acknowledged with an ACK or NAK response.

(Contd.)

.15 Description (Contd.)

If the command is a write command, the D-21 Display Unit responds with an ACK character if it receives the message correctly and a NAK if not. The computer then transmits one or more messages to the addressed D-21 in the same format as above. Each message is acknowledged with an ACK or NAK by the D-21. If the command is a Write Line Address, the line address is inserted following STX in the computer message.

The D-21 Display Unit will make no response if it detects a parity error or an invalid command or address in the addressing sequence.

A one-character response of EOT from the D-21 is transmitted to terminate a message after having received positive acknowledgement to a Read or Specific Poll command from the remote computer. An EOT is transmitted by the remote computer to terminate a message after having received a positive acknowledgement to a write command from the D-21. An EOT is also transmitted by the D-21 as a negative response (no message waiting) to a Specific Poll.

The text can contain up to 1536 characters. The displayed data between a New Line symbol and the end of the line is not transmitted when a D-21 is polled; fixed data can be retained on the screen during a write operation if New Line symbols are contained in the received message in the appropriate places.

Operating Procedure

A message to be transmitted from a D-21 Display Unit is composed by depressing the Erase key to clear the screen and position the cursor at the upper left corner of the screen (first position in memory), and then entering the data from the keyboard. Controls are provided to advance or backspace the cursor one or several positions at a time (when using the Repeat key) to move the cursor to the beginning of the next line or the beginning of the previous line, or to return the cursor to the beginning of the first line. Composition errors can be corrected or changes to existing text can be made by positioning the cursor to the character(s) to be changed and keying new data; existing text can only be erased by entering spaces over the portion of text to be erased.

The message to be transmitted is bracketed by the displayed Start-of-Entry and End-of-Entry symbols which are entered from the keyboard. Once the message has been composed and is ready for transmission, the operator depresses the Transmit key and places the Display Unit in the On-Line mode. Only the bracketed data is transmitted when the D-21 is polled. Specific cursor positioning is not essential prior to transmission. Keyboard entry is inhibited while receiving or transmitting a message.

Error Detection and Correction

Character and longitudinal parity checking is performed on all data received by the D-21 Display Unit from the remote computer; character parity bits and longitudinal check characters are generated and transferred with all data transmitted from the D-21. If the remote computer returns a negative acknowledgement indicating that an error was detected at the computer site, the D-21 Display Unit automatically retransmits the message.

The D-21 Display Unit also checks parity and validity of each command sequence received from the computer. If errors are detected, the D-21 does not respond.

Software

Philco states that the D-21 is compatible with the IBM software (including BTAM and QTAM) for the IBM 2260 Display Station.

.16 First Delivery:. . . . . March 1968.

.17 Availability:. . . . . 3 months.

.8 PHYSICAL SPECIFICATIONS

Component	D-21 Display Unit
Width (inches)	18.25
Depth (inches)	28.50
Height (inches)	19.50
Weight (pounds)	125
Power (KVA)	0.345
Voltage	115
Frequency (cps)	60
Phases	1
Temperature Range (°F.)	59 to 95
Humidity Range (%)	10 to 90
Heat (BTU/hr)	?

.9 PRICE DATA

Component or Feature	Purchase* Price, $
Model D-21 Alphanumeric Display Unit	9200

* Philco states that a leasing arrangement and a maintenance contract is available on request.

RCA 70/653 COMMUNICATION CONTROL (WITH RCA SPECTRA 70 COMPUTERS)

.1 GENERAL

.11 Identity: . . . . . RCA 70/653 Communication Control (Single Channel)

.12 Manufacturer: . . . . . Radio Corporation of America
Electronic Data Processing Division
Cherry Hill, New Jersey 08101

.13 Basic Function: . . . . . transmission of data over a voice or broadband line between an RCA Spectra 70 computer system and another RCA computer, which has appropriate communications equipment

.15 Description

The single-channel RCA Communication Control was designed to permit synchronous, half-duplex communication between an RCA Spectra 70 computer system and a remote RCA 301, 3301, or Spectra 70 computer system equipped with the appropriate communications equipment.

All models of the 70/653 Communications Controls are functionally similar; they differ in transmission speeds and in the communications facilities with which they can be used. In general, communications between an RCA Spectra 70 computer equipped with a 70/653 Communication Control and a remote computer equipped with compatible equipment take place as an interchange of data and and acknowledgment messages. An interrupt is generated only at the end of a data block or because of errors or malfunctions.

A 70/653 Communication Control (any model) can be connected via one trunk of any type of input/output channel in any Spectra computer system.

Three models of the 70/653 Communication Control are available. The 70/653-25 permits communications at 2000 bits per second over the public telephone network or at 2400 bits per second over a common-carrier leased voiceband line. The 70/653-26 is restricted to transmission at 2000 bits per second over the public telephone network and includes provisions for programmed automatic dialing in conjunction with a Bell System Automatic Calling Unit. The 70/653-34 operates at 40,800 bits per second over a leased broadband line such as a Telpak A channel with a Type A2 termination arrangement.

All three models can use either an 8-level transmission code that contains 6 data bits, 1 parity bit, and 1 control bit or a 9-level code that contains 8 data bits and 1 parity bit; the selected code level is permanently wired at installation time. The 8-level code is intended for communications with RCA 301 or RCA 3301 computer systems. For each message character, the RCA 70/653 transmits the 6 least significant bits of one 8-bit byte in core memory of the RCA Spectra 70 plus a parity bit and a control bit. If code interpretation is required, the stored program in the transmitting or receiving computer must perform the code translation. The 9-level code is intended for communication with other Spectra 70 computer systems only. Character transmission speeds for the different code options are listed in Table I.

TABLE I. CHARACTER TRANSMISSION SPEEDS

Bit Rate, bits/sec	Character Rate, char/sec	
	8-level code	9-level code
2,000	250	222
2,400	300	267
40,800	5,100	4,533

Checking provisions in all models include character parity and block or longitudinal parity. Errors or other conditions (such as no more data to transmit) are generally indicated by failure to respond to a data or acknowledgement message within a specified time. Upon expiration of this time, the computer is interrupted and the message can be retransmitted or the call can be terminated, depending on the program and the conditions.

.16 First Delivery: . . . . . not specified

.17 Availability: . . . . . 9 months

.2 CONFIGURATION

A 70/653 Communication Control (any model) can be connected via one trunk of any type of input/output channel in any Spectra computer system. Connections to standard communications facilities and compatible data sets are listed in Paragraph .72.

.3 INPUT

All input to the 70/653 Communications Control is transferred from the associated RCA computer system under control of the computer program. Input to the computer can be from the console keyboard, punched cards, punched paper tape, magnetic tape, optically coded documents, inquiry stations, or other RCA computers.

.35 Message Configuration: . . . . . 10 to N characters per block, including 7 synchronization characters, message characters, end-of-message character, and longitudinal parity check character. Various control codes, such as acknowledge, terminate message, transmit next message, etc., are transmitted as 1-character messages, preceded by the 7 sync characters.

.36 Operating Procedure

In attended operation, the operator establishes a connection by manually dialing or signaling. The control is then ready for transmission or reception. Further action is controlled by the stored program in the associated computer system.

Programmed automatic dialing over the public switched telephone network can be performed with the 70/653-26. All models are capable of unattended call reception.

.4 OUTPUT

All output from the 70/653 Control is transferred to the associated RCA computer under control of the computer program. Output from the computer can be printed copy, punched cards, punched paper tape, or magnetic tape.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors

Type of checking: . . . . . character parity checking is performed on data transferred to the 70/653 from the associated computer.
Error indication: . . . . . an interrupt is generated.
Correction procedure: . . . . . as programmed.

.52 Data Transmission Errors

Type of checking: . . . . . character and message parity checking.
Error indication: . . . . . an interrupt is generated.
Correction procedure: . . . . . as programmed; usually retransmission.

.53 Data Recording Errors

Type of checking: . . . . . character parity checking is performed on data transferred from the 70/653 to the associated computer system.
Error indication: . . . . . an interrupt is generated.
Correction procedure: . . . . . as programmed.

.55 Line Malfunctions

Detection:	failure to receive a response from the remote terminal within 19 seconds.
Action:	an interrupt is generated, and the Control is automatically disconnected.

.6 CONDITION INDICATORS

A switch is provided to condition the 70/653 Control for operation over the public telephone network or over a leased line. The 70/653-26 can be set to operate in either a manual or automatic dialing mode. A switch is also furnished to allow signaling of the remote operator. Lights are provided to indicate Transmit or Receive mode, transmission or reception errors, and that the remote operator is signaling. A buzzer is sounded when errors are detected and when the remote operator signals.

.7 DATA TRANSMISSION

In general, communications between an RCA Spectra 70 computer equipped with a 70/653 Control and a remote computer equipped with compatible equipment take place as an interchange of data and acknowledgment messages. Failure to receive an acknowledgment within 1.6 seconds causes an interrupt to be generated. Failure to receive a "continue-to-transmit" character code within 19 seconds causes an interrupt to be generated and the 70/653 Control to be automatically disconnected.

.71 Basic Characteristics

Rated transmission speed —	
70/653-25:	2000 or 2400 bits/sec.*
70/653-26:	2000 bits/sec.*
70/653-34:	40,800 bits/sec.*
Transmission method:	serial by bit.
Transmission code:	any 8-level code including 6 data bits, 1 parity bit, and 1 control bit or any 9-level code including 8 data bits and 1 parity bit. One of these code levels is permanently wired at installation time. Data bits transmitted are the lower 6 bits (8-level) or all 8 bits (9-level) of one Spectra 70 core location (byte).
Transmission mode:	half-duplex
Order of bit transmission:	low-order bit first.
Synchronization:	synchronous; synchronization is maintained by idle characters transmitted at the beginning of each data block.

.72 Connection to Communications Lines

Communications Line	Data Set**
Public switched telephone network (2000 bits/sec):	Bell System Data-Phone Data Set 201A
Common-carrier leased voiceband line (2400 bits/sec):	Bell System Data Set 201B or Western Union 2400 Baud Data Modem
Telpak A (40,800 bits/sec):	requires a Telpak Channel Terminal A-2, which includes a data set

*See Table I for relationships between bits/sec rate and char/sec rate for 8-level and 9-level codes.

**In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

.73 Transmission Control

Call initiation:	manual dialing or signaling; programmed automatic dialing with 70/653-26.
Call reception:	all models are capable of unattended operation.
Functional operation:	no direct control, but incoming data can be used to control operations via appropriate programming of the associated computer system.

.74 Multistation Operation: no provision other than the facilities of the associated computer system; would require program analysis of the responses of the remote terminals.

.8 PHYSICAL SPECIFICATIONS

Component	RCA 70/653 (all models)
Width (inches)	27
Depth (inches)	25
Height (inches)	62
Weight (pounds)	440
Power (KVA)	1.2
Voltage	208
Frequency (cps)	60
Phases	3
Temperature range (°F)	60 to 90
Humidity range (%)	20 to 80
Heat (BTU/hr)	3000

.9 PRICE DATA

Component or Feature	Monthly Rental $	Purchase Price $	Monthly Maintenance $
RCA 70/653 Communication Control (all models)	285	14,550	31

REPORT UPDATE

RCA REPLACES THE 6051 DISPLAY UNIT WITH THE 70/752

RCA has introduced the 70/752 Video Data Terminal and 70/755 Video Data Switch (see Report 6702) to replace the 6051 Video Data Interrogator and its controller, the 6077 Interrogator Control Terminal. RCA states that the 6051 and 6077 are no longer in production but are available on an "as returned" basis.

RCA 6051 VIDEO DATA INTERROGATOR

.1 GENERAL

.11	Identity:	6051-1, -2, or -3 Video Data Interrogator; 6077 Interrogator Control Terminal.
.12	Manufacturer:	Radio Corporation of America Electronic Data Processing Division Camden, New Jersey 08101
.13	Basic Function:	displays, via cathode ray tube, data received from a remote computer or entered via keyboard; transmits data to remote computer over a leased voice-band line.

.14 Basic Components

Name:	Video Data Interrogator.
Model number:	6051-1, -2, -3.
Function:	display of alphanumeric data; keyboard data entry.
Name:	Interrogator Control Terminal.
Model number:	6077.
Function:	provides communications interface, buffer storage, and basic control logic.

.15 Description:

The RCA 6051 Video Data Interrogator is designed to permit rapid, convenient exchange of data between an RCA 301, 3301, or Spectra 70 computer and a remote operator. Up to eight 6051 units can be controlled by a 6077 Interrogator Control Terminal. Each 6051 unit can be located up to 650 feet from the Control Terminal.

There are three models of the 6051 Interrogator. Each can display a total of 480 characters, but the models differ in the number of lines per display and the number of characters per line. Table II shows the display characteristics of each model. Different models of the 6051 unit cannot be intermixed. Each unit can display 64 different characters and symbols including digits, upper-case letters, punctuation marks, and special symbols. Characters are displayed on the face of a 14-inch rectangular cathode ray tube. A four-row keyboard, which can be moved up to 1,300 feet from the display unit, is provided for data entry, but there are no provisions for printed output of displayed data.

The 6077 Interrogator Control Terminal contains logic for character generation, display regeneration, and control. The 6077 control also contains buffer storage for all units in the form of a magnetic disc. (The RCA 6050 Video Data Terminal, which provided a video display unit and integrated control in a single cabinet, has been discontinued.)

A unique feature of the 6077 Control Terminal is its capability for storing up to 16 different prerecorded formats on the magnetic disc. Each format defines areas open for operator data entry, areas where the operator cannot write, and fixed data to be displayed (such as headings, titles, and entry legends). Data within the fixed area is not transmitted. The operator can call for any of the prerecorded formats by depressing one of 16 switches. When transmitting, a format identification code is transmitted, but not the locked-out area of the format. The remote computer can specify any one (or none) of the 16 formats when transmitting a message to a display terminal. Different formats can be recorded on the magnetic disc in the Control Terminal only via a transmission from the remote computer.

The 6077 Control Terminal and associated 6051 display units operate in a half-duplex mode over a common-carrier leased voice-band line. Operation over the public telephone network is possible but not recommended if heavy message traffic is anticipated due to the high cost for prolonged calls. The transmission speed is either 120 or 180 characters per second (1,200 or 1,800 characters per second, respectively), as specified when ordered. Start/stop synchronization is used.

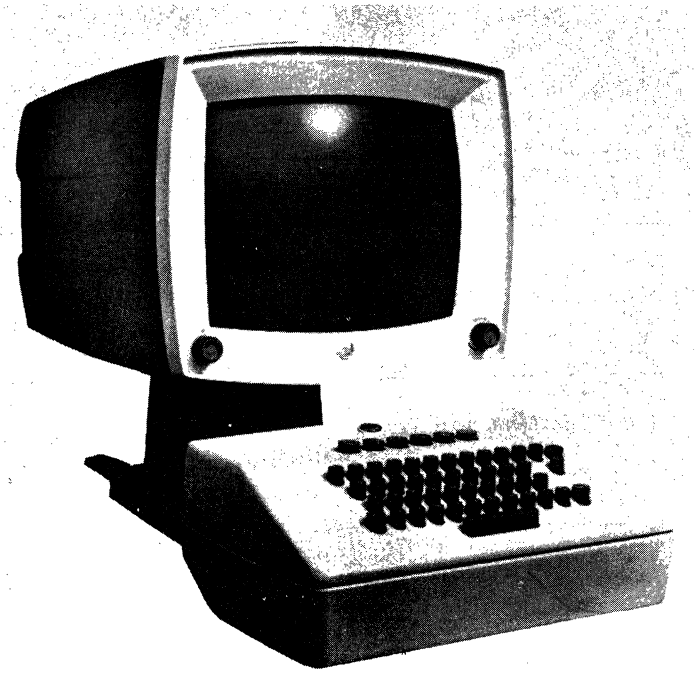


Figure 1: RCA 6051 Video Data Interrogator

.15 Description (Contd.)

The Control Terminal scans the display units sequentially for messages to be transmitted. When a display unit is found to have a message ready, the unit is shifted to the Transmit mode and the message is transmitted. The Control remains locked to that display unit until a response is received from the remote computer or until a predetermined amount of time has elapsed. The Control then begins the scan again with the next sequential display unit. Messages sent to the remote computer contain the identification of the transmitting display unit. Return messages from the computer do not contain a display unit designation. The computer cannot originate messages to particular units; it can only respond to inquiries from the display units.

The communication line is terminated at the remote RCA computer by a data set and the appropriate communications buffer and controller; see Report 8700 on the 378 CMC (RCA 301 computer), Report 8701 on the 3378 CMC (RCA 3301 computer), and Report 8703 on the 70/668 CCM (RCA Spectra 70 computers).

Local 6051 and 6077 units, located within 50 feet of the computer, can be connected to an I/O channel of a 301, 3301, or Spectra 70 computer via the same controller and buffer as when connected remotely; no data sets are required in this case.

Editing facilities available to the operator include movement of the cursor forward or backward, or to the beginning of the next line or to the next field as defined by the pre-recorded format. The cursor is non-destructive; i.e., it does not erase the character displayed in the position the cursor occupies. Only data not in the fixed portion of the format is transmitted.

Character parity is checked on all data received by the 6077 Control; a parity bit is generated and transferred with each character transmitted from the Control. The Control and associated display units do not generate or recognize any acknowledgment messages. If a parity error is detected by the Control, that character is displayed as a brightened area. The Control Terminal contains a timer which is started when a message is transmitted to the remote computer. If a response is not received within a predetermined time, the timer expires and causes the data display to be flashed on and off. This is the normal technique for informing the operator that the message should be retransmitted. The message does not need to be rekeyed for retransmission.

(Contd.)

RCA states that I/O control routines are being provided under the operating systems of the RCA 3301 and Spectra 70 computers for remote RCA 6051 Video Data Interrogator terminals. The programmer specifies the formats of messages to be transmitted to the remote terminals and must be aware of the formats of messages transmitted to the computer. RCA states that no RCA 301 Software to support a display station network is available or being planned.

.16 First Delivery: . . . . . April 1965.

.17 Availability: . . . . . 9 to 12 months.

.2 CONFIGURATION

Up to eight RCA 6051-1, -2, or -3 Video Data Interrogator units can be connected to a 6077 Interrogator Terminal Control. No intermixing of models is possible. The differences in the characteristics of the three models of the 6051 unit are shown in Table II.

The 6077 Control Terminal contains buffer storage and logic for all eight units; no extra-cost features are required for the addition of Video Interrogator units.

See Paragraph .72 for the standard communications facilities that can be used and the data sets required.

.3 INPUT

.31 Prepared Input: . . . . . no provision.

.32 Manual Input

Keyboard —

Method of entry:	via 48-key keyboard, including some control keys; 24 additional keys provide functional control.
Quantity of data:	up to 479 characters per display.
Character set:	64 characters: digits, upper-case letters, and 28 punctuation marks and special symbols.
Comments:	standard keyboard layout is same as standard typewriter keyboard except for punctuation marks and special symbols.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . format identification code could be used as transaction code; see Paragraph .35.

.35 Message Configuration: . . . . . each message transferred from the display unit is transmitted in the following format: DD1, VI, FI, Data, DD2.
each message transferred from the remote computer is transmitted in the following format: SOH, FI, Data, DD2.
VI is a one-character display unit address; FI is a one-character identifier of the prerecorded format used; DD1 and DD2 are special characters specified when ordered; DD1 and VI are automatically generated by the Terminal Control; FI and DD2 are generated by depressing keys.
up to 479 characters of data can be included in one message.

.36 Operating Procedure

A message is composed for transmission by:

(1) Depressing the Write switch, which clears the display;

(2) Depressing the appropriate format switch, which displays 1 of 16 prerecorded formats; and

(3) Keying in the desired data, using the cursor controls as necessary to position the cursor.

.36 Operating Procedure (Contd.)

The cursor automatically skips locations occupied by thr prerecorded format. The display is visually verified and corrections are made by positioning the cursor and rekeying. The cursor is nondestructive.

To transmit the displayed data, the Transmit Switch is depressed. This disables the Write mode and prevents any more data from being entered.

If a response from the remote computer is not received within a predetermined period of time, the display begins to flash on and off. Normally, this indicates that an error was detected by the computer and that a retransmission is required. To retransmit, the operator depresses the Write Switch and then the Transmit Switch.

If the computer generates a response, the receiving display unit is erased and the prerecorded format indicated in the message is transferred to the display unit buffer. After reception is complete, the Write Switch is illuminated and the message is displayed.

.37	Entry of Time and Date:	no provisions.
.4	OUTPUT	
.44	Output to Printer:	no provisions.
.46	Output to Visual Display Device	

Display unit —

Output medium:	cathode ray tube; displays black characters on white background.
Character set:	64 characters: digits, upper-case letters, and 28 punctuation marks and special symbols; see Table I.
Character size:	see Table II.
Display size:	displayed on rectangular tube with a 14-inch diagonal; see Table II for display size for each model.
Characters per line:	see Table II.
Lines per display:	see Table II.
Characters per display:	see Table II.
Buffer capacity:	11,536 characters total; 480 characters for each of 8 display units and 481 characters for each of 16 prerecorded formats.
Format control:	cursor (underline) can be advanced or backspaced; movement of cursor does not erase character positions; cursor can also be positioned at the beginning of the next line. prerecorded formats can be transmitted from the remote computer, stored in the buffer, and displayed on command of the operator or the computer; data and spaces can be included in the format; cursor cannot be positioned within the defined areas of the format.
Rated output speed:	120 or 180 char/sec (1,200 or 1,800 bits/sec, respectively) over a voice-band line.
Effective output speed:	less than rated speed, depending on message length, turnaround time, etc.

.5	ERROR DETECTION AND CORRECTION	
.51	Data Entry Errors:	no checking except for visual verification of displayed data.

(Contd.)

TABLE I: RCA 6051 ASCII DATA TRANSMISSION CODE

			b7	0	0	0	0	1	1	1	1
			b6	0	0	1	1	0	0	1	1
			b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1								
0	0	0	0			SP	0	@	P		
0	0	0	1			!	1	A	Q		
0	0	1	0			"	2	B	R		
0	0	1	1			#	3	C	S		
0	1	0	0			$	4	D	T		
0	1	0	1			%	5	E	U		
0	1	1	0			&	6	F	V		
0	1	1	1			'	7	G	W		
1	0	0	0			(	8	H	X		
1	0	0	1			)	9	I	Y		
1	0	1	0	SKIP		*	:	J	Z		
1	0	1	1			+	;	K		SOM	
1	1	0	0			,	<	L			
1	1	0	1	RET		-	=	M	]		
1	1	1	0			.	>	N	↑		
1	1	1	1			/	?	O	←		

Note: Any displayable characters can be used for DD1 and DD2, as specified when ordered.

.52 Data Transmission Errors

Type of checking: . . . . . character parity; character validity.

Error indication: . . . . . received character with parity error is displayed as a brightened area; invalid codes are displayed as blanks; if a "no response" is used to indicate detection of an error by the computer, the display flashes on and off.

Correction procedure: . . . . . manual retransmission by operator. Remote computer can be programmed to recognize a retransmission request.

Comments: . . . . . unit does not transmit or recognize a positive or negative acknowledgment message.

TABLE II: DISPLAY CHARACTERISTICS OF RCA 6051 MODELS

Characteristic	Model 6051-1	Model 6051-2	Model 6051-3
Character size —			
Width, inches	0.18	0.12	0.14
Height, inches	0.22	0.15	0.18
Display size —			
Width, inches	8.0	8.16	8.0
Height, inches	6.0	4.0	4.8
Characters per line	32	48	40
Lines per display	15	10	12
Characters per display	480	480	480

.53 Data Recording Errors: . . . . . no checking except for visual verification of displayed data.

.55 Line Malfunctions

Detection: . . . . . no data received within a predetermined time; see also Paragraph .52.

Action: . . . . . display flashes on and off.

.6 CONDITION INDICATORS: . . . . . a switch/lamp is provided on the Control Terminal to indicate that the power is on; a switch/lamp is provided on the Control and each display unit to indicate that the data set is ready; a switch/lamp is provided on each display unit to indicate when the unit is transmitting.

.7 DATA TRANSMISSION

The Interrogator Control Terminal sequentially scans the associated Video Data Interrogator units. When one is found to be in the Transmit mode, transmission is initiated. The connection between that display unit and the remote computer is maintained until the computer responds or until a predetermined amount of time has elapsed. The timer can be set for a period of 5, 10, or 30 seconds or can be disabled. After the computer has responded or the timer has timed out, the Terminal Control continues the scan with the next sequential display unit.

.71 Basic Characteristics

Rated transmission speed: . . . . . 120 or 180 char/sec (1,200 or 1,800 bits/sec, respectively).

Transmission method: . . . . . serial by bit.

Transmission code: . . . . . 7-level ASCII plus an added parity bit; a total of 10 bits are transmitted for each character, including start and stop bits.

Transmission mode: . . . . . half-duplex.

Order of bit transmission: . . . . . low-order bit first, parity bit last.

Synchronization: . . . . . start and stop bits are transmitted with each character.

(Contd.)

.72 Connection to Communications Lines

Communications Line or Service	Data Set*
Public switched telephone network operating at 1,200 bits/sec (120 char/sec):	Bell System Data-Phone Data Set 202C.
Common-carrier leased voice-band line operating at:	
1,200 bits/sec (120 char/sec):	Bell System Data Set 202C or 202D, or Western Union 1200 Baud Modem.
1,800 bits/sec (180 char/sec):	Bell System Data Set 202D.

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

.73 Transmission Control

Call initiation: manual dialing (public telephone network); direct transmission (dedicated line).

Call reception: operator must establish voice communication and then switch to data mode (public telephone network); direct transmission (dedicated line).

Functional operations: receipt of SKIP character causes the succeeding character to be placed in the first position of the next area available as defined by pre-recorded format; receipt of RETURN character causes the succeeding character to be placed in the first available position of the next line.

.74 Multistation Operation

Polling: remote computer cannot poll display units; units transmit only to computer under control of operator.

Addressing: remote computer cannot selectively address the display units connected to the Control Terminal; display units can transmit only to computer.

.8 PHYSICAL SPECIFICATIONS

Component	6051-1, -2, or -3 Video Display Interrogator		6077 Interrogator Control Terminal
	Display unit	Keyboard	
Width (inches)	15	15	69.4
Depth (inches)	19	10	24
Height (inches)	195	6	62
Weight (pounds)	50	16	1,200
Power (KVA)	0.1	*	3.0
Voltage	115	*	115
Frequency (cps)	60	*	60
Phases	1	*	1
Temperature Range (°F)	10 to 120	*	60 to 90
Humidity Range (%)	0 to 90	*	10 to 80
Heat (BTU/hr)	340	*	10,000

* Included in figures for Display unit.

.9 PRICE DATA

Component or Feature	Monthly Rental,* $	Purchase Price, $	Monthly Maintenance, $
605-1, -2, or -3 Video Display Interrogator	45	1,900	6.25
6077 Interrogator Control Terminal	1,160	48,700	162.00

* Monthly rentals are for unlimited use.

RCA 70/752 VIDEO DATA TERMINAL

.1 GENERAL

.11 Identity: . . . . . 70/752 Video Data Terminal.

.12 Manufacturer: . . . . . Radio Corporation of America
Electronic Data Processing Division
Camden, New Jersey 08101

.13 Basic Function: . . . . . displays, via cathode ray tube, data received from a remote computer or entered via keyboard; transmits data to a remote computer over a leased voice-band line.

.15 Description

The RCA 70/752 Video Data Terminal is a visual communications terminal designed to permit rapid exchange of data between an RCA Spectra 70 Model 35, 45, 46, or 55 computer and a remote operator. The basic 70/752 Terminal is designed to operate as a single station in a non-polling environment. Multi-station operation in a polling environment can be obtained with optional components. An adapter is also available for connecting a Teletypewriter if hard copy is desired.

Configuration

The 70/752 Video Data Terminal contains a cathode ray tube (CRT) display, a separate keyboard, a 1080-character magnetostrictive delay-line buffer, and character generation and control logic.

The 70/755 Video Data Switch allows multiple 70/752 Terminals at one location to share one communications line in a non-polling environment. The Video Data Switch can accommodate up to eight 70/752 Terminals. In this configuration, the Video Data Switch scans each of the 70/752 Terminals until it finds a Terminal in the Transmit mode. The scanning is then interrupted and that Terminal is connected to the line. A timer in the Data Switch monitors the time required for the computer to respond. The Terminal is disconnected and the scanning continues when the timed interval has elapsed. The timer can be manually set for an interval of 15 or 30 seconds, or it can be locked out. Each 70/752 Terminal can accommodate a Teletype Model 33 or 35 Receive-Only Teletypewriter when the Printer Adapter feature is incorporated.

Transmission Characteristics

The 70/752 Video Data Terminal operates asynchronously in the half-duplex mode over the public telephone network or a leased voice-band line at up to 120 characters per second (1200 bits per second). The Bell System Data-Phone Data Set 202C or Data Set 202D is compatible with the 70/752 Terminal for use over the public telephone network or leased voice-band line, respectively.

The transmission code used by the 70/752 Terminal is a modified 7-level USASCII code with an even parity bit, a start bit, and a stop bit added. A total of 10 bits are transmitted per character. The low-order bit of each character is transmitted first.

Display Unit

The display portion of the 70/752 Video Data Terminal is a 12-inch rectangular CRT with a 5.6-inch-high by 8-inch-wide viewing area. The characteristics of the display unit are shown in Table I. The monoscope technique is used to generate each character of a 64-symbol character set consisting of upper-case alphabetics, numerics, punctuation marks, and special symbols.

Keyboard

The keyboard included with the 70/752 Video Data Terminal contains 62 keys, including cursor, editing, and control keys arranged in conventional typewriter style. The keyboard is not permanently attached to the display unit and can be positioned up to 20 cable-feet from the display.

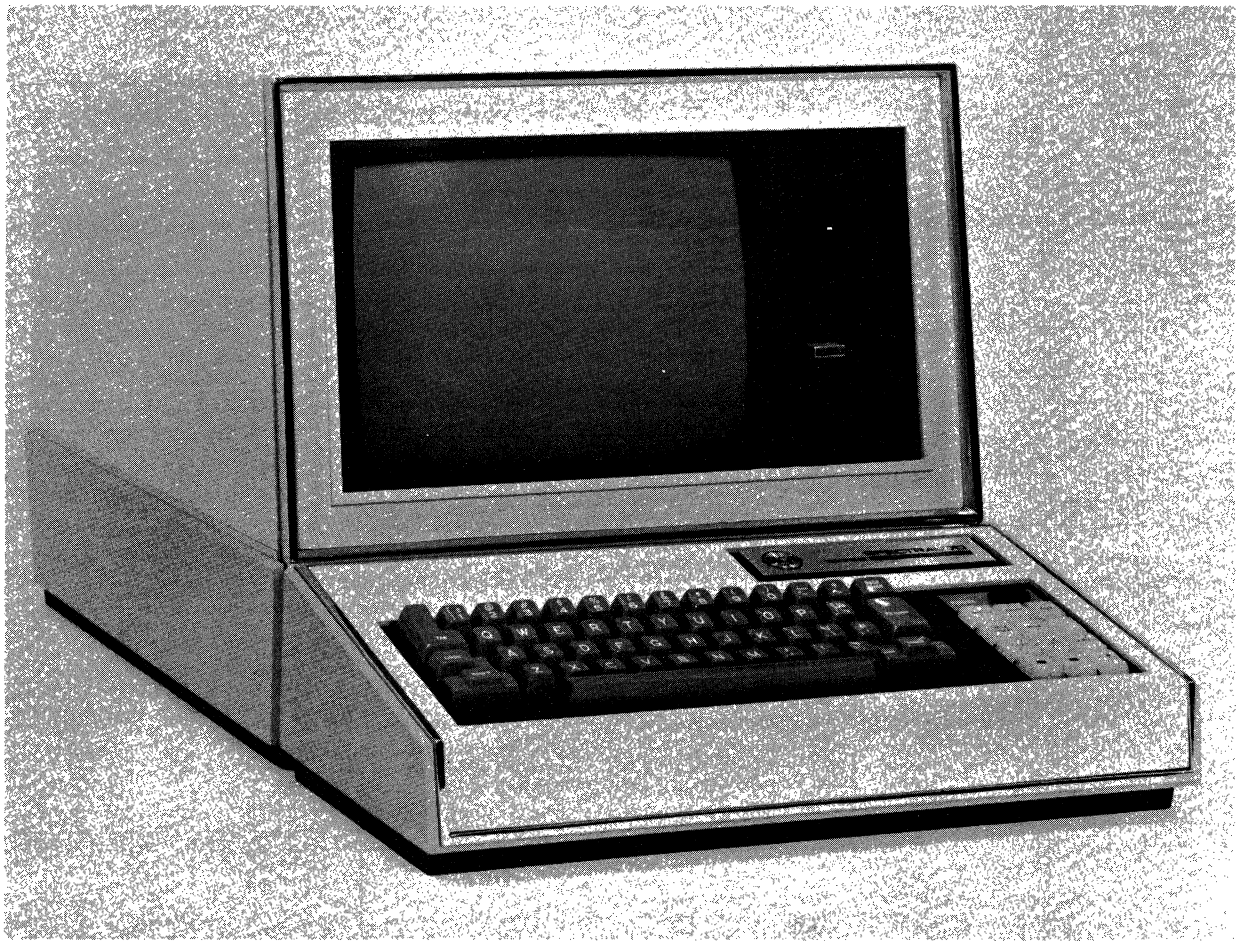


Figure 1. RCA 70/752 Video Data Terminal.

.15 Description (Contd.)

Cursor controls allow the operator to position the cursor (an underscore) to:

- The first character position of the next line (or to the first character position of the first line when the cursor is positioned on the last line),
- The next position to the right (which can be the first position of the next line or the first position of the first line), or
- The adjacent position to the left (this function is terminated when the first position of the line is reached).

Editing Facilities

Editing facilities available for the 70/752 Video Data Terminal include the Data Insert function, which allows data to be inserted in a line of text; existing data is displaced to the right with each character inserted. Data displacement propagates from line to line, except that control characters are not displaced beyond the end of a line. This function is deleted when the Data Format feature is installed.

The Data Format feature provides for receiving display format messages. The format message is displayed with reduced brightness. After receipt of a format message, the cursor is positioned to the beginning of the first data field. As data is entered from the keyboard, the cursor is advanced to the next position until the end of the data field is reached. At this point, the cursor is positioned to the beginning of the next data field and data entry continues until the last data field is completed. When data entry is completed and the transmit control is depressed, only the data that has been entered in the data fields within the format is transmitted.

(Contd.)

TABLE I: 70/752 DISPLAY CHARACTERISTICS

Characteristic	Description
Output medium	Cathode ray tube; displays white characters against black background.
Character set	64 characters, including upper-case alphabetics, numerics, punctuation marks, and special symbols.
Character size	Nominally 0.10 inch wide and 0.14 inch high.
Display size	8 inches wide by 5.6 inches high.
Characters per line	54 characters.
Lines per display	20 lines.
Characters per display	1080 characters.
Buffer capacity	1080 characters.
Format control	Return characters, Data Insert function or Data Format feature; split-screen capability; flexible cursor movement controls.
Rated output speed	Up to 120 char/sec (1200 bps).
Effective output speed	Limited by message length and communications facility.

Other editing facilities include: Screen Erase, which erases the entire contents of the buffer memory and positions the cursor to the beginning of the display area; Line Erase, which erases the character in the cursor position and all following characters on that line; Character Erase, which erases the character in the cursor position; and Format Data Erase, which erases the data entered from the keyboard in conjunction with the Data Format feature.

Erase functions are controlled by the Master Erase key and require simultaneous depression of two keys. The Line Erase function will erase only non-format data when the Data Format feature is incorporated.

Operating Procedure

Message composition is performed when the terminal is in the Write mode. Data can be entered at any location on the display by positioning the cursor and keying the data. The cursor is advanced one character position for each character entered. The cursor returns to the beginning of the next line when the end of a line is reached. The Return function erases the characters to the right of the cursor in the current line when the Return key is depressed and, unconditionally, returns the cursor to the beginning of the next line.

After the message is composed and the End-of-Text (ETX) character is entered, the message can be visually verified; if in error, the message can be altered by means of the editing controls in conjunction with the cursor controls. When the message is found to be correct, the communications link is established and the Transmit mode enabled. The message is transmitted; the contents of the display memory remain unchanged. Following the transmission of ETX, the Terminal is automatically switched to the Receive mode, and the cursor returns to the start of the message. If a computer response is not received within a reasonable period of time, the operator can switch to the Write mode and retransmit the message.

The received computer message is preceded by start-of-text (STX) and is displayed beginning at the first character position of the first line. Existing data (the inquiry) is overwritten by the message. The balance of the screen is erased; the Terminal is automatically switched to the Write mode; and the cursor is returned to the beginning of the screen when ETX is received. Further input from the communications line is inhibited, and the displayed computer message remains on the screen until erased.

The Transmit and Receive modes are modified when the Message Segment Address (MSA) function is used. With MSA, each message transmitted begins at the cursor position and ends with ETX. The cursor advances with each character transmitted as in the normal Transmit mode,

.15 Description (Contd.)

but the cursor does not return to the start of the message; it remains at the location following the ETX character. A received computer message is displayed starting at that cursor location. With the MSA function, both inquiry and response messages can be displayed simultaneously and can be separated by the use of Line Return, Null, or Space characters at the beginning of the computer-response message.

Message Configuration

The message configuration for the 70/752 Video Data Terminal includes a Start-of-Text (STX) character (automatically inserted), the text, and an End-of-Text (ETX) character. When the Station Selection feature is used, the Terminal is under the control of the computer. The terminal is polled by a Transmit Start Code (TSC), a two-character sequence including EOT and a customer-assigned terminal address character. (Up to 26 address codes can be specified). The received EOT character places all terminals on the multistation line in the Select mode. The addressed Terminal responds to a TSC with a text message or a no-text message (identified by an EOT), or the Terminal does not respond. The remote computer must be programmed to handle a no-response condition.

Multistation Operation

The Station Selection Feature allows up to 26 70/752 Video Data Terminals, each incorporating this feature, to communicate in a multistation arrangement over a single leased line with a remote computer. All communications are initiated by the computer by polling or addressing the Terminals. The polling operation is described in the paragraph under Message Configuration.

Error Detection and Correction

Character parity is checked on all data received by the 70/752 Terminal; a parity bit is generated and transferred with each character transmitted from the Terminal. If a parity error is detected by the Terminal, that character is displayed as a brightened area. The Terminal does not generate or recognize any acknowledgement messages for automatic retransmission.

Software

RCA provides two software packages for implementing communications-oriented programs: Primary Communications Oriented System (PCOS) and Multichannel Communications System (MCS). PCOS provides an independent, though limited, operating environment. It permits concurrent operation of a single user's communication program with up to six data transcription programs. MCS operates under the Tape/Disc Operating System (TDOS) and provides extensive data communication support. Although message-switching applications can be accommodated, MCS is primarily intended for use in either remote batch-processing or inquiry/response data communications applications. Provisions are made to accommodate the RCA 70/752 Video Data Terminal in both the PCOS and the MCS environment.

.16 First Delivery: . . . . . April 1967.

.17 Availability: . . . . . 9 months.

.9 PRICE DATA

Component or Feature	Monthly Rental, $	Purchase Price, $	Monthly Maintenance, $
70/752 Video Data Terminal	190	8325	23.50
70/755 Video Data Switch	125	5900	13.75
Options			
Station Selection	20	850	2.50
Data Format	20	850	2.50
Printer Adapter	40	1700	5.00
Keyboard Cable Extension (1)	—	75*	—
Data Set Cable Extension (2)	—	75*	—

* One-time charge.

(1) Allows keyboard to be located up to 20 cable-feet away from display.

(2) Allows 70/752 Terminal to be located up to 100 cable-feet away from 70/755 Video Data Switch.

RCA 70 750 MODULAR VIDEO DATA SYSTEM

.1 GENERAL

.11 Identity: . . . . . RCA 70/750 Modular Video Data System.

.12 Manufacturer: . . . . . Radio Corporation of America
Electronic Data Processing Division
Camden, New Jersey 08101

.13 Basic Function: . . . . . displays via cathode ray tube, data received from a remote computer or entered via keyboard; transmits data to remote computer over a leased voice-band line.

.14 Basic Components

Name: . . . . . Video Data Terminal.
Model number: . . . . . 70/751-10, -11, -12.
Function: . . . . . display of alphanumeric data; keyboard data entry.

Name: . . . . . Video Data Generator.
Model number: . . . . . 70/756-11, 21, -31.
Function: . . . . . provides display memory, character generator, and control logic.

Name: . . . . . Video Data Controller.
Model number: . . . . . 70/759-11, -21.
Function: . . . . . provides communications interface and transmission control.

.15 Description

The RCA 70/750 Modular Video Data System is a visual communications system designed to permit rapid exchange of data between an RCA Spectra 70 Model 35, 45, 46, or 55 computer and one or more remote stations in a single- or multi-station arrangement under control of a stored program in the computer.

The 70/750 System can be operated in a single-station non-polling environment where all message transmission is initiated by the operator, or the 70/750 System can be operated in a multi-station arrangement under a polling and addressing environment.

The 70/750 System includes the 70/751 Video Data Terminal (a visual display with an independent keyboard) the 70/756 Video Data Generator, and the 70/759 Video Data Controller. Each Video Data Generator can accommodate from two to eight Video Data Terminals; the number of Terminals that can be connected is dependent upon the Video Data Generator model employed. The Video Data Controller provides housing for the Video Data Generators and can accommodate up to six (when directly connected to a multiplexor channel) or four Video Data Generators (when remotely connected via a communications line).

The 70/750 Modular Video Data System can operate synchronously in a full-duplex mode over a leased voice-band line at 300 characters per second (2400 bits per second). The transmission code used is a modified 7-level USASCII code with odd parity; see Table I. When directly connected, the 70/750 system transfers data at 2400 bytes per second each way simultaneously. The remainder of this report pertains to a remotely connected 70/750 system unless otherwise specified.

The 70/751 Video Data Terminal contains a 12-inch rectangular CRT with a 5.6- inch-high by 8-inch wide viewing area. The 70/751 can display from 270 to 1080 characters depending upon the type of Video Generator employed. The monoscope technique is used to generate each character of a 96-symbol character set consisting of upper- and lower-case alphabetics, numerics, punctuation marks and special symbols. The characteristics of the display unit are presented in Paragraph .46. The 70/751 can be positioned up to 500 cable-feet from the 70/756 Video Data Generator.

The 70/751 Terminal includes a 66-key keyboard and is available in three different models: 70/751-10, -11, and -12. Model 70/751-10 provides a typewriter style keyboard capable of generating a 70-character set. Model 70/751-11 provides a combination key-punch and

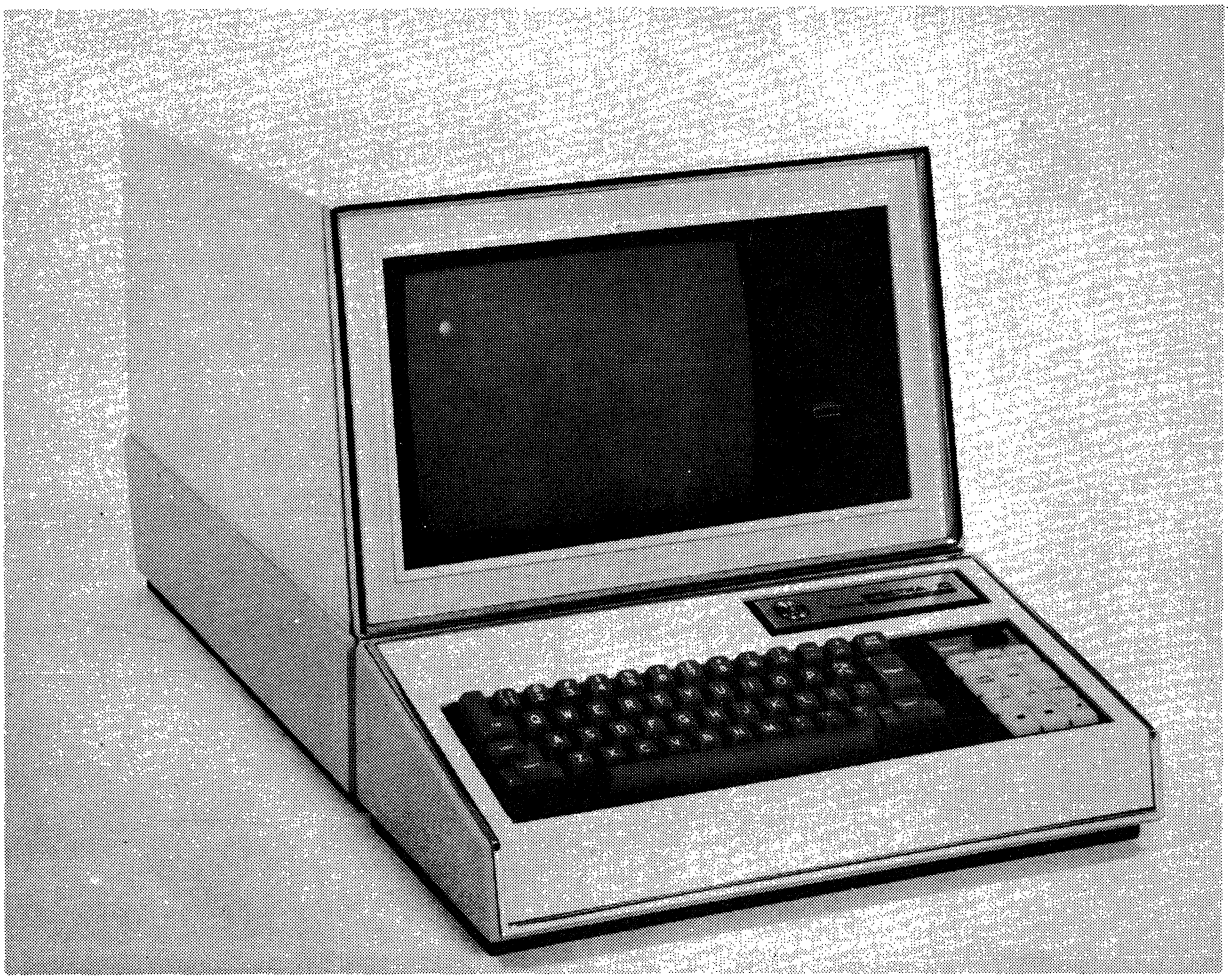


Figure 1. RCA 70/751 Video Data Terminal, an integral component of the RCA 70/750 Modular Video Data System.

.15 Description (Contd.)

typewriter style keyboard with selectable alphanumeric and numeric modes also capable of generating a 70- character set. Model 70/751-12 provides a typewriter style keyboard capable of generating a 96-character set that includes lower-case alphabetics. The keyboard can be physically attached to the 70/751 Terminal or it can be positioned up to 12 inches from the 70/751.

The cursor controls provide step-by-step operation or continuous movement at nine steps per second when a cursor control key is held in a depressed position. Cursor controls allow the operator to position the cursor to:

- The first character position of the next line or to the first character position of the first line when the cursor is positioned on the last line (Return key).
- The next position to the right, which can be the first position of the next line, or the first position of the first line (Advance key).
- The next position to the left terminating at the first position of a line (Back-space key).

TABLE I: RCA 70/750 USASCII DATA TRANSMISSION CODE

DATA INSERTING →					NON-SHIFTING TO NEXT LINE		SHIFTING TO NEXT LINE					
b_7 →					0	0	0	0	1	1	1	1
b_6 →					0	0	1	1	0	0	1	1
b_5 →					0	1	0	1	0	1	0	1
Bits b_4 ↓	b_3 ↓	b_2 ↓	b_1 ↓	Row ↓ / Column →	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	(blank)	SP	0	@	P	(blank)	p
0	0	0	1	1	(blank)	(blank)	!	1	A	Q	a	q
0	0	1	0	2	⊥ (STX)	(blank)	"	2	B	R	b	r
0	0	1	1	3	⌋ (ETX)	(blank)	#	3	C	S	c	s
0	1	0	0	4	EOT	(blank)	$	4	D	T	d	t
0	1	0	1	5	(blank)	(blank)	%	5	E	U	e	u
0	1	1	0	6	(blank)	SYN	&	6	F	V	f	v
0	1	1	1	7	(blank)	(blank)	'	7	G	W	g	w
1	0	0	0	8	(blank)	CAN	(	8	H	X	h	x
1	0	0	1	9	→(HT)	(blank)	)	9	I	Y	i	y
1	0	1	0	10	(blank)	(blank)	*	:	J	Z	j	z
1	0	1	1	11	(blank)	(blank)	+	;	K	(blank)	k	¢
1	1	0	0	12	(blank)	(blank)	,		L	x	l	|
1	1	0	1	13	⌇ (CR)	(blank)	-	=	M	÷	m	⌆
1	1	1	0	14	SO	(blank)	.	>	N	^	n	¬
1	1	1	1	15	SI	(blank)	/	?	O	(blank)	o	(blank)

LEGEND: *United States (of) America Standard Code (for) Information Interchange
HT = tab character
SI = Data Format off
\\\\ = not displayed
||||= may be manually generated from 70/751-12 boards only.
SO = Data Format On

.15 Description (Contd.)

When the Data Format feature is incorporated, cursor controls allow the operator to position the cursor to:

- The first data position of the next variable data field (Skip key). The cursor returns to the first position of the first line when format headings are not present.
- The first data position of the next variable data field, an HT character is entered in the display memory at the location occupied by the cursor before the action is initiated (Tab key).
- The next position to the left terminating at the first position of the same variable data field (Backspace key).

Editing facilities available for the 70/751 Video Data Terminal include the Data Insert function, which allows data to be inserted in a line of text; existing data is displaced to the right with each character inserted. Data displacement propagates from line to line, except that control characters are not displaced beyond the end of a line.

The Data Format feature provides for receiving display format messages. After receipt of a format message, the cursor is automatically positioned to the beginning of the first data field. As data is entered from the keyboard, the cursor is advanced to the next position until the end of the data field is reached. At this point, the cursor is automatically positioned to the beginning of the next data field and data entry continues until the last data field is completed. When data entry is completed and the transmit control is depressed, only the data that has been entered in the data fields within the format is transmitted.

Other editing facilities include flexible erase functions that operate only in the Write mode. Screen Erase erases the entire contents of the buffer memory and positions the cursor to the beginning of the display area. Line Erase erases the character in the cursor position and all following characters on that line and the cursor is positioned at the beginning of the next line. (Execution of the Line Erase function when the cursor is positioned on the last line, causes the cursor to move to the beginning of the first line.) When the Data Format feature is incorporated, execution of the Line Erase function causes erasure of variable data in and to the right of the cursor, terminating at the end of the variable data field, and the cursor is positioned at the first position of the next variable data field. (When the cursor is located on the last line, execution of the Line Erase function will position the cursor at first position of the first variable data field.) Character Erase erases the character at the cursor position. Variable Data Erase is provided with the Data Format feature and when executed, erases all variable data fields, the cursor is positioned at the beginning of the first variable data field.

Options available for the 70/750 System include:

- Variable Start-of-Transmission - permits the operator to indicate the starting point of a transmission by inserting an STX character at any screen location except within a format heading.
- Data Format - permits a rigid format, consisting of format headings and variable data fields, to be constructed and displayed. The displayed format permits the operator to insert data only in the variable data fields and to transmit only the inserted data when the transmit function is initiated.
- Station Selection - permits operation in a multi-station environment. Up to six Video Data Controllers can be connected to a single communications line. The computer polls for messages from the remote 70/750 System.

.2 CONFIGURATION

The 70/750 Modular Video Data System consists of:

- The 70/759 Video Data Controller;
- Up to four (remotely connected) or six (directly connected) 70/756 Video Data Generators; and
- Up to thirty-two (remotely connected) or from two to forty-eight (directly connected) 70/751 Video Data Terminals.

Up to six 70/759 Video Data Controllers can be connected to a single voice-band line in a multistation environment when the Station Selection option is incorporated. The 70/759 Controller is available as two distinct models: 70/759-11, directly connects to a multiplexer trunk of a Spectra 70/35, 45, 46, or 55 computer; 70/759-21, remotely connects to a Spectra 70/35, 45, 46, or 55 computer via a 70/668 Communications Controller Multichannel (CCM) and two 70/721 Communications Buffers.

Three distinct models of the 70/756 Video Data Generator are available; see Table II. The 70/756 model employed determines the maximum number of Video Data Terminals that can be attached to it and the choice of character array.

Three distinct keyboard styles are available for the 70/751 Video Data Terminals. The three keyboard styles are reflected in the three model numbers of the Video Data Terminal as follows:

- 70/751-10 — Typewriter-style keyboard capable of generating a 70-character set excluding lower-case alphabetics.
- 70/751-11 — Combination typewriter- and keypunch-style keyboard capable of generating a 70-character set excluding lower-case alphabetics.
- 70/751-12 — Typewriter-style keyboard capable of generating a 96-character set including lower-case alphabetics.

See Paragraph .72 for the standard communications facilities that can be used and the data sets required.

.3 INPUT

.31	Prepared Input:	no provision.
.32	Manual Input	
	Models 70/751-10 and -12 Typewriter Style Keyboards; Model 70/751-11 Keypunch Style Keyboard -	
	Method of entry:	via 66-key keyboard including cursor, edit and control keys.
	Quantity of data:	up to 270, 480, 540, 960, or 1080 characters depending on Video Data Generator model used and number of displays connected; see Table II.
	Character set -	
	Model 70/751-10 and -11:	70 characters including upper-case letters, numerics, punctuation, and special symbols.
	Model 70/751-12:	96 characters, including upper- and lower-case letters, numerics, punctuation, and special symbols.
	Comments:	16 keys provide cursor edit, and control functions and do not produce a displayable symbol.
.33	Fixed Input:	no provision.
.34	Transaction Code Input:	no provision.

TABLE II: DISPLAY CHARACTERISTICS OF RCA VIDEO DATA GENERATOR MODELS

Characteristics	Model 70/756-11		Model 70/756-21			Model 70/756-31	
Character size -							
Width, inches	0.10	0.10	0.10	0.10	0.085	6.10	0.085
Height, inches	0.14	0.14	0.14	0.14	0.12	0.14	0.12
Display size -							
Width, inches	4.0	8.0	4.0	8.0	8.4	8.0	8.4
Height, inches	2.8	1.4	5.6	2.8	1.7	5.6	3.4
Characters per line*	27	54	27	54	80	54	80
Lines per display*	10	5	20	10	6	20	12
Characters per display	270	270	540	540	480	1080	960
Maximum number of displays	8	8	4	4	4	2	2

.35 Message Configuration

The 70/750 System is designed to be operated as a single-station in a non-polling environment or as a multi-station arrangement in an addressing and polling environment where only the computer can initiate data transmission from the 70/750 System. The message format consists of a Start-of-Text (STX) character, two address characters, the text portion, and an End-of-Text (ETX) character. The first address character identifies one of six Video Data Controllers (three most significant bit positions) and one of six Video Data Generators. The second address character identifies one of eight Video Data Terminals. Messages, composed at the Video Data Terminal are automatically appended with the necessary control and address characters except for ETX which can be automatically or manually generated. Messages transmitted to or received from the Spectra 70 computer via the 70/668 CCM are preceded by three marking and four SYN characters.

A polling sequence, consisting of marking for a three character period, four SYN characters, an EOT (which activates all controllers) and a controller identifier character is transmitted by the computer where more than one 70/750 System is connected to a single communications line. The Station Selection option is required for the multi-station arrangement. The 70/750 System response to the polling sequence consists of a series of messages from the attached Video Data Terminals or a "no-traffic" response consisting of four SYN characters, an EOT, and marking which continues for a three-character period.

When the Data Format option is incorporated, data format characters, DF On and DF Off, are employed in the text portion of the computer message to establish a fixed format, displayed by the addressed Video Data Terminal. The control characters DR On and DF Off bracket each of the format headings; variable data fields are bracketed by the DF Off and DF On characters. The DF On character can be used at the start of the first format heading and serve all following format headings if NUL characters are employed to specify each of the variable data fields.

.36 Operating Procedure

Message composition is performed when the terminal is in the Write mode. Data can be entered at any location on the display by positioning the cursor and keying the data. The cursor is advanced one character position for each character entered. The cursor returns to the beginning of the next line when the end of a line is reached. The Return function inserts a CR character and erases the characters to the right of the cursor in the current line when the Return key is depressed and, unconditionally, returns the cursor to the beginning of the next line. The Return key should not be confused with the Return cursor control key which does not erase or insert data in the display memory.

.36 Operating Procedure

After the message is composed and the End-of-Text (ETX) character is manually entered (if automatic ETX is not selected), the message can be visually verified; if in error, the message can be altered by means of the editing controls in conjunction with the cursor controls. When the message is found to be correct, the operator initiates the Transmit mode by depressing the Transmit key.

The Video Data Generator, which sequentially scans the attached Video Data Terminals for a request to transmit, transfer the data contained by those segments of the delay-line display memory corresponding to the requesting Video Data Terminals, to the communications facility under control of the Video Data Controller.

Transmission of data is initiated by the Video Data Controller except when the Controller is operating in a multi-station environment where data transmission is initiated by the computer. The Video Data Controller sequentially scans the attached Video Data Generators for a request to transmit messages from the attached Video Data Terminals.

The scanning Video Data Controller advances its scan to the subsequent Video Data Generator after having transmitted all messages from a previous Video Data Generator. Transmission is terminated when the ETX character of the final message is transmitted. After each message is transmitted from a Video Data Terminal the terminal automatically enters the Receive mode.

The Transmit and Receive modes are modified when the Message Segment Address (MSA) function and/or the optional Variable Start of Transmission (VST) are employed. Normally, message transmission begins with the first displayed message character and continues through the ETX character; if an ETX character is not present when the ETX switch is in the manual position, transmission is inhibited. The operator can choose to manually insert the ETX character or the ETX can be generated automatically. The cursor advances with each character transmitted. With MSA, each message transmitted begins at the cursor position and ends with ETC or the end of the frame if ETX is not present. With VST, each message transmitted begins with the first non-format STX. When both MSA and VST are selected, the message transmitted begins with the first non-format STX only where the STX precedes the cursor position. The STX is erased unless it is positioned after the cursor when it is transmitted as data.

When the Data Format feature is incorporated, only the data contained in the variable data fields (non-format data) is transmitted.

When the Station Selection feature is employed, transmission from a Video Data Controller is initiated only when the controller is polled. All messages are transmitted by the polled controller followed by a "no traffic" response (see Paragraph .35).

The operator can, by manual selection, permit computer messages to override data stored in the display memory; otherwise, computer messages are lost if the Terminal is not in the Receive mode.

.37 Entry of Time and Data: . . . . . no provisions.

.4 OUTPUT

.44 Output to Printer: . . . . . Copy key is provided for future implementation of of a print function.

.46 Output to Visual Display Device

Display unit -

Output medium:	cathode ray tube; displays white characters against black background.
Character set:	96 characters, including upper- and lower-case alphabetics, numerics, punctuation marks, and special symbols.
Character size:	see Table II.
Display size:	8 inches wide by 5.6 inches high.
Lines per display:	see Table II.
Characters per display:	see Table II.

.46 Output to Visual Display Device (Contd.)

Buffer capacity:	1080 characters total, see Table II.
Format control:	flexible cursor controls, Data Insert capability Data Format feature, and flexible erasure.
Rated output speed:	300 char/sec (2400 bps).
Effective output speed:	limited by message length and communications facility.

.5 ERROR DETECTION AND CORRECTION

The 70/750 System does not incorporate data transmission error detection circuits. The 70/750 converts between the odd character parity of transmitted and received data and the even internal character parity. All characters are stored with even parity; parity is checked for each character read from the display memory to be displayed at a Video Data Terminal. A detected parity error causes a brightened rectangular area to appear on the screen in place of the character read in error. All requests for retransmission must be performed by the operator.

.55 Line Malfunctions

Detection:	absence of data.
Action:	time-out occurs and CAN (cancel) character is transmitted.

.6 CONDITION INDICATORS

Each Video Data Terminal provides indicators for mode status, Memory Segment Address and Data Insert functions, and power control. The Video Data Controller provides indicators for control functions.

.7 DATA TRANSMISSION

The 70/750 Modular Video Data System is designed to communicate with a Spectra 70/35, 45, 46, or 55 computer equipped with a 70/668 Communications Controller Multichannel (CCM) and two SDS 70/721 buffers.

.71 Basic Characteristics

Rated transmission speed:	250 char/sec (2000 bits/sec) or 300 char/sec (2400 bits/sec).
Transmission method:	serial by bit.
Transmission code:	7-level USASCII plus an odd parity bit per character.
Transmission mode:	full-duplex.
Order of bit transmission:	low-order bit (b1) first.
Synchronization:	synchronous; synchronization is established by SYN characters transmitted at the beginning of code message.

.72 Connection to Communications Lines

Communications Line	Data Set*
Common-carrier leased voice-band line (2400 bits/sec):	Bell System Data Set 201 B, Western Union 2400 Baud Data Modem or equivalent.

.73 Transmission Control

Call initiation	terminals can initiate calls except when controller is operating in a multi-station environment where calls are initiated by remote computer.
Call reception:	each terminal is directly addressable.
Functional operations:	control characters in message initiate format control functions.

.74 Multistation Operation

Multistation operation requires the optional Station Selection feature. This feature provides for operating with up to six Video Data Controllers connected to a single voice-band line.

Polling: ..... the 70/759 Video Data Controller is polled for all messages from the attached 70/751 Terminals; the controller responds with sequential messages, including the address header of each message, or a negative response indicating there are no messages to be transmitted.

Addressing: ..... the 70/751 Terminals can be addressed individually for messages from the computer.

.8 PHYSICAL SPECIFICATIONS

Component	70/759-21 Controller	70/756* Generator	70/751 Terminal
Width (inches)	49.5	20	16.9
Depth (inches)	24.75	21	20.5
Height (inches)	62	14.5	14.5
Weight (pounds)	400	40	80
Power (KVA)	1.1		0.25
Voltage	115	Power derived	115
Frequency (Hz)	60	from controller	60
Phases	1		1
Temperature Range (°F)	40 to 110	40 to 110	40 to 110
Humidity Range (%)	10 to 90	10 to 90	10 to 90
Heat (BTU/hr)	3560	—	810

*Contained in 70/759-21 Controller

.9 PRICE DATA

Component or Feature	Monthly Rental, $	Purchase* Price, $
RCA Video Data Controller -		
Model 70/759-11	600	28,200
Model 70/759-21	400	18,800
RCA Video Data Generator -		
Model 756-11	275	12,925
Model 756-21	225	10,575
Model 756-31	200	9,400
RCA Video Data Terminal -		
Model 751-10	75	3,525
Model 751-11	75	3,525
Model 751-12	75	3,525
Options -		
Station Selection	25	1,175
Data Format	10	470
Variable Start-of-Transmission	10	470

*Monthly maintenance costs for purchased equipment is not available from RCA at present.

RCA 70/740 DATA TERMINAL

.1 GENERAL

.11	Identity:	Model 70/740 Data Terminal.
.12	Manufacturer:	Radio Corporation of America Information Systems Division Cherry Hill, 204-2 Camden, N. J. 08101
.13	Basic Function:	reception and optional transmission of data over a voice-band line with a wide variety of RCA computer systems at up to 300 char/sec; received data is printed, transmitted data is read from punched cards.

.14 Basic Components

Name:	Data Terminal.
Model number:	70/740-11.
Function:	provides basic control unit functions and prints alphanumeric information at up to 300 lines/min at up to 80 char/line.
Name:	Data Terminal.
Model number:	70/740-21.
Function:	provides basic control unit functions and prints alphanumeric information of up to 300 lines/min at up to 132 char/line.
Name:	Card Reader (optional).
Model number:	70/741.
Function:	reads cards at up to 300 cards/min.

.15 Description

The RCA 70/740 Data Terminal, a high performance printer terminal with a card reader option, is designed for remote operation with an RCA Spectra 70 Model 35, 45, 46, 55, or 60 computer via the RCA 70/668 Communication Controller-Multichannel and 70/721 Communication Buffer (see Report 8702) or the RCA 70/656 Communication Controller-Single channel.

The 70/740 is available in two models:

- Model 70/740-11 -- provides printed output with an 80-character print line.
- Model 70/740-21 -- provides printed output with a 132-character print line.

The optional Model 70/741 Card Reader can be used with either model printer terminal.

The 70/740 operates in a poll/address environment where all communication between the Terminal and computer is under control of the stored program at the remote computer. The Terminal can be used in a single-station or multi-station arrangement, communication between two 70/740 Terminals, however, is not permitted. The 70/740 also operates in an off-line mode to provide printed copy from punched card data.

The 70/740 operates over the public telephone network at 2000 bits per second or over a leased voice-band line at 2000 or 2400 bits per second. Communications are synchronous

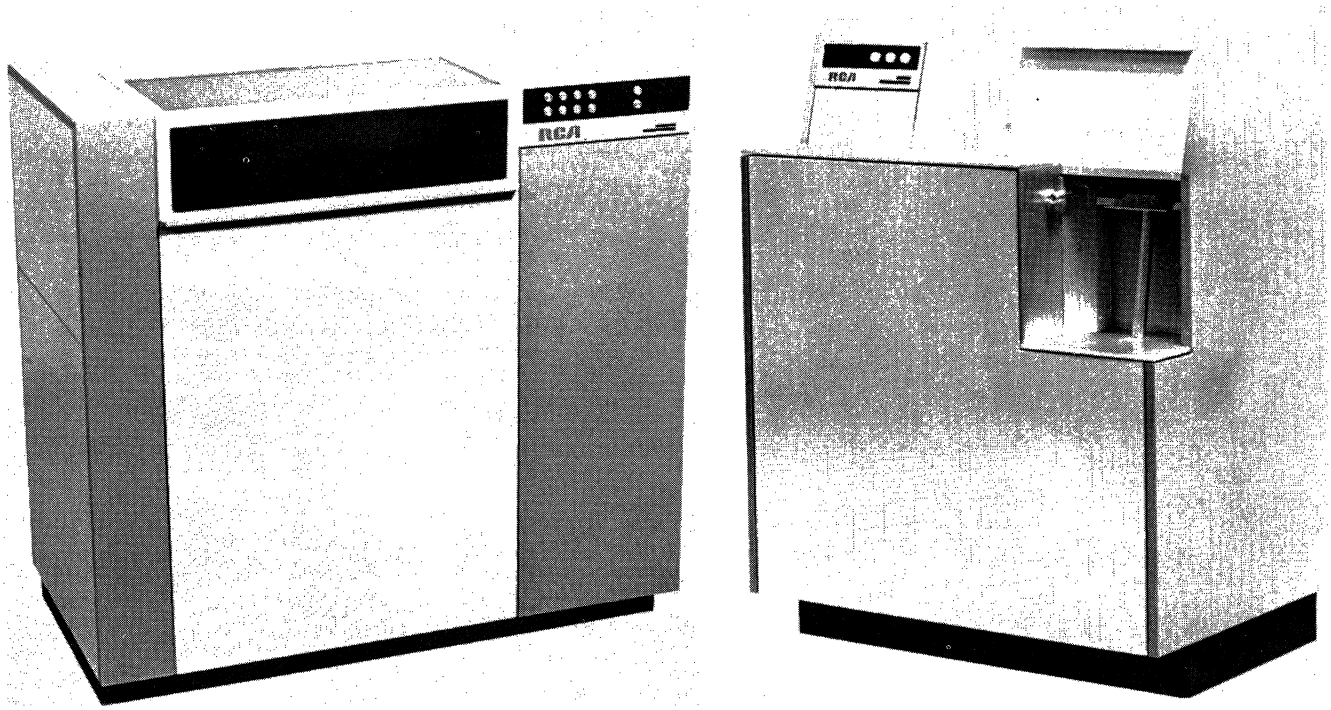


Figure 1. RCA 70/740 Data Terminal (left) and Optional 70/741 Card Reader (right)

.15 Description (Contd.)

in a half-duplex mode, but full-duplex communications facilities can be utilized to maintain synchronization in both directions; this reduces the turn-around time and consequently provides higher effective performance.

The transmission code is 7-level USASCII plus odd parity. An optional card-reader adapter provides for translation from extended Hollerith to USASCII code.

The basic 70/740 consists of a 300-line per minute, 80- or 132-column impact printer and a communications control unit, which includes I/O control logic and 446 characters of buffering. The basic terminal can be expanded by the addition of the 5753 Card Reader Adapter and 70/741 Card Reader, a 300-card per minute reader.

Communication between the 70/740 and remote computer constitutes an alternate series of data messages and message acknowledgements. A data message can contain an unlimited number of blocks, each composed of up to 16 sub-blocks; each sub-block is equivalent to one print line or one 80-column card. Reader messages are restricted to a maximum block length of 365 characters limited by the buffer capacity. Printer messages are not restricted in this respect, since extensive buffering is not required.

The printing operation requires the use of alternate print areas within the buffer, each with the capacity of a full print line. Alternate use of the two print areas permits printing to be performed concurrent with receiving and assembling the following print line.

Horizontal and vertical tabulation are standard features on the 70/740. Horizontal tabulation is implemented through the use of a stored horizontal format record; vertical tabulation

is implemented through the use of a 12-channel punched tape loop, which defines the vertical format. Horizontal and vertical tabulation respond to a two-character format-control sequence contained within a Printer message; see Paragraph .35 for a detailed description.

The peak printing speed is 300 lines per minute; the print cycle time is 200 milliseconds. The actual print operation requires 175 milliseconds; the remaining 25 milliseconds are used to advance paper one line and to restore the print hammers. Line advancement in excess of one line requires 8.4 milliseconds maximum per line for six lines per inch vertical spacing and 6.2 milliseconds maximum per line for eight lines per inch vertical spacing; both line advance times are based upon a paper-slewing rate of 20 inches per second.

The print line consists of 80-character positions for the Model 70/740-11 and 132-character positions for the Model 70/740-21. Features common to both models include horizontal spacing at 10 characters per inch, programmed horizontal and vertical tabulation.

The peak reading speed of the 70/741 Card Reader is 300 cards per minute. The cards are fed from a 1000-card-capacity hopper, read column by column, and loaded into a 1000-card-capacity stacker. The extended Hollerith card code is translated to the 7-level USASCII code by the 5753 Card Reader Adapter.

Protection against the loss or duplication of message blocks is provided by a block count feature. Each block within a message is preceded by a block identification number ranging in sequence from zero to seven. The block number is automatically assigned by the 70/740 when transmitting to the remote computer. The block count of each received message block is sampled and compared to the count of an internal counter for equality. The received block is printed only when equal to the internal count and the count is advanced by one. The 70/740 responds to a block count greater than the internal block count by transmitting a negative acknowledgement at the end of the block and by visually alerting the operator. A received block count less than the internal block count results in a positive acknowledgement at the end of the block.

.16 First Delivery: ..... February 1970.

.17 Availability: ..... 9 months (initially).

.2 CONFIGURATION

The baisc RCA 70/740 Data Terminal includes a communications control unit and a 300-line per minute printer and is available in two models that differ only in the number of print positions per print line:

- Model 70/740-11 — provides printed output at 80 characters per line.
- Model 70/740-21 — provides printed output at 132 characters per line.

The optional RCA 70/741 Card Reader and 5753 Card Reader Adapter can be added to the basic 70/740 Terminal.

The standard communications facilities that can be accommodated and the associated data sets are listed in Paragraph .72.

.3 INPUT

.31 Prepared Input

70/741 Card Reader --
Input medium: ..... standard IBM 80-column punched cards.
Input code: ..... standard Hollerith card code; see Table II.

TABLE I: USASCII DATA TRANSMISSION CODE

Bit Positions (b7 b6 b5)	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b4 b3 b2 b1								
0 0 0 0	NUL	DLE	SP	0	@	P	`	p
0 0 0 1	SOH	DC1	!	1	A	Q	a	q
0 0 1 0	STX	DC2	"	2	B	R	b	r
0 0 1 1	ETX	DC3	#	3	C	S	c	s
0 1 0 0	EOT	DC4	$	4	D	T	d	t
0 1 0 1	ENQ	NAK	%	5	E	U	e	u
0 1 1 0	ACK	SYN	&	6	F	V	f	v
0 1 1 1	BEL	ETB	'	7	G	W	g	w
1 0 0 0	BS	CAN	(	8	H	X	h	x
1 0 0 1	HT	EM	)	9	I	Y	i	y
1 0 1 0	LF	SUB	*	:	J	Z	j	z
1 0 1 1	VT	ESC	+	;	K	[	k	{
1 1 0 0	FF	FS	,	<	L	\	l	|
1 1 0 1	CR	GS	-	=	M	]	m	}
1 1 1 0	SO	RS	.	>	N	^	n	~
1 1 1 1	SI	US	/	?	O	_	o	DEL

TABLE II: RCA 70/741 CARD CODE*

Col. → / Row ↓	0	1	2	3	4	5	6	7
0	NUL 12-0-9-8-1	DLE 12-11-9-8-1	SP no punches	0 0	@ 8-4	P 11-7	\ 8-1	P 12-11-7
1		DC1 11-9-1	1 12-8-7	1 1	A 12-1	Q 11-8	a 12-0-1	q 12-11-8
2		DC2 11-9-2	" 8-7	2 2	B 12-2	R 11-9	b 12-0-2	r 12-11-9
3	ETX 12-9-3	DC3 11-9-3	# 8-3	3 3	C 12-3	S 0-2	c 12-0-3	s 11-0-2
4	EOT 9-7	DC4 9-8-4	$ 11-8-3	4 4	D 12-4	T 0-3	d 12-0-4	t 11-0-3
5			% 0-8-4	5 5	E 12-5	U 0-4	a 12-0-5	u 11-0-4
6			& 12	6 6	F 12-6	V 0-5	f 12-0-6	v 11-0-5
7	BEL 0-9-8-7		8-5	7 7	G 12-7	W 0-6	g 12-0-7	w 11-0-6
8	BS 11-9-6	CAN 11-9-8	(12-8-5	8 8	H 12-8	X 0-7	h 12-0-8	x 11-0-7
9	HT 12-9-5	EM 11-9-8-1	) 11-8-5	9 9	I 12-9	Y 0-8	i 12-0-9	y 11-0-8
10	LF 0-9-5	SUB 9-8-7	* 11-8-4	: 8-2	J 11-1	Z 0-9	j 12-11-1	z 11-0-9
11	VT 12-9-8-3	ESC 0-9-7	+ 12-8-6	; 11-8-6	J 11-2	[12-8-2	k 12-11-2	{ 12-0
12	FF 12-9-8-4	FS 11-9-8-4	, 0-8-3	< 12-8-4	L 11-3	\ 0-8-2	l 12-11-3	: 12-11
13	CR 12-9-8-5	GS 11-9-8-5	- 11	= 8-6	M 11-4	] 11-8-2	m 12-11-4	} 11-0
14	SO 12-9-8-6	RS 11-9-8-6	. 12-8-3	> 0-8-6	N 11-5	11-8-7	n 12-11-5	~ 11-0-1
15	SI 12-9-8-7	US 11-9-8-7	/ 0-1	? 0-8-7	O 11-6	- 0-8-5	o 12-11-6	DEL 12-9-7

* The Hollerith card code is translated to the USASCII character set, shown above the dotted line, by the 5753 Card Reader Adapter.

	Quantity of data:	up to 80 characters per card.
	Character set:	128-character USASCII character set.
	Rated input speed:	300 cards per minute.
	Effective speed:	less than rated speed depending on number of characters per card, block length and limitations of communications facility; see Table VII.
	Comments	Hollerith code is translated to 7-level USASCII code plus odd parity by the 5753 Card Reader Adapter.
.32	Manual Input:	no provision.
.33	Fixed Input:	no provision.
.34	Transaction Code Input:	no provision.

.35 Message Configuration

Message Types

The 70/740 employs five message types: Poll, Select, Request, Printer, and Reader; see Table V.

Basic Format

Printer and Reader messages are divided into blocks; each block is divided into sub-blocks or records. Each block can contain up to 16 records. The number of blocks per message is unlimited.

Block Identification

Each block is assigned a module-8 number for identification. Block identification is employed in both transmit and receive modes to prevent the loss or duplication of a data block within a message. An internal block counter is preset to one by a Select message or an EOT character prior to receiving the first message, which must be assigned a block count of one. The received block count is sampled at the beginning of each block and compared to that of the block counter for equality. A message block is not printed when its block count is less or greater than the internal block counter. Each block correctly received is printed and the block counter is advanced by one.

Message Sequence

Both Printer and Reader messages are identical except for the format-control sequence required by the printer. The text contained in the initial record of each block is preceded by: four SYN characters; STX, BLK, and a two-character format-control sequence, (see Tables IV, V, and VI) which is required for Printer messages only. Records other than the initial record begin with text when contained in a Reader message and with a format-control sequence followed by text when contained in a Printer message. Each record is terminated by a US, ETB, or ETX character followed by a longitudinal parity character. A DEL character terminates the last record of each block contained in a Reader message to allow for equipment timing considerations. A Unit Separator (US) terminates each record of a block except the final record, which is terminated by an End-of-Transmission Block (ETB) character. The final record of the last message block is terminated by an End-of-Text (ETX) character.

TABLE III: RCA 70/740 PRINTER CHARACTER SET*

Print Sequence	Symbol	USASCII Code, Column/Row	Print Sequence	Symbol	USASCII Code, Column/Row
1	@	4/0	33	A	4/1
2	-	2/13	34	L	4/12
3	0	3/0	35	Q	5/1
4	1	3/1	36	T	5/4
5	2	3/2	37	U	5/5
6	3	3/3	38	P	5/0
7	4	3/4	39	F	4/6
8	5	3/5	40	Y	5/9
9	6	3/6	41	V	5/6
10	7	3/7	42	/	2/15
11	8	3/8	43	]	5/13
12	9	3/9	44	[	5/12
13	$	2/4	45	?	3/15
14	.	2/14	46	|	7/12
15	,	2/12	47	)	2/9
16	E	4/5	48	(	2/8
17	O	4/15	49	;	3/11
18	N	4/14	50	!	2/1
19	S	5/3	51	^	5/14
20	I	4/9	52	"	2/2
21	C	4/3	53	:	3/10
22	R	5/2	54	_	5/15
23	G	4/7	55	`	2/7
24	H	4/8	56	>	3/14
25	J	4/10	57	<	3/12
26	D	4/4	58	=	3/13
27	M	4/13	59	*	2/10
28	W	5/7	60	#	2/3
29	B	4/2	61	%	2/5
30	K	4/11	62	&	2/6
31	X	5/8	63	¢	5/11
32	Z	5/10	64	+	2/11

* The symbols], /, and [can be substituted for the symbols at print locations 43, 44, and 63, respectively, at no additional cost.

.35 Message Configuration (Contd.)

Poll and Select messages are also identical and are constructed as follows: four SYN, SID, DEV, ENQ. The SID character identifies one of several stations in a multi-station environment. The DEV character identifies the device (printer or reader) and also defines the message type as a Poll (reader) or Select (printer) message. An EOT character can be used directly ahead of the SID character to ensure that the 70/740 is ready to respond to the Poll or Select message.

The request message is manually initiated as an invitation to a Poll message. The message is constructed as: four SYN, SID, ENQ, DEL.

Acknowledgement

The 70/740 acknowledges all messages received and requires an acknowledgement to all messages transmitted. The 70/740 responds to an ETB or ETX at the end of a received message block with one of the following replies:

- DLE 1 - a positive reply to the first and all subsequent odd numbered blocks.
- DLE 0 - a positive reply to all even numbered blocks.
- NAK - a negative reply prefixed by an A, B, or C to designate a specific error condition.

TABLE IV: RCA 70/740 PRINTER VERTICAL FORMAT CONTROL CODES

USASCII Format Control Code	Carriage Operation after Printing
ESC 0	No Space
ESC 1	Single Space
ESC 2	Double Space
ESC 3	Triple Space
ESC 4	Skip to Channel 1
ESC 5	Skip to Channel 2
ESC 6	Skip to Channel 3
ESC 7	Skip to Channel 4
ESC 8	Skip to Channel 5
ESC 9	Skip to Channel 6
ESC :	Skip to Channel 7
ESC ;	Skip to Channel 8
ESC <	Skip to Channel 9
ESC =	Skip to Channel 10
ESC >	Skip to Channel 11
ESC ?	Skip to Channel 12

A positive reply indicates a block was received without error and that the received block count was equal to or less than the internal block count. The Terminal responds to a received block count that is greater than the internal block count with a NAK.

The Terminal anticipates the computer to retransmit a message block following a NAK reply or an acknowledgement following an ENQ reply.

The computer is required to acknowledge the Terminal within a predetermined period ranging from 2.6 to 3.6 seconds following the transmission of ENQ, ETB, or ETX. Failure for the computer to respond with STX, DLE 0/1 (ACK), NAK, BEL, EOT, or WABT within the established period, results in a retransmission of the last message block, or if three retransmissions have already occurred, an EOT is transmitted to terminate the transmission.

Printer Messages

Each record received consists of a format control sequence followed by the data to be printed and represents one print line of up to 80 or 132 characters depending on the printer model. Printing is performed first, vertical formatting last. Minimum record length requirements are 49 text characters when receiving at 250 char/sec (4 Msec/char) and 59 text characters when receiving at 300 char/sec (3.3 Msec/char). These minimum requirements can be satisfied by the use of NUL characters in the print positions of each record.

Printer Format Control

Horizontal and vertical tabulation are standard features on the 70/740.

Horizontal tabulation is implemented through the use of a stored horizontal format record, which contains horizontal tab (HT) characters in predetermined positions; remaining positions are filled with space characters. The HT characters in the format record identify the

TABLE V: RCA 70/740 MESSAGE TYPES

Type of Message	Origin of Transmission	Message Sequence	Purpose of Message
Poll	Computer	four SYN, EOT, SID, DEV, ENQ	To request the addressed 70/740 to transmit a message from the 70/741 Card Reader
Select	Computer	four SYN, EOT, SID, DEV, ENQ	To request control unit/printer status; i.e., "ready" or "not ready" to receive a Print message
Request	Terminal	four SYN, SID, ENQ, DEL	To request a Poll message; the Request message is manually initiated by Terminal operator
Printer	Computer	Initial record: four SYN, STX, BLK, ESC, Text, US, BCC Following records: ESC, Text, ETB/ETX, BCC	To print message on paper
Reader	Terminal	Initial record: four SYN, STX, BLK, Text, US, BCC Following records: Text, ETB/ETX, BCC, DEL	To read message from punched cards
Acknowledgement	Terminal	four SYN, SID, NAK, DEL	To inform the remote computer that the Terminal is not ready to receive a message; the audible alarm is activated
		four SYN, DEL O, DEL, O, DEL	To inform the remote computer that the Terminal is ready to receive a message
		four SYN, EOT, DEL	To inform the remote computer that the 70/740 does not have a waiting message

.35 Message Configuration (Contd.)

beginning of printed data fields. When an HT character is received in an incoming message, the next data field will be printed beginning with the next horizontal tab position as defined by the HT character in the stored format record. The format record remains stored until a new format record is received. A format record is identified by the prefix ESC HT.

Vertical tabulation is implemented through the use of a 12-channel punched tape loop, which defines the vertical format. A print record is prefixed by a two-character sequence, ESC followed by an address code, that specifies one of the twelve channels on the format loop or paper advance positions up to three, see Table IV.

TABLE VI: RCA 70/740 DATA TERMINAL CONTROL CHARACTERS

Control Character	Function	Character Transmitted
Bell	To light BEL lamp and sound audible alarm when transmitted or received by the terminal.	BEL
Block Check Character	To establish block parity check; generated and checked by the terminal; follows US, ETB, or ETX control characters.	BCC
Block Number	To identify the message block; immediately follows STX control character.	BLK
Delete	To allow for equipment timing considerations; generated by the terminal following last character of each transmission; ignored by the terminal when received.	DEL
Device Number	To identify a message for printer or card reader.	DEV
Data-Link Escape	To inform the transmitting terminal that the last block of data was received without error; a DLE is followed by a 0 (even) or 1 (odd) block designation.	DLE
Disconnect Line, DEOT	To terminate a connection via public telephone network when the two character sequence is transmitted or received by the terminal.	DLE EOT
Substitute	To replace an invalid character from the 70/741 Card Reader; automatically inserted by terminal.	SUB
Wait-Before-Transmit WABT	To indicate to the terminal that remote computer is not ready to receive; initiates retransmission of previous message from the terminal.	DLE ?
End of Transmission	To indicate a no-message status in response to a polling message from remote computer.	EOT
Inquiry	To terminate a polling or selection sequence from remote computer. To initiate retransmission of a response such as DLE, DLE ?, etc.	ENQ
End-of-Transmission Block	To identify the end of a message block.	ETB
End-of-Text	To identify the end of a message.	ETX
Format Control Character	To initiate a printer forms feed or horizontal tab operation; see Table IV. The two-character sequence immediately follows a BLK or US, BCC control characters.	ESC
Horizontal Tabulation	To initiate printer horizontal tab operation; part of format control character sequence; see Table IV.	HT
Negative Acknowledge	To indicate to remote computer that last block of data transmitted was received in error; it is prefixed by A, B, or C to identify type of error	NAK
Null	To be used as a fill character only; causes no printing or spacing.	NUL
Station Identification	To identify the recipient terminal of a polling or selection sequence; one of 64 address combinations.	SID
Start-of-Text	To identify beginning of a message	STX
Synchronization Character	To establish synchronization between transmitting and receiving devices; can be used as a filler character.	SYN
Unit Separater	To identify the end of a message block; initiates Block Check Character generation or checking when transmitted or received by the terminal. (16 blocks per message maximum.)	

.35 Message Configuration (Contd.)

The printer format-control sequence for vertical or horizontal formatting immediately follows the Block Count (BLK) character of the initial record in a block and at the very beginning of each of the following records. Compensation for the time required to space paper in a vertical format operation is accomplished through the use of NUL characters following the format-control sequence.

Reader Message

Each record represents one 80-column card. Block length is limited to 360 characters over a maximum of 16 records. Record length is automatically set at 80 characters unless the 70/740 encounters a US, ETB, or ETX character punched into the card. Punched data following one of these characters on the same card is ignored. Block length is established at 320 characters (four punched cards) in the absence of punched control characters, unless limited by the number of remaining cards.

.36 Operating Procedure

The operator prepares the terminal by loading the printer with forms if required, by loading the card reader with cards (if transmitting data), and by setting the switches on the Operator's Control Panel to conform with the desired operating procedure. Calls are initiated manually and answered automatically. The subsequent transmission and reception of data are largely automatic and require little operator attention, if any. Retransmission of data blocks containing errors is automatic. Up to three retransmissions resulting from any combination of a consecutively negative response or fixed time-out due to a no-response condition will occur before operator intervention is required. The terminal halts, and visual and audible alarms are activated in response to a fourth negative reply or time-out.

.37 Entry of Time and Date:..... no provision.

.4 OUTPUT

.44 Output to Printer

Printer (70/740 Models -11 and -21)

Output medium:	pin-fed continuous fanfold forms from 4.00 to 22 inches wide and up to 17 inches long; maximum printed line length is 80 characters for Model 70/740-11 and 132 characters for Model 70/740-21.
Character set:	64 characters; see Table III.
Rated printing speed:	300 lines/min.
Effective speed:	less than rated speed depending on the number of characters per line, transmission speed, type of line, and size of message block; see Table VII.
Format control:	via Format Control Character (ESC) sequence at beginning of each print record and stored horizontal tab format; vertical and horizontal tabulation is standard; see Table IV.
Comments:	prints up to 16 lines per message block; available as a no-charge option, three RCA special symbols replace three USASCII special symbols; see Table III.

.5 ERROR DETECTION AND CORRECTION

The 70/740 classifies errors detected within a received message as belonging to one of three general types: parity errors, block-count errors, and format errors. A negative acknowledgement (NAK) preceded by the prefix A, B, or C to define the error type is transmitted in response to a message block containing any one or combination of three error conditions. When more than one type occurs in the same message block, the first to be detected is the one reported. The prefix A, B, and C is assigned to parity, block-count, and format errors, respectively. A parity error reflects either incorrect character or longitudinal parity. A block-count error is reported only when the received block count is greater than the internal block count. A format error includes any one of the following conditions:

(1) the loss of received data due to a buffer-full condition.

(2) a message block containing more than 16 records.

(3) a record containing more than 80 (Model 70/740-11) or 132 (Model 70/740-21) characters.

(4) an invalid character code.

(5) an undefined format-control sequence.

.51 Data Entry Errors

Type of checking:	validity checking on data read from cards.
Error indication:	indicator lights, SUB character substituted for USASCII control character other than US, ETB or ETX; character read in error is not transmitted.
Correction procedure:	operator intervention.

.52 Data Transmission Errors

Type of checking:	character and longitudinal parity check; modulo-8 block-count check.
Error indication:	indicator lights, printing halts, and an acknowledgement (A NAK if parity error, B NAK if block-count error) is returned at end of block.
Correction procedure:	automatic retransmission of block received in error; terminal halts, a lamp is lighted and an audible alarm is sounded after three retransmissions; operator intervention is then required.

.53 Data Recording Errors: . . . . . no provisions.

.54 Buffer Errors

Type of checking:	odd character parity check on data read from buffer storage.
Error indication:	indicator lights, terminal halts, and EOT is transmitted.
Correction procedure:	operator intervention.

.55 Line Malfunctions

The 70/740 guards against prolonged periods of inactivity on the public telephone network by disconnecting the line and energizing the audible alarm and the respective indicator lamp when a transmission has not begun within a 20-second period following the initial connection.

.55 Line Malfunctions (Contd.)

Detection:	expiration of a fixed time interval (approximately two seconds) between a received STX character and a two-character sequence of SYN or any character (selected manually).
Action:	terminal halts indicator lights; terminal responds to a received ENQ with A NAK.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	250 or 300 char/sec (2000 or 2400 bits/sec), respectively.
Transmission method:	serial by bit.
Transmission code:	7-level USASCII plus parity totaling 8 bits/char; see Table I.
Transmission mode:	half-duplex.
Order of bit transmission:	low-order bit first.
Synchronization:	synchronous; a sequence of four SYN characters precedes each message and acknowledgement to establish synchronization between transmitting and receiving units.

.72 Connection to Communications Lines

Communications Line or Service	Data Set*
Common-carrier leased voice-band line operating at the following speeds:	
2000 or 2400 bits/sec:	Bell System Data Set 201B or Western Union 2400 Baud Data Modem.
Public telephone network operating at 2000 bits/sec:	Bell System Data-Phone Data Set 201A.

.73 Transmission Control

Call initiation:	manual dialing or signaling.
Call reception:	capable of unattended transmit-receive operation.
Functional operations:	printer or reader is selected by control codes; vertical form spacing or skipping and horizontal tabulation on printer, audible alarm and indicator lamp can be energized by BEL code.

.74 Multistation Operation

Polling:	a polling sequence requests data from the addressed 70/740; a request for a polling sequence can be manually initiated.

* Equivalent data sets can be used; see Section 4620 for a current list of modems available from independent manufacturers of telephone equipment, then check with your local common-carrier communications consultant.

TABLE VII: EFFECTIVE DATA TRANSMISSION RATES OF RCA 70/740 DATA TERMINAL

Component and Record Size(1)	Data Transmission Rate, records per minute (2)	
	Half-duplex, 2000 bits/sec(5)	Full-duplex, 2400 bits/sec(6)
Printer(3) -		
50 char/record	186; 263	297; 300
65	165; 213	240; 270
80	140; 170	200; 220
95	120; 145	168; 185
110	112; 130	148; 162
120	105; 118	137; 145
130	93; 108	127; 137
Card Reader(4) -		
10	281	300
25	270	300
40	253	295
60	188	265
80	142	200

(1) Record size includes HT horizontal format characters and ESC sequences controlling vertical spacing but excludes all other control characters.

(2) A record corresponds to one card or one line of print. The data transmission rates include transmission of all control characters, turnaround times, and the transmission of acknowledgement messages.

(3) The data transmission rate is based on a four-record block (first column) and a sixteen-record block (second column).

(4) The data transmission rate is based on a 360-character block.

(5) This transmission mode is normally used over the public telephone network (300 msec total turnaround time).

(6) This transmission mode is normally used with a full-duplex leased voice-band line (40 msec total turnaround time).

Addressing: . . . . . individual Data Terminals cannot communicate directly with one another; such communication could be provided on a store-and-forward basis by appropriate programming of the remote computer, utilizing the individual addressability of the terminal units.

.8 PHYSICAL SPECIFICATIONS

Component	70/740 Data Terminal Models -11 and -21	70/741 Card Reader
Width (inches)	57	25.5
Depth (inches)	30	36.25
Height (inches)	54	46.5
Weight (pounds)		150
Power (KVA)	3.5	0.75
Voltage	208/240	120
Frequency (Hz)	60	60
Phases	1	1
Temperature Range (°F)	50 to 110	50 to 110
Humidity Range (%)	10 to 90	10 to 90
Heat (BTU/hr)	9600	2560

.9 PRICE DATA

Component or Feature	Monthly Rental, $	Purchase Price, $	Monthly Maintenance, $
70/740 Data Terminal:			
Model 70/740-11	857.50	37,125	162.50
Model 70/740-21	1075.00	40,500	175.00
70/741 Card Reader	238.75	9000	38.75
5753 Card Reader Adapter	30.00	1125	5.00
5750-01 Special Print Symbols	NC	NC	-

NC - No Charge

RAYTHEON DIDS–400 SYSTEM

.1 GENERAL

.11 Identity: . . . . . DIDS-400 Digital Information Display System.

.12 Manufacturer: . . . . . Raytheon Company
Equipment Division
60 First Avenue
Waltham, Massachusetts.

.13 Basic Function: . . . . . displays, via a cathode ray tube, data received from a remote computer or entered via keyboard; transmits data to a remote computer over the public telephone network or leased voice-band line.

.15 Description

The Raytheon DIDS-400 is a visual communications terminal designed to facilitate rapid and efficient exchange of data between a computer and one or more remote stations under control of a program stored in the computer. The DIDS-400 can operate in a polling or non-polling environment and in a single-station or multistation arrangement.

Configuration

Two models of the Display Console are available: Models 401 and 402. Both models possess the same display characteristics and keyboard layout.

Model 401 is designed for operation in a polling or non-polling (query-response) environment and is connected to the Model 425 Control Unit. Teletype Model 33 or 35 Receive Only Teleprinters can be combined with a Model 401 display when hard copy is desired. The Model 441 Printer Adapter provides buffering and control for one Teletype Teleprinter and is used to interface the Teleprinter to the 425 Control Unit.

The basic Model 425 Control Unit permits connection of any combination of up to eight 441 Printer Adapters and 401 Display Consoles; the attached devices are selectively interfaced with a single voice-band line via a data set. The basic Model 425 can be expanded in increments of 8 positions up to a maximum of 64 positions.

The Model 402 Display is essentially designed for single-station operation, although a multi-unit station can be achieved via the Model 426 Multiplex Switch Unit. The Switch Unit can accommodate any combination of up to five Model 402 Displays and Model 442 Printer Adapters; the attached devices are interfaced with a single voice-band line via a data set. Each 442 Adapter accommodates one Teletype Model 33 or 35 Receive-Only Teleprinter.

Transmission Characteristics

The Model 425 Control Unit operates synchronously, in a half-duplex mode, over the public telephone network at 2000 bits per second or over a leased voice-band line at 2400 bits per second. The 425 is compatible with the Bell System Data-Phone Data Set 201A for connection to the public telephone network, or with the Data 201B for connection to a leased voice-band line.

The Model 402 Display Console or Model 426 Multiplex Switch operate asynchronously, in a half-duplex mode, over the public telephone network or a leased voice-band line at up to 1200 bits per second. The 402 and 426 are compatible with the Bell System Data-Phone Data Set 202C for connection to the public telephone network, or with Data Set 202D for connection to a leased voice-band line.

The transmission code used with the 425 Control Unit is modified 7-level USASCII, plus one parity bit (odd or even) per character. The 402 terminal also employs 7-level USASCII, plus an even parity bit per character; a total of 10 bits are transmitted for each character, including one start and one stop bit.

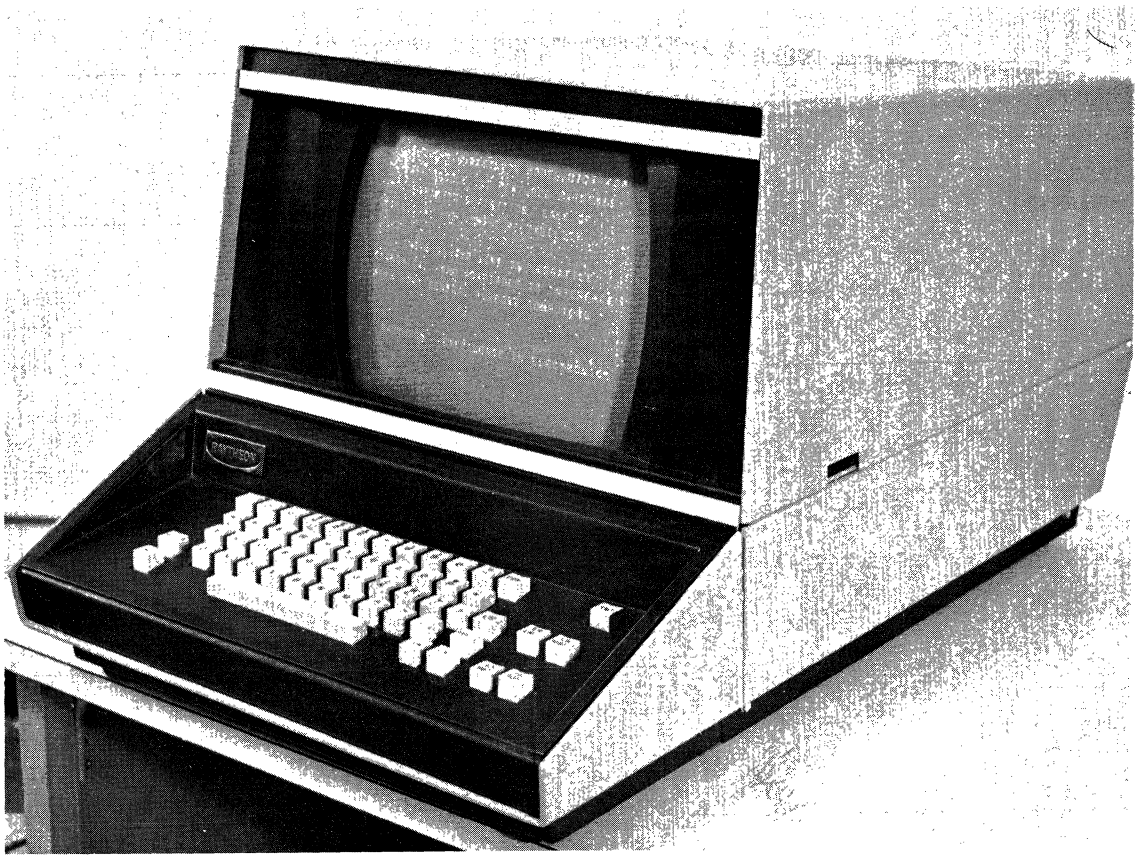


Figure 1. Raytheon DIDS-400 Display Console.

.15 Description (Contd.)

Display Unit

The characteristics of the display unit, which is the same for both Display Consoles, are shown in Table I.

The monoscope technique is used to generate each character of a 64-character set which consists of upper-case alphabetics, numerics, and special symbols. The characters are regenerated 67 times per second.

The keyboard included with the Model 401 or 402 Display Console contains 60 keys, including control, cursor, and editing keys, arranged in conventional typewriter style.

Consor controls provide for positioning the blinking cursor to:

- The first character position of the top line,
- The first character position of the preceding line,
- The first character position of the following line,
- The next Tab Stop position (optional),
- One space to the right, or
- One space to the left.

A cycle key depressed simultaneously with a character or function key causes repetitive action at a rate of 6 or 12 times per second (6 in the 520-character unit or 12 in the 1040-character unit).

Editing Facilities

The editing controls included with the Model 401 or 402 Display Console provide for inserting a character into or deleting a character from a line of text. The edited line of text expands

(Contd.)

TABLE I: DIDS-400 DISPLAY CHARACTERISTICS

Characteristic	Description
Output medium	12-inch rectangular cathode ray tube; displays green characters against black background.
Character set	64 characters, including upper-case alphabetics, numerics, punctuation marks, and special symbols.
Character size	Nominally 0. 15 inch wide and 0. 15 to 0. 20 inch high (adjustable).
Display size	8. 5 inches wide by 6. 5 inches high.
Characters per line	40 characters; optionally 80 characters.
Lines per display	13 lines.
Characters per display	520 characters; optionally 1040 characters.
Buffer capacity	520 characters; optionally 1040 characters.
Format control	Horizontal tab characters (optional); insert and delete functions; split-screen capability; flexible cursor movement controls.
Rated output speed	Up to 100,000 char/sec with direct connection; Model 402 Display operates up to 120 char/sec over voice-band line; Model 425 Control operates at 250 or 300 char/sec over voice-band line.
Effective output speed	Limited by message length and communications facility.

or contracts to compensate for the inserted or deleted characters. When a character is deleted from a line of text, a blank space occurs to the right of the text; when a character is inserted in a full line of text, the last character position to the right is lost. The line of text or the message to the right of the cursor can be erased. The cycle feature can be used in conjunction with an edit function.

A special tab control option, available with the Model 401 Console only, permits restricted areas to be established within the display, and data entry from the keyboard is prevented in these areas. The restricted portion is bracketed by start and stop tab characters which are entered via the keyboard or by a computer message. The tab characters can be displayed, if desired, and can be erased via the keyboard.

Operating Procedure

Data can be entered at any location on the display by positioning the cursor to the location and then entering the data. The cursor is advanced one character position as each character is entered. Editing is performed prior to message transmission. The EOM key, which is depressed at the end of the message, causes a special symbol to be displayed at the end of the composed message. The EOM key also causes the cursor to be repositioned to the top left corner of the screen and the transmit function to be enabled. All data between the cursor and EOM symbol, except for restricted areas bracketed by tab symbols (401 option) is transmitted. Partial-screen transmission is possible by positioning the cursor to the starting location of the message before the transmit key is depressed. The keyboard is locked out during the transmit cycle until a computer response is received or until the operator manually releases the keyboard.

TABLE II: RAYTHEON DIDS-400 USASCII TRANSMISSION CODE

			b_1	0	1	0	1	0	1	0	1	
			b_2	0	0	1	1	0	0	1	1	
			b_3	0	0	0	0	1	1	1	1	
b_7	b_6	b_5	b_4									
0	0	0	0	NULL	SOH	STX	ETX	EOT				CONTROL CHARACTERS
0	0	0	1	TAB		LINE RESET		FRAME RESET	CR			
0	0	1	0					ERASE		SYN	ETB	
0	0	1	1									
0	1	0	0	.	!	≣	⋇	$	%	&	'	
0	1	0	1	(	)	*	+	,	-	.	/	
0	1	1	0	Ø	1	2	3	4	5	6	7	
0	1	1	1	8	9	:	;	<	=	>	?	DISPLAYED CHARACTERS
1	0	0	0	@	A	B	C	D	E	F	G	
1	0	0	1	H	I	J	K	L	M	N	O	
1	0	1	0	P	Q	R	S	T	U	V	W	
1	0	1	1	X	Y	Z	[	⊞	\		⊠	

(1) Model 402 Display Terminal control characters include STX, ETX, EOT, and CR only

(2) Model 425 Control Unit tab control option uses the "[" and "⊞" codes for non-displayable control characters.

(3) Symbol identification:
≣ Cursor character
⋇ End of message character
\ Carriage return character
⊠ Parity error character

.15 Description (Contd.)

Message Configuration

The message configuration for the Model 425 Control Unit includes a Start-of-Header (SOH) character, an Address character which identifies a specific control unit or display console, the text, and an End-of-Transmission Block (ETB) character. Transmission is synchronized by sync characters preceding each message.

The message configuration for the Model 402 Display Terminal includes a Start-of-Text (STX) character, a display address, text, and an End-of-Text (ETX) character. An EOT character can be substituted for the ETX character.

Error Detection and Correction

Errors that occur during off-line composition can be corrected by positioning the cursor over the character in error and rekeying the correct character. A detected transmission error occurring during a computer message causes a special symbol to be displayed in place of that character. Atuomatic retransmission request upon detection of a transmission error is optional.

If a transmission error occurs when the Start-of-Message (SOM) character or the Address character is received, the message is not displayed and the operator must repeat the query. If the End-of-Message character is not received by the display, the display remains on-line and the message is displayed. The receive mode is terminated in this case by depressing the Shift and Clear keys.

(Contd.)

Multistation Operation

Polling options are available for the Model 425 Control Unit and the Model 402 Display Terminal.

The 425 Control Unit with the polling option responds to four separate commands: transmit message from a specified display, transmit message from all displays associated with one control unit, transmit message from the first display ready to transmit, and receive computer message addressed to a specified display.

The polling option available with the Model 402 terminal permits polling an individual display, polling all displays common to a specific Multiplex Switch Unit, or both. A Broadcast Address option, also available for the 402 terminal, allows all display devices to receive the same computer message.

Options

Other options presently available for the Model 402 display terminal include a Keyboard Lockout option which inhibits keyboard operation during the receive mode, special cursor operation options, and non-standard USASCII coding for control characters. Raytheon states that the cost of these options is negotiated individually. Similar options can be requested for the Model 401 display terminal.

.16 First Delivery: . . . . . November 1965.

.17 Availability: . . . . . 6 months.

.9 PRICE DATA

Component or Feature	Monthly Rental, $	Purchase Price, (4) $
Model 401 Display Console (used with Model 425 Control Unit)	114	4100
1040 Character Option (3)	17	600
Model 402 Display Console (used as single unit or with Model 426 Multiplex Switch Unit)	167	6000
1040 Character Option (3)	17	600
Model 402 Polling Capability	11	400
Model 425 Control Unit (1)	225 to 390	8300 to 14,000
8-Module Add-On Capability	31	1100
Model 426 Multiplex (2) Switch Unit	32	1160
Model 441 Printer Adapter (used with Model 425 Control Unit)	78	2800
Model 442 Printer Adapter (used with Model 426 Multiplex Switch Unit)	117	4200
Teletype Model 33 Receive-Only Teleprinter	19	660
Teletype Model 35 Receive-Only Teleprinter	52	1870

(1) Provides connections for any combination of up to eight Model 401 Display Consoles or Model 441 Printer Adapters; expandable to 64 positions in increments of 8 positions. Price variation reflects hardware additions required to operate with some computers.

(2) Provides connections for any combination of up to five Model 402 Display Consoles on Model 442 Printer Adapters.

(3) Expands basic 520-character capacity to 1040-character capacity (13 lines at 80 char/line).

(4) The maintenance cost for purchased units is individually negotiated and is dependent upon the number of units installed and their geographical location.

SANDERS 620 STAND-ALONE DATA DISPLAY SYSTEM

.1 GENERAL

.11 Identity: . . . . . 620 Stand-Alone Data Display System.

.12 Manufacturer: . . . . . Sanders Associates, Inc.
Data Systems Division
95 Canal Street
Nashua, New Hampshire 03060

.13 Basic Function: . . . . . displays, via cathode ray tube, data received from a remote computer or entered via keyboard; transmits data to a remote computer over the public telephone network or leased voice-band lines.

.14 Basic Components

Name:. . . . . Model 6220 Display Unit
Function:. . . . . display of alphanumeric data.

Name:. . . . . Model 6240 Typewriter Style Keyboard Unit.
Function:. . . . . provides entry of data into the buffer memory contained in the Display Unit.

.15 Description

The Sanders 620 Stand-Alone Data Display System is designed to facilitate rapid exchange of data between a computer and a remote station under control of a stored program in the computer. The 620 is a self-contained unit and includes a keyboard, I/O module, and memory module. A Teletype Model 33 or 35 RO teleprinter can be connected to the 620 via a special adapter.

The transmission rate is governed by the specific communications interface and can range from 110 bits per second to 2400 bits per second. This report discusses the 620 Display System as used in a communications environment only, except where noted.

There are two communications interfaces available for the 620: asynchronous and synchronous. The asynchronous interface provides selectable transmission rates of 110, 1000, 1200, and 1800 bits per second; the synchronous interface provides selectable transmission rates of 2000 and 2400 bits per second.

The 7-level USASCII transmission code is employed, with an eighth bit added for character parity; see Table I, Report 6745 (Sanders 720 Data Display System). When the asynchronous communications interface is used, one start bit and one or two stop bits are added to each character transmitted, resulting in a 10- or 11-bit character. Character length is eight bits with the synchronous communications interface.

The Model 6220 Display Unit contains a 768-character memory module, composed of magnetostrictive delay lines, in addition to editing logic, character generation circuits, control logic, and a communications interface.

The Model 6220 Display Unit provides a 9.5-inch by 7.5-inch image area. Normally, the long side of the cathode ray tube (CRT) is mounted horizontally. The CRT can be mounted vertically if desired.

The image area is arranged in 32 lines of 64 or 84 (optional) characters per line when the horizontal orientation is specified, and 40 lines of 52 characters per line with the vertical orientation. A maximum of 768 characters can be simultaneously displayed on the screen, but they can be displayed in any of the more than 2000 display locations. Various control and format characters also occupy positions in the buffer and therefore reduce the number of data characters that can be displayed.

The stroke technique is employed to generate the displayed characters.

The Display Unit provides controls for adjusting focus, brightness, page size, page centering, character size, and the character tilt. The character tilt control varies all displayed characters from a vertical position to a slanted (italic) position.

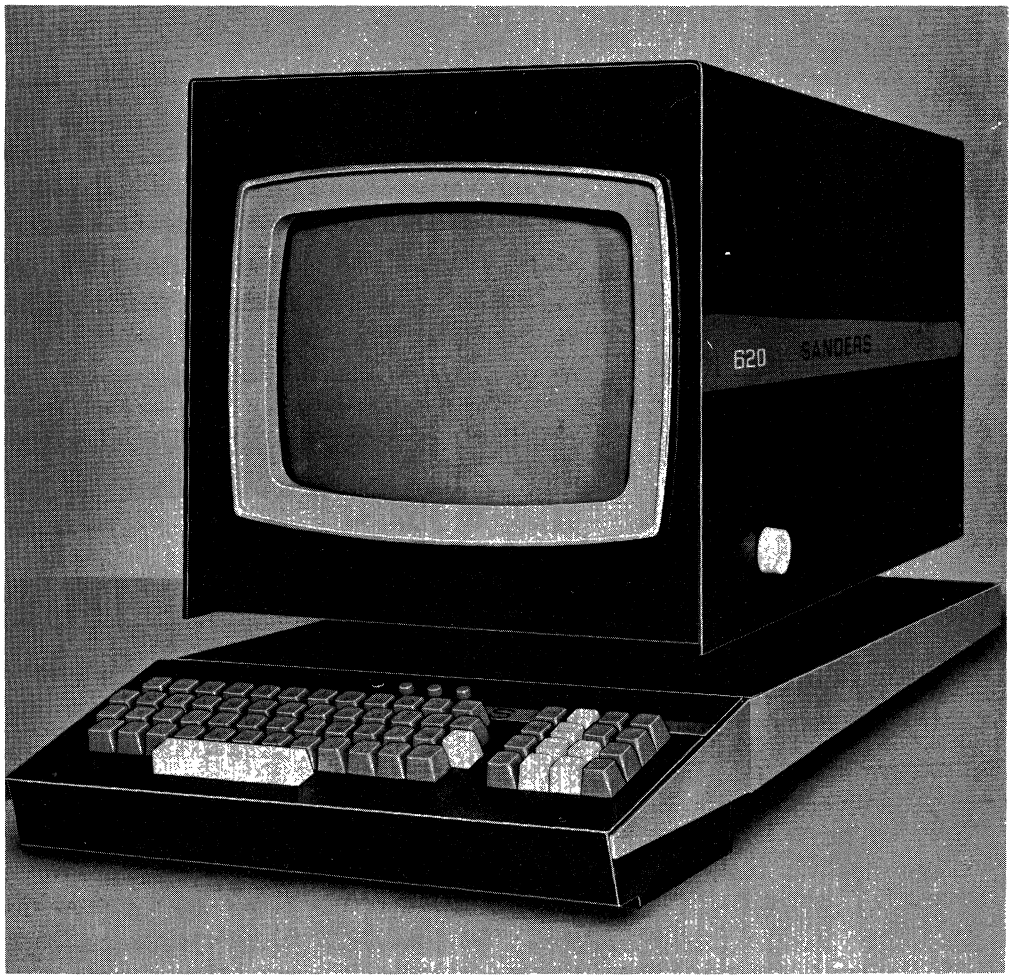


Figure 1. Sanders 620 Stand-Alone Data Display System with Horizontal Screen Orientation.

.15 Description (Contd.)

The Model 6240 Keyboard Unit can be attached directly to the Display Unit or can be connected remotely at a distance of up to 10 cable feet. The keyboard has 51 keys arranged in conventional typewriter style plus an array of 16 special function keys located at the right of the keyboard. Of the 16 special function keys, 11 provide discrete control functions; the 5 remaining keys are adaptable to a variety of customer uses. Depressing a key causes the generation of a unique USASCII character or control code.

Editing Facilities

Four operating modes are available for the 620: Data Entry, Format (optional), Conversation (optional), and Hard Copy (optional). Functional keys associated with these operating modes include:

- Format Type — initiates Data Entry mode; permits data to be entered into the buffer memory replacing any previous text.
- Type — initiates Format mode; permits data to be entered into the buffer memory only in areas (variable fields) specified by a previously stored display format.
- Conversation Type — initiates Conversation mode; permits data to be entered into the buffer memory following the last line of displayed data.

(Contd.)

- Clear — erases all data stored in buffer memory (Data Entry or Conversation modes); erases only data contained in variable fields specified by stored format (Format mode).
- Send — transmits the entire displayed page (Data Entry mode); transmits data contained in variable fields or data bracketed by left and right delta symbols (Format mode); transmits last displayed line (Conversational mode).

The Hard Copy mode can be entered from the Format Type, Type, or Conversational mode to specify transferring all data stored in the buffer memory or only data contained in variable fields (Format mode). Data is transferred to the attached Teletype Unit when the Send key is depressed.

Cursor Controls

Six control keys provide a high degree of cursor mobility by directing the cursor to anyone of five positions. When used with the Format Type mode (requires Format option), four of the cursor control keys place control characters (formaters) in the buffer memory. The formaters are used to structure the data entered in the Format mode, and can be erased only by typing over in the Format mode or when the Clear key is depressed in the Data Entry mode. Cursor controls include:

- Horizontal Tab (optional) — establishes four character spaces between segments of the displayed text for each Horizontal Tab formater stored.
- Vertical Tab (optional) — establishes four line spaces following the last displayed line of text for each Vertical Tab formater stored.
- Carriage Return — establishes a single space between displayed lines with the cursor positioned at the initial character location for each key depression or each Carriage Return formater stored.
- Frontspace/Backspace — establishes a single character space forward or backward for each key depression or Frontspace/Backspace formater stored.
- Reset — returns the cursor to the display position of the initial character stored in buffer memory; when used with Format mode, the cursor is returned to the initial character position of the first variable field. Reset formaters are stored in buffer memory.
- Shift — provides control for dual-operation keys including the cursor control keys described above.
- Cycle Left/Right — steps the cursor forward or backward at a 30-steps-per-second rate for duration of key depression. The backward limiting position is the initial character location in memory or initial character location of the first variable field; the forward limiting position is the last character location in memory or final character location of the last variable field. Cursor will not wrap-around when in Data Entry mode.

A repeat key causes repetition of any operation associated with a simultaneously depressed key as long as both keys are depressed.

The Sanders 620 Data Display System can also interface the 731 Display Communications Buffer for operation in an IBM System/360 environment; see Sanders 720 Data Display System (see Paragraph 6745 .15). The Sanders file maintenance software package (AUTOGRAPH) is also applicable with the 620.

.16 First Delivery: . . . . . September 1968.

.17 Availability: . . . . . 3 months (after initial deliveries).

.2 CONFIGURATION

The 620 Data Display System includes:

- A Model 6220 Display Unit,
- A Model 6240 Keyboard, and
- An optional Model 6250 Hard Copy Adapter.

.2 CONFIGURATION (Contd.)

Up to 20 Model 620 Display Terminals can be connected to the same communications line via a Model 716 Serial Distributor. One Keyboard Unit can be connected to each Display Unit. The Keyboard Unit can be attached to the Display Unit or located 10 feet away from it.

.32 Manual Input

Model 6240 Typewriter Style Keyboard;
Model 6242 Keypunch Style Keyboard —

Method of entry:	via 51-key keyboard; an additional set of 16 keys (grouped separately) is provided for editing.
Quantity of data:	768 characters.
Character set:	64 characters including digits, upper case letters, and special symbols.
Comments:	16 keys control edit operations only and do not produce a displayable symbol.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration

The 620 was designed to operate in a polled environment; only the computer can initiate data transmission from the 620. The 620 accepts a request-to-send poll (SOH, AO, AI, DCI) and replies with a negative (NAK) or positive (STX, AO, AI, Text, ETX, and LPC) response. After transmitting the message the 620 waits for a NAK (request for retransmission) or ACK (positive acknowledgement) from the computer and responds with an EOT (End of Transmission) character. The 620 accepts a request-to-receive poll (SOH, AO, AI. and DC2) and replies with a negative (NAK) or positive (ACK) response. An ACK response is followed by the computer message (STX, Text, ETX, and LPC). The 620 responds with NAK (request for transmission) or ACK (positive acknowledgement). The computer message is terminated by an EOT character. The Control characters are defined in Table I. All messages are preceded by from two to five SYN characters when operating synchronously.

The size of the text portion of a transmitted or received message is variable up to 768 characters. Careful coordination is required when transmitting information between the 620 and the computer; there are no interlocks to prevent the operator from interfering with a message being received from the computer or to prevent a computer message from interfering with message composition by the operator.

.36 Operating Procedure

A message to be transmitted from a 620 Data Display System is composed by depressing the Clear key to clear the screen and position the cursor at the upper left corner of the screen (first position in memory), and then keying in the data. Controls are provided to space the cursor forward or backward one or four (optional) positions at a time, to move the cursor to the beginning of the next line or back to the end of the previous line, step the cursor forward or backward at a fixed rate, or to space the cursor down the page one or four (optional) line spaces at a time.

To transmit a portion of the displayed message (i.e., a variable field of text), the operator depresses the Type key followed by the Send key, which transmits only that portion of text bracketed by Delta characters. To transmit all the displayed data, the operator enters Data Entry mode by depressing the Format Type key and then simply depresses the Send key. If a transmission error is detected at the remote computer, a retransmission can be requested.

.37 Entry of Time and Data: . . . . . no provision.

.4 OUTPUT

.44 Output to Printer

Teletype Model 33 or 35 Receive-Only (RO) sets can be used for printed output at 10 characters per second. Each RO requires a Hard Copy Adapter. The Teletype equipment is fully described in Reports 6804 and 6805.

(Contd.)

TABLE I: SANDERS 620 SYSTEM USASCII TRANSMISSION CODE

Bit Position				7, 6, 5							
4	3	2	1	000	001	010	011	100	101	110	111
0	0	0	0	NULL*		S (SP)	0	@	P	COPY	
0	0	0	1	SOH*	DC1*	1	1	A	Q		
0	0	1	0	STX*	DC2*	"	2	B	R	T1	
0	0	1	1	ETX*		.	3	C	S	T2	
0	1	0	0	EOT*		$	4	D	T		
0	1	0	1		NAK*	%	5	E	U		
0	1	1	0	ACK*	SYN*	&	6	F	V		
0	1	1	1			(APOS)	7	G	W		
1	0	0	0	FS	BS	(	8	H	X		
1	0	0	1	HT		)	9	I	Y	02	
1	0	1	0			*	:	J	Z	INT	
1	0	1	1	VT		+	;	K	[	RCU	
1	1	0	0			(COMMA)	<	L	\		
1	1	0	1	CR		-	=	M	]		
1	1	1	0	▷		•	>	N	↑	MS**	
1	1	1	1	◁		/	?	O	←	T3	PARITY*
				Control and Operation Characters		Alphanumeric				Edit and I/O Function Characters	

BS — Back Space
FS — Front Space
HT — Horizontal Tab
VT — Vertical Tab
CR — Carriage Return
RCU — Reset Cursor

Copy — Hard Copy
MS — Memory Marker
T1 — Type
T2 — Format Type
T3 — Conversation Type
O2 — Send (output)
INT — Clear (initiate)

SOH — Start of Header*
STX — Start of Text*
ETX — End of Text*
EOT — End of Transmission*
DC1 — Request to Send*
DC2 — Request to Receive*
PARITY — Parity error symbol ■

* These codes cannot be generated from the keyboard.
** This code is generated by 620 hardware only.

.46 Output to Visual Display Device

Model 6210 Display Unit —

Output medium: . . . . . cathode ray tube; displays white characters against black background.

Character set: . . . . . 64 characters: digits, upper-case letters, punctuation marks, and special symbols; see Table I.

Character size: . . . . . nominally 0.09 inch wide and 0.12 inch high.

Display size: . . . . . display field is 7.5 inches by 9.5 inches; CRT may be positioned vertically or horizontally.

Characters per line: . . . . . 52 with vertical display; 64 or 84 (optional) with horizontal display.

Lines per display: . . . . . 40 with vertical display; 32 with horizontal display.

Characters per display: . . . . . 768.

Buffer capacity: . . . . . 781.

Format control: . . . . . optional horizontal or vertical tabbing; flexible cursor movement controls; see Paragraph .15, Editing Facilities.

Rated output speed: . . . . . up to 300 char/sec over a voice-band line.

Effective output speed: . . . . . limited by transmission speed, turnaround time, block length, etc.

Comments: . . . . . character size and tilt are adjustable.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors: . . . . . no checking except for visual verification of displayed data. Errors are corrected by repositioning the cursor and rekeying the data.

.52 Data Transmission Errors

Type of checking: . . . . . character parity; longitudinal parity is optional at no extra cost.
Error indication: . . . . . error character is replaced with a special character; see Table I.
Correction procedure: . . . . . manually clear displayed message and request retransmission. Automatic retransmission when operating with an IBM System 360 computer.

.53 Data Recording Errors: . . . . . no checking except for visual verification of displayed data.

.55 Line Malfunctions: . . . . . no special provisions for checking.

.6 CONDITION INDICATORS: . . . . . a minimum of indicators are provided in a 620 system. Three yellow indicators centered directly above the keyboard indicate (when lighted) the operating mode; i.e., Type mode, Format Type mode, or Conversation mode. A red indicator adjacent to the yellow indicators indicates Power on/off.

.7 DATA TRANSMISSION

The 620 Data Display System can be arranged for non-polling or polling operations; see Paragraphs .73 and .74. The primary difference between the two arrangements is that the Display Unit initiates all communications in the non-polling arrangement, while the remote computer initiates all communications in the polling arrangement.

.71 Basic Characteristics

Rated transmission speed —

Asynchronous: . . . . . 110, 1000, 1200, or 1800 bits/sec.
Synchronous: . . . . . 2000 or 2400 bits/sec.
Transmission method: . . . . . serial by bit.
Transmission code: . . . . . 7-level USASCII plus an added parity bit; see Table I. A total of 8 bits are transmitted synchronously, or 10 or 11 bits asynchronously.
Transmission mode: . . . . . half-duplex.
Order of bit transmission: . . . . . low-order bit (b1) is transmitted first, parity bit last.
Synchronization: . . . . . synchronous or asynchronous; start and stop bits are transmitted with each asynchronously transmitted character.

.72 Connection to Communications Lines

Communications Line or Service	Data Set*
Bell System Type 1006 Data Channel (up to 150 bits/sec):	Bell System Data Set 103F.
Western Union Class D Data Channel (up to 180 bits/sec):	Western Union 180 Baud Data Modem.
Public switched telephone network operating at the following speeds —	
110 bits/sec:	Bell System Data Phone Data Set 103A.
1200 bits/sec:	Bell System Data Phone Data Set 202C.
2000 bits/sec:	Bell System Data Phone Data Set 201A.

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

(Contd.)

.72 Connection to Communications Lines (Contd.)

Communications Line or Service	Data Set*
Common-carrier leased voice-band line operating at the following speeds —	
Up to 1200 bits/sec:	Western Union 1200 Baud Data Modem.
Up to 1800 bits/sec:	Bell System Data Set 202C or 202D.
2000 bits/sec:	Bell System Data Set 201A.
2400 bits/sec:	Bell System Data Set 201B, or Western Union 2400 Baud Data Modem.

.73 Transmission Control

Non-Polling Arrangement —
- Call initiation: . . . manual dialing over switched network; direct transmission over a dedicated line.
- Call reception: . . . capable of unattended operation.
- Functional operations: . . . carriage return, horizontal and vertical tab, etc. can be initiated by control characters; see Table I.

Polling Arrangement —
- Call initiation: . . . only when polled by remote computer; display stations cannot initiate a call.
- Call reception: . . . capable of unattended operation.
- Function operations: . . . same as non-polling arrangement.

.74 Multistation Operation

- Polling: . . . the 620 Display Terminals are individually addressable.
- Addressing: . . . Display Terminals cannot communicate directly with one another; the remote computer can selectively communicate with each terminal.

.8 PHYSICAL SPECIFICATIONS

Component	Model 620 Display Unit
Width (inches)	15.5
Depth (inches)	21.5
Height (inches)	18.5
Weight (pounds)	60
Power (KVA)	200
Voltage	115
Frequency (cps)	60
Phases	1
Temperature Range (°F.)	60 to 100
Humidity Range (%)	0 to 90
Heat (BTU/hr)	7000

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

.9 PRICE DATA

Component or Feature	Monthly Rental, $	Purchase Price, $	Monthly Maintenance, $
620 Data Display System*	180	5400	40
Synchronous I/O Control Module** (with or without LPC and ACK/NAK acknowledgement)	5	100	—
Horizontal and Vertical Tab Option	4	120	—
Format Mode Option (includes Tab Option)	19	500	—
Conversational Mode Option	10	300	—
Hard Copy Option (adapter for Teletype Model 33 or 35 RO Teleprinter)	40	1000	5
84 Character Horizontal Screen Option	3	95	—
Model 716 Serial Distributer	40	900	7
Model 731 Display Communications Buffer	250	6930	40

* The basic 620 Data Display System includes a Typewriter Style Keyboard and an Asynchronous I/O Control Module with or without LPC (longitudinal parity checking) and positive or negative (ACK/NAK) acknowledgement.

** Replaces Asynchronous I/O Control Module.

SANDERS 720 DATA DISPLAY SYSTEM

.1 GENERAL

.11 Identity: . . . . . 720 Data Display System.

.12 Manufacturer: . . . . . Sanders Associates, Inc.
Data Systems Division
95 Canal Street
Nashua, New Hampshire 03060

.13 Basic Function: . . . . . displays, via cathode ray tube, data received from a remote computer or entered via keyboard; transmits data to a remote computer over the public telephone network or leased voice-band lines.

.14 Basic Components

Name: . . . . . Model 708 Display Unit.
Function: . . . . . display of alphanumeric data.

Name: . . . . . Model 722 Typewriter Style Keyboard Unit.
Function: . . . . . provides entry of data into the buffer memory contained in the Control Unit.

Name: . . . . . Model 701 Control Unit.
Function: . . . . . provides basic control and buffer storage for Display Units.

.15 Description

The Sanders 720 Data Display System is designed to facilitate rapid exchange of data between a computer and one or more remote stations under control of a stored program in the computer. A large number of cathode ray tube (CRT) Display Units can be connected to a Control Unit, which contains the interface for the communications line. The Control Unit can also be connected directly to a computer. Each Display Unit can be located up to 1000 cable feet from the Control Unit. Several types of non-display devices, including Teletype paper tape readers and punches and Teletype Models 33 or 35 Receive-Only Printers, can also be incorporated through the use of special adapters.

The data transmission rate between a directly-connected 720 station and the computer averages about 47,500 characters per second. When the 720 is connected remotely, the transmission rate is governed by the specific communications interface and can range from 110 bits per second to 2400 bits per second. This report discusses the 720 Display System as used in a communications environment only, except where noted.

There are two communications interfaces available for the 720: asynchronous and synchronous. The asynchronous interface provides switch-selected transmission rates of 110, 1000, 1200, 1800, 2000, and 2400 bits per second; the synchronous interface provides switch-selected transmission rates of 2000 and 2400 bits per second.

The 7-level USASCII (formerly ASCII) transmission code is employed, with an eighth bit added for character parity; see Table I. When the asynchronous communications interface is used, one start bit and one or two stop bits are added to each character transmitted, resulting in a 10- or 11-bit character. Character length is eight bits with the synchronous communications interface; sync characters are transmitted whenever there is no data to be transmitted.

The Model 701 Control Unit can contain up to three 1024-character memory modules composed of magnetostrictive delay lines. Each memory module provides buffering for one, two, or four Display Units; the same number of Display Units must be attached to each memory module. The 1024 character locations contained in a memory module are divided equally among the number of attached Display Units. In addition to the memory modules, the Control Unit contains the communications interface, editing logic, character generation circuits, multiplexing logic, and control logic.

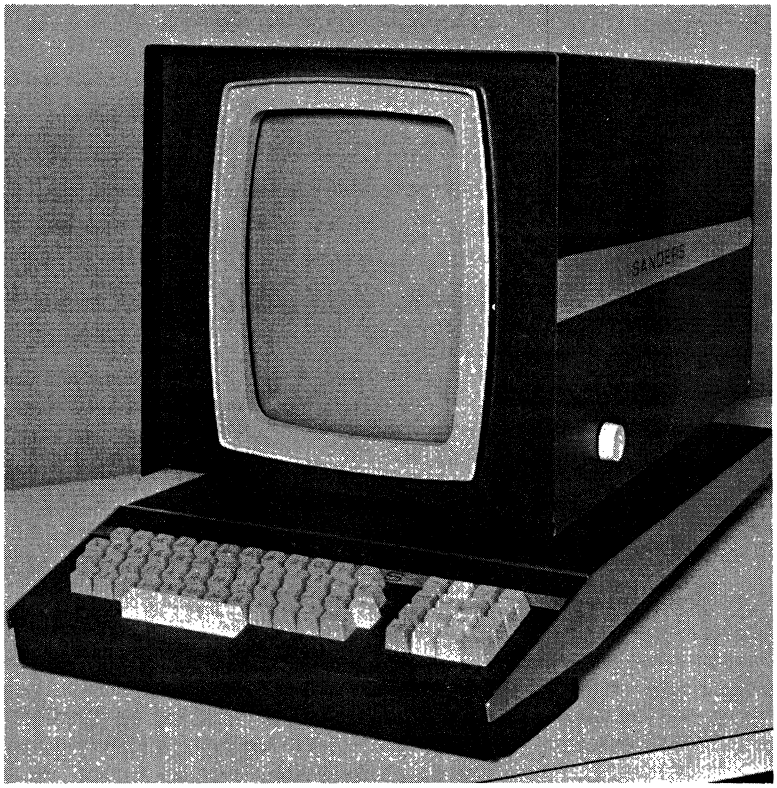


Figure 1. Sanders 720 Data Display System with Vertical Screen Orientation.

.15 Description (Contd.)

The basic Model 716 Serial Distributor can accommodate up to four Control Units and is used to interface the Control Units to a single leased line. The Serial Distributor operates in the full-duplex mode, which permits concurrent polling of one Control Unit while transmitting from another. Up to 20 Control Units can be accommodated by the Serial Distributor with the addition of Model 7180 Expansion Units; each Expansion Unit accommodates four Control Units.

The Model 708 Display Unit provides a 7.5-inch by 9.5-inch image area. Normally, the long side of the cathode ray tube (CRT) is mounted vertically so that the displayed information appears in a conventional page format. The CRT can be mounted horizontally if desired.

The image area is arranged in 49 lines of 52 characters per line when the vertical orientation is specified, or in 32 lines of 64 or 84 (optional) characters per line with the horizontal orientation. A maximum of 256, 512, or 1024 characters can be displayed on the screen, but they can be displayed in any of the more than 2000 display locations. Various control and format characters occupy positions in the buffer and therefore reduce the number of data characters that can be displayed.

The stroke technique is employed to generate the displayed characters.

Each Display Unit provides controls for adjusting focus, brightness, page size, page centering, character size, and character tilt. The character tilt control varies the displayed character from a vertical position to a slanted (italic) position.

The Model 722 or 7240 Keyboard Unit can be attached directly to a Display Unit or can be connected remotely at a distance of up to 10 cable-feet. The keyboard has 51 keys arranged in either conventional typewriter (722) or keypunch (7240) style plus an array of 16 special function keys located at the right of the keyboard. Of the 16 special function keys, 11 provide discrete control functions; the 5 remaining keys are adaptable to a variety of custom uses. Depressing a key causes the generation of a unique USASCII character or control code.

(Contd.)

Editing Facilities

The 720 Data Display System incorporates a very flexible set of edit functions. Editing operations are divided into two categories: Data Entry (Operator) Mode operations and Format (Programmer) Mode operations. Data Entry operations are controlled by a group of four keys and enable the operator to enter, manipulate, or erase data within a preset format. Format Mode operations are controlled by a group of seven keys and enable a programmer or supervisor to enter, manipulate, or erase the data formats used to structure data entered in the Data Entry Mode.

Data Entry Mode functional keys include:

- Type — permits data to be entered into the buffer memory, replacing any previous text.
- Insert — permits data to be added to an existing text. As data is entered the existing text is automatically spread to accommodate the added text.
- Delete — permits data to be erased from the existing text while closing the text to maintain continuity.
- Send Block — transmits a block of text; a block is defined as the text that is bracketed by two Home characters.

Format Mode functional keys include:

- Format Type — permits format data to be entered into the buffer memory.
- Format Insert — permits format data to be added to the existing format.
- Format Delete — permits format data to be erased from the existing format.
- Move Cursor — permits the cursor to be positioned at any location on the viewing screen.
- Clear — erases all data stored in the buffer memory segment associated with the display unit.
- Send Page — transmits the entire displayed page.
- Reset Cursor — returns the cursor to the display position of the initial character stored in the buffer memory (home position).

The newly announced Sanders Model 737 PHOTOPEN Cursor Controller can be used with a Model 708 Display Unit. This device contains a light-sensing element and outputs a signal in synchronization with the appearance of a character on the screen within the field of view (one character) of the PHOTOPEN. An outlining circle of light, projected by the light pen, identifies the field of view. The amplified output from the PHOTOPEN is used to reposition the cursor to the PHOTOPEN's present location when the Cursor button on the PHOTOPEN is depressed. The Send Block button on the PHOTOPEN initiates transmission of the block of text identified by the cursor.

Cursor Controls

Six control keys provide a high degree of cursor mobility by directing the cursor to any one of eight positions. When used with the Format Type or Format Insert functions, four of the cursor control keys place control characters (formaters) in the buffer memory. The formaters are used to structure the data entered in the Data Entry Mode, and can be erased only with the Format Delete function. The formaters include:

- Horizontal Tab/Back Tab — establishes four character spaces between segments of the displayed text for each Horizontal Tab character stored.
- Vertical Tab — establishes four line spaces following the last displayed line of text for each Vertical Tab character stored.
- Carriage Return/Back Return — establishes a single space between displayed lines with the cursor positioned at the initial character location.
- Home — establishes the initial position for a block of text; the "home" or starting position for the first block of text is always the upper left margin. (A block of text is the text that is included between two Home characters.) The Send Block key transmits the block of text that contains the cursor.

.15 Description (Contd.)

- Frontspace/Backspace — establishes a single character space forward or backward.
- Shift — provides control for dual-operation keys including the cursor control keys described above.

Other Controls

A Repeat key causes repetition of any operation associated with a simultaneously depressed key as long as both keys are depressed. Specific characters can be made to blink by entering a Start Blink (SB) control character before entering the characters to be blinked. A Clear Blink (CB) control character is entered when blinking is to be discontinued. The SB and CB control characters are located on the shifted positions of the Vertical Tab and Home keys.

731 Display Communications Buffer

The 731 Display Communications Buffer is specifically designed to interface a 720 Data Display System with an IBM System/360 and is capable of operating in a local or remote mode. In the local mode, data is transferred between the 720 system and the System/360 computer in parallel-by-bit fashion at 47,500 characters per second. Up to 192 Display Units can be directly connected to a single System/360 Multiplexor or Selector Channel. In the remote mode, data is transferred synchronously, in serial-by-bit fashion, at 2000 or 2400 bits per second. Up to 16 half-duplex lines can be connected to a 731 Buffer.

Sanders provides a software package called AUTOGRAPH that permits file maintenance functions to be performed via 720 Data Displays connected directly to an IBM System/360 computer. Sanders states that AUTOGRAPH is fully compatible with the IBM Disk Operating System (DOS/360) or Operating System/360 (OS/360). A simple mnemonic language allows an operator to insert, revise, or delete forms or records stored in any one of several libraries. Printed output of the additions or changes can be obtained via the System/360 printer or the Sanders Hard Copy Adapter.

.16 First Delivery

720 System without 731 Buffer	October 1966.
720 System with 731 Buffer	December 1967.

.17 Availability

720 System without 731 Buffer	3 months.
720 System with 731 Buffer	3 months (after initial deliveries).

.2 CONFIGURATION

A 720 Data Display System includes:

- A Model 701 Control Unit,
- Up to 12 Model 708 Display Units,
- Up to 12 Model 722 or 7240 Keyboard Units (one per Display Unit),
- Optional Model 737 PHOTOPEN Cursor Controllers (one per Display Unit),
- An optional Model 706 Hard Copy Adapter (one per Control Unit), and
- An optional Model 718 Paper Tape Reader/Punch Adapter (one per Control Unit).

Up to four Model 701 Control Units and their associated components can be connected to the same communications line via a Model 716 Serial Distributor. Up to 3 Model 7180 Expansion Units can be incorporated to expand the basic interface capability of 4 Control Units to a maximum of 20 in increments of 4.

A 701 Control Unit can contain up to three memory modules. Each memory module can service one, two, or four 708 Display Units. The same number of Display Units must be connected to each memory module.

(Contd.)

TABLE I: SANDERS 720 SYSTEM USASCII TRANSMISSION CODE

BIT POSITION				7, 6, 5							
4	3	2	1	000	001	010	011	100	101	110	111
0	0	0	0	NULL*		5 (SP)	0	@	P		
0	0	0	1	SOM *	RTS*	1	1	A	Q	CM	
0	0	1	0	EOA*	RTR*	"	2	B	R	T1	
0	0	1	1	EOM*		•	3	C	S	T2	
0	1	0	0	EOT*		$	4	D	T	I1	
0	1	0	1			%	5	E	U	I2	
0	1	1	0			&	6	F	V	D1	
0	1	1	1			(APOS)	7	G	W	D2	
1	0	0	0	FS	BS	(	8	H	X	01	
1	0	0	1	HT	BT	)	9	I	Y	02	
1	0	1	0			*	:	J	Z	INT	
1	0	1	1	VT	SB	+	;	K	C	RC	
1	1	0	0	HM	CB	(COMMA)	<	L	\		
1	1	0	1	CR	BR	-	=	M	]		
1	1	1	0			↓	>	N	↑		
1	1	1	1			/	?	O	←		
				CONTROL & OPERATION CHARACTERS		ALPHANUMERIC				EDIT & I/O FUNCTION CHARACTERS	

SB	—	Start Blink	BR	—	Back Return	0_1	— Send (output) Block
CB	—	Clear Blink	CM	—	Cursor Motion	0_2	— Send (output) Page
BS	—	Back Space	RCU	—	Reset cursor	INT	— Clear (initiate)
FS	—	Front Space	I_1	—	Insert	SOM	— Start of Message*
HT	—	Horizontal Tab	I_2	—	Format Insert	EOA	— End of Address*
BT	—	Back (horizontal) Tab	D_1	—	Delete	EOM	— End of Message*
VT	—	Vertical Tab	D_2	—	Format Delete	EOT	— End of Transmission*
HM	—	Home	T_1	—	Type	RTS	— Request to Send*
CR	—	Carriage Return	T_2	—	Format Type	RTR	— Request to Receive*

*These codes cannot be generated from the keyboard.

A memory module provides 1024 character display positions when servicing a single Display Unit. When servicing two or four Display Units, a memory module provides 512 or 256 character positions per Display Unit, respectively.

One Keyboard Unit can be connected to each Display Unit. The Keyboard Unit can be attached to the Display Unit or located up to 10 feet away from it.

The Model 718 Paper Tape Reader/Punch Adapter permits connection of up to three Teletype Model CX Paper Tape Readers and one Teletype Model DRPE Paper Tape Punch.

.3 INPUT

.31 Prepared Input

Teletype Model CX Reader —

Input medium:	1-inch-wide punched paper tape; chad or chadless.
Input code:	7-level USASCII plus character parity (8 bits); see Table I.
Quantity of data:	up to maximum size of associated buffer segment.

.31 Prepared Input (Contd.)

Rated input speed:	105 char/sec.
Effective speed:	limited by transmission speed, turnaround time, etc.
Comments:	requires a Model 718 Adapter; CX Reader must be obtained directly from Teletype Corporation.

.32 Manual Input

Model 722 Typewriter Style Keyboard;
Model 7240 Keypunch Style Keyboard —

Method of entry:	via 51-key keyboard; an additional set of 16 keys (grouped separately) is provided for editing.
Quantity of data:	up to 1024, 512, or 256 characters, depending on number of displays connected to a single memory module.
Character set:	64 characters, including digits, uppercase letters, and special symbols.
Comments:	16 keys control edit operations only and do not produce a displayable symbol.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration

The basic format for messages transmitted to or from a 720 terminal operating in a non-polled environment is as follows: SOM, A0, A1, A2, EOA, Text, and EOM. The A0 character is a control unit address; A1 is a memory buffer address; A2 is a display unit address. The control characters are defined in Table I.

When operating in a polled environment, the 720 System responds to a request-to-send poll, received from the remote computer, by replying with the requested message (SOM, A0, A1, A2, EOA, Text, EOM, EOT, EOT) or by replying with a no-message response (SOM, A0, A1, A2, EOA, EOT, EOT). The 720 System does not reply to the request-to-receive poll that is used to select a display unit for receiving a message from the computer.

The message format for the request-to-send poll is SOM, A0, A1, A2, EOA, RTS, EOM, EOM. The message format for the Request-to-receive poll is the same except that RTS is replaced by RTR and the message, and the two EOM characters are replaced by EOT characters.

Sanders states that a message format identical with the IBM 2260 message format is available at no extra cost. Changing from the Sanders standard message format to the IBM-compatible message format is easily accomplished by replacing the standard I/O control module in the Model 701 Control Unit with an IBM-compatible I/O control module.

A request-to-send poll can be issued to a specific control unit, memory buffer, or display unit. When a request-to-send poll contains only the address of a control unit or the address of a control unit and memory buffer, the 720 System replies to the request-to-send poll with up to 12 sequential messages (one message from each display unit associated with the addressed Control Unit) or up to 4 sequential messages (one message from each display unit associated with the addressed buffer memory). Each sequential message is preceded by an A0, A1, A2 address header and terminated with an EOM character.

The size of the text portion of a transmitted or received message is variable, and is limited only by the buffer segment associated with the specific display device.

Careful coordination is required when transmitting information between a display unit and the computer; there are no interlocks to prevent the operator from interfering with a message being received from the computer or to prevent a computer message from interfering with message composition by the operator.

(Contd.)

.36 Operating Procedure

A message to be transmitted from a 720 Data Display System is composed by depressing the Clear key to clear the screen and position the cursor at the upper left corner of the screen (first position in memory), and then keying in the data. Controls are provided to space the cursor forward or backward one or four positions at a time, to move the cursor to the beginning of the next line or back to the end of the previous line, or to space the cursor down the page, four line spaces at a time. Other controls allow data to be inserted or deleted. The cursor can also be positioned by pointing the optional PHOTOPEN at the desired cursor position on the display screen.

To transmit a portion of the displayed message (i.e., a single block of text), the operator depresses the Send Block key, which transmits only that block of text containing the cursor. A block is defined as a group of text characters bracketed by Home characters. To transmit all the displayed data, the operator simply depresses the Send Page key. If a transmission error is detected at the remote computer, a retransmission can be requested only when operating with a System/360 computer.

.37 Entry of Time and Date: . . . . . no provision.

.3 OUTPUT

.41 Output to Punched Tape

Teletype DRPE Punch —

Tape size:	1-inch.
Tape code:	7-level USASCII including character parity (8 bits); see Table I.
Rated punching speed:	105 char/sec.
Effective speed:	limited by transmission speed, turnaround time, etc.
Format control:	none.
Comments:	requires a Model 718 Adapter. DRPE Punch must be obtained directly from Teletype Corp.

.44 Output to Printer

Teletype Model 33 or 35 Receive-Only (RO) sets can be used for printed output at 10 characters per second. Each RO requires a Hard Copy Adapter. The Teletype equipment is fully described in Reports 6804 and 6805. See Paragraph .2, Configuration, for the rules governing the number of RO sets that can be connected.

.46 Output to Visual Display Device

Model 708 Display Unit —

Output medium:	cathode ray tube; displays white characters against black background.
Character set:	64 characters: digits, upper-case letters, punctuation marks, and special symbols; see Table I.
Character size:	nominally 0.09 inch wide and 0.12 inch high.
Display size:	display field is 7.5 inches by 9.5 inches; CRT may be positioned vertically or horizontally.
Characters per line:	52 with vertical display; 64 or 84 (optional) with horizontal display.
Lines per display:	40 with vertical display; 32 with horizontal display.
Characters per display:	1024, 512, or 256, depending on the number of Display Units connected to the Control Unit.
Buffer capacity:	1024 characters per memory module; up to three memory modules can be incorporated in one Control Unt.
Format control:	horizontal or vertical tabbing; very flexible cursor movement controls; see Paragraph .15, Editing Facilities.

.46 Output to Visual Display Device (Contd.)

Rated output speed:	47,500 char/sec when connected directly to a computer; up to 300 char/sec over a voice-band line.
Effective output speed:	limited by transmission speed, turnaround time, block length, etc.
Comments:	character size and tilt are adjustable.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors:	no checking except for visual verification of displayed data. Errors are corrected by repositioning the cursor and rekeying the data.

.52 Data Transmission Errors

Type of checking:	character parity; longitudinal parity is optional at no extra cost.
Error indication:	error character is replaced with question mark character.
Correction procedure:	manually clear displayed message and request retransmission. Automatic retransmission when operating with an IBM System 360 computer.
.53 Data Recording Errors:	no checking except for visual verification of displayed data.
.55 Line Malfunctions:	no special provisions for checking.
.6 CONDITION INDICATORS:	a minimum of indicators are provided in a 720 system. Three yellow indicators centered directly above the keyboard indicate (when lighted) that the cursor is located directly on an HM control character, a CR control character, or an HT character. The cursor does not appear on the viewing screen under these conditions.

.7 DATA TRANSMISSION

The 720 Data Display System can be arranged for non-polling or polling operations; see Paragraphs .73 and .74. The primary difference between the two arrangements is that the Display Unit initiates all communications in the non-polling arrangement, while the remote computer initiates all communications in the polling arrangement. The Control Unit performs a scan of associated devices when it receives a request in the polling mode. The computer can request the Control Unit to scan all Display Units, Display Units associated with a specific buffer memory, or a specific Display Unit.

.71 Basic Characteristics

Rated transmission speed —

Asynchronous:	100, 1000, 1200, 1800, 2000, or 2400 bits/sec.
Synchronous:	2000 or 2400 bits/sec.
Transmission method:	serial by bit.
Transmission code:	7-level USASCII plus an added parity bit; see Table I. A total of 8 bits are transmitted synchronously, or 10 or 11 bits asynchronously.
Transmission mode:	half-duplex.
Order of bit transmission:	low-order bit is transmitted first, parity bit last.
Synchronization:	synchronous or asynchronous; start and stop bits are transmitted with each asynchronously transmitted character.

(Contd.)

.72 Connection to Communications Lines

Communications Line or Service	Data Set*
Bell System Schedule 3A Data Channel (up to 300 bits/sec):	Bell System Data Set 103F.
Western Union Class D Data Channel (up to 180 bits/sec):	Western Union 180 Baud Data Modem.
Public switched telephone network operating at the following speeds —	
110 bits/sec:	Bell System Data Phone Data Set 103A.
1200 bits/sec:	Bell System Data Phone Data Set 202C.
2000 bits/sec:	Bell System Data Phone Data Set 201A.
Common-carrier leased voice-band line operating at the following speeds —	
Up to 1200 bits/sec:	Western Union 1200 Baud Data Modem.
Up to 1800 bits/sec:	Bell System Data Set 202C or 202D.
2000 bits/sec:	Bell System Data Set 201A.
2400 bits/sec:	Bell System Data Set 201B, or Western Union 2400 Baud Data Modem.

.73 Transmission Control

Non-Polling Arrangement —	
Call initiation:	manual dialing over switched network; direct transmission over a dedicated line.
Call reception:	capable of unattended operation.
Functional operations:	carriage return, horizontal and vertical tab, blink, etc. can be initiated by control characters; see table I.
Call initiation:	only when polled by remote computer; display stations cannot initiate a call.
Call reception:	capable of unattended operation.
Function operations:	same as non-polling arrangement.

.74 Multistation Operation

Polling:	the 708 Display Units are individually addressable; units can be polled individually or in groups of four, or all units can be polled for messages.
Addressing:	Display Units cannot communicate directly with one another; the remote computer can selectively communicate with each terminal.

.8 PHYSICAL SPECIFICATIONS

Component	Model 708 Display Unit	Model 701 Control Unit
Width (inches)	15.5	19
Depth (inches)	21.5	17
Height (inches)	18.5	14
Weight (pounds)	60	50
Power (KVA)	200	150
Voltage	115	115
Frequency (cps)	60	60
Phases	1	1
Temperature Range (°F.)	60 to 100	60 to 100
Humidity Range (%)	0 to 90	0 to 90
Heat (BTU/hr)	?	?

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

.9 PRICE DATA

Component or Feature	Monthly Rental, $	Purchase Price, $	Monthly Maintenance, $
Model 701 Control Unit* with one memory module	238	6,000	50
Model 701 Control Unit* with two memory modules	293	7,500	50
Model 701 Control Unit* with three memory modules	339	9,000	50
Model 716 Serial Distribution	40	900	7
Model 7180 Expansion Unit	9	270	NC
Model 708 Display Unit	100	2,550	35
Model 722 Typewriter Style Keyboard	20	475	NC
134 characters per line (horizontal orientation only)	3	95	NC
Model 7240 Keypunch Style Keyboard	25	650	NC
Model 737 PHOTOPEN Cursor Controller	POR	POR	—
Model 718 Paper Tape Reader/Punch Adapter (for Teletype CX or DRPE paper tape equipment)	POR	POR	—
Model 706 Hard Copy Adapter	POR	POR	—
Model 731 Display Communications Buffer	POR	POR	—
Model 713D Control** Unit Cabinet	37	950	NC

NC — No Charge.

POR — Price on Request.

* The Model 701 Control Unit price includes the communications interface.

** Two models of the 713D Control Unit Cabinet are available: Model 713 D-1 can house one 701 Control Unit plus power supply; Model 713 D-2 is capable of containing two 701 Control Units plus a power supply.

SANGAMO DATA STATION

.1 GENERAL

.11 Identity: . . . . . DS-7300 and DS-9300 Data Stations.

.12 Manufacturer: . . . . . Sangamo Electric Company
P.O. Box 359
Springfield, Illinois 62705

.13 Basic Function: . . . . . transmission and reception of data over a voice-band line; input is from magnetic tape recorded in a 7-channel or 9-channel IBM compatible format; source tape can be recorded and verified via keyboard.

.15 Description

Sangamo is one of the more recent manufacturers to enter the keyboard-to-magnetic-tape market. Its two initial entries are the Model 7100 and 9100 Data Stations, the first members of two proposed product lines that are to functionally correspond to the Mohawk and Honeywell keyboard-to-magnetic tape product lines. Sangamo has also started production on the 7200 and 9200 Poolers and the 7300 and 9300 Communication Terminals. The Sangamo Data Stations are designed to reduce or eliminate the need for punched cards as an input medium for computer installations. The 7000 Series Data Stations record data entered from a keyboard directly on seven-track magnetic tape in a format compatible with IBM 729 Series Magnetic Tape Units; the 9000 Series record in a nine-track format compatible with IBM 2400 Series Magnetic Tape Units. The units used to record data can also be used to verify previously recorded records. The Data Stations provide the same general facilities for preparation and verification of magnetic tape records that a conventional keypunch and verifier provide for punched cards, plus some specialized capabilities.

A magnetic core buffer, a central component of the Data Stations, holds the keyed-in data or data received from a communications line (7300 and 9300 only) where recording and the record to be checked when verifying. The core storage unit provides ease and flexibility of preparing, verifying, and searching magnetic tape records and permits storing a program to define the tape record format and to automatically initiate certain operations.

The basic core storage unit contained in the 7000 Series provides 100-character positions; manual control is provided to permit selection of 80- or 100-character record lengths. With options, the 7000 Series core capacity can be increased to 120 or up to 240 positions. Manual selection of 80, 100, or 120 character records is provided for the 120 position option. Manual selection of from 20- to 240-character records in increments of 20 character positions is provided with the 240-position option.

The basic core storage unit contained in the 9000 Series provides 120-character positions; manual control is provided to permit selection of 80-, 100-, or 120-character record lengths. As an option, the 9000 Series core capacity can be increased to 240 positions with provision for manual selection of from 20- to 240-character records in increments of 20 character positions.

The program storage area contains four bits of storage for each character position of the record; the fourth bit is used to control auxiliary devices. Its function is similar to that of a program card in keypunch units. Codes stored in the bits are used to delimit fields within a record and to define operations such as automatic duplication or verification of common information, automatic skipping, and alphabetic (lower) or numeric (upper) shift. The field definition allows fields to be skipped out, either in their entirety or after they have been partially filled with data. The other program functions relieve the operator of the necessity of depressing keys for the related functions. The Alternate Program feature provides additional bits for each character position to allow two different record formats to be defined.

Figure 1. The Sangamo Data Station

.15 Description (Contd.)

The Program switch is used to select which of the two programs is to be active at the beginning of each record. Program memory is loaded from the keyboard. A feature allowing program data to be read from a magnetic tape is expected to be announced this year.

There are five principal modes of operation for all Data Stations; two additional modes are incorporated in the 7300 and 9300 to be used for data communications. The five principal modes, as selected by the operator, are Data Entry, Data Verify, Search, Program Entry, and Program Verify. In addition to these principal operating modes, the 7300 and 9300 incorporate Send and Receive modes for data communication.

Data is recorded on magnetic tape in the Data Entry mode. Data entered via the keyboard is stored in the core storage unit. Fixed data can be automatically retained from record to record. When a complete record has been assembled, the recording action can be initiated automatically or manually.

Data is written on the tape along with the character parity bits and the longitudinal parity check character. The tape is then automatically backspaced and read, and the recorded data is compared bit for bit with the data stored in memory. The recorded character parity bits and the longitudinal check character are also checked. The keyboard is locked for approximately 120 milliseconds during the checking operation.

A magnetic tape previously recorded on a Data Station can be checked in the Data Verify mode. A record is read into the unit's data storage area. Duplicate information in a series of records can be verified automatically as specified by the program. The operator can also initiate automatic verification of a duplicate data field by depressing the Dup key. Character and longitudinal parity are checked as the record is read in.

If a discrepancy is detected while data is being keyed in to verify a tape record, the keyboard is locked and the operator is alerted by an indicator lamp and an adjustable audible alarm. The operator can determine whether there is an error in the tape record by making repeated attempts to key in the character or by observing the one-character data display; all characters are displayed as real symbols. Corrections are easily made by depressing the Correction key and then keying the correct character. After completing the verification and correction of a record containing errors the operator depresses the Home key to verify the same record or the Override key to go on to the next record. The verified record is written on tape, backspaced, and checked as when recording.

In the Search mode, a particular record can be located on the tape if it contains a unique identifying code or field. The identifying data is keyed into memory in the same position it occupies in the record. The tape halts when a match is found or when blank tape is encountered. The Search mode can be used to locate the beginning point of an interrupted recording or verifying operation, or to locate a specific record for modification or correction.

The basic or alternate program is entered via keyboard in the designated program storage area of the core buffer when the Data Station is placed in the Program Entry mode. A previously entered program is checked in the Program Verify mode by rekeying the program in sequence to the stored program. A verify error occurs when the key just depressed does not compare with the corresponding program character in the core buffer.

A 47-key keyboard, arranged in a conventional keypunch style, is incorporated in the 7000 Series Data Stations; a 64-key keyboard is available as an option. The 9000 Series incorporates a 64-key keypunch-style keyboard. An option available for the 64-key keyboard permits manual lockout of all upper case special characters.

The remainder of this report is devoted to describing the data communications aspect of the Data Stations equipped with a communications interface. See AUERBACH Data Handling Reports for a detailed analysis of the other members of the Data Station family that are used for input preparation.

Data Station Models 7300 and 9300 are designed to provide buffered, synchronous communications in a half-duplex mode with a remote 7300 or 9300 Data Station over the public telephone network at 1200 or 2000 (optional) bits per second, or over a leased voice-band line at 1600 or 2400 (optional) bits per second. The higher speeds of 2000 and 2400 bits per second require an optional communications interface. Data transfer between terminals is under control of the program stored in the sending and receiving buffers.

The Model 7300 Data Station translates its internal six-bit BCD code to one of two specific transmission codes. Buffer positions designated as numeric positions by the stored program are translated to a four-bit transmission code; alphabetic buffer positions are translated to an eight-bit transmission code. Table I shows the relationship between the numeric internal code and the transmission code. Alphabetic characters are encoded as follows:

Internal Code:	1 2 4 8 A B
Transmission Code:	1 2 $\overline{2}$ 4 8 A $\overline{A}$ B

The barred numbers indicate the complement of the preceding bit.

The numeric and alphabetic transmission codes permit a limited means for checking character validity. The stored program at the receiving terminal designates specific buffer positions as numeric or alphabetic codes. If an alphabetic character is received in a position programmed for a numeric character, a character error results. A numeric character received in a position programmed for an alphabetic character does not cause a character error.

The Model 9300 Data Station performs translation from its internal eight-bit EBCDIC code to the six-bit BCD code as the first step prior to transmitting the data. The six-bit code is then modified to the transmission code using the same procedure as the Model 7300. Because both the 7300 and 9300 produce the same transmission code; the two terminals can intercommunicate.

TABLE I: SANGAMO NUMERIC TRANSMISSION CODE

Numeric to be Transmitted	Representation in Buffer and on Magnetic Tape*	Transmission Code
	B A 8 4 2 1	8 4 2 1
0	0 0 1 0 1 0	1 0 1 0
1	0 0 0 0 0 1	0 0 0 1
2	0 0 0 0 1 0	0 0 1 0
3	0 0 0 0 1 1	0 0 1 1
4	0 0 0 1 0 0	0 1 0 0
5	0 0 0 1 0 1	0 1 0 1
6	0 0 0 1 1 0	0 1 1 0
7	0 0 0 1 1 1	0 1 1 1
8	0 0 1 0 0 0	1 0 0 0
9	0 0 1 0 0 1	1 0 0 1

*Each numeric includes a parity bit which accompanies the numeric when recorded on tape or in the buffer.

.15 Description (Contd.)

Although 256 character codes can be generated by the Model 9300 keyboard by using the Multiple Code key, the 9300 translator is designed to translate only those codes included in the basic 64-character set employed by the Model 7300. Sangamo states that at present it has not resolved the problem of what it intends to do with EBCDIC codes external to the basic 64-character set. There are several alternates to be considered; some of the more obvious of these are: (1) non-translated EBCDIC codes can be ignored, (2) the terminal can be halted and the operator alerted, (3) a case shift character can precede the codes, (4) the 256 character set can be folded into the 64 character set with resulting ambiquities.

The modified BCD transmission code is shown in Table II.

The recorded and verified data is transmitted to the receiving terminal by placing the sending and receiving terminals in the Send and Receive mode, respectively. Both operations are discussed in the following paragraphs.

Data is recorded in fixed-length records as specified by the manual switch settings. Transmission record size can vary from a single character up to the capacity of the buffer as determined by the send and receive programs. A record can contain as many as 240 characters when the available buffer options are employed at both the sending and receiving terminals.

Before a record is transmitted, the sending terminal reads the record from the tape, checks each character read for correct parity, and loads the entire record into the core buffer. Transmission begins when the core buffer contains the complete record and a ready status is received from the receiving terminal. Each character read from the core buffer during transmission is translated to a four-bit or eight-bit character, serialized, and transmitted to the receiving terminal. In addition to the transmitted data, a modulo four block count is inserted to identify the record sequence.

The receiving terminal performs a validity check on each received character, translates the four- or eight-bit character to the internal code, and stores each of the translated characters in the core buffer. In addition to the validity check performed on each character, the receiving terminal performs a modulo four block-count check and a longitudinal parity check (modulo 64 count of all ones in the text portion of each record). After each character of the record has been correctly received (i.e., no transmission or programming errors), the record is written on tape and the recorded data is checked for data recording errors.

TABLE II. SANGAMO BCD TRANSMISSION CODE

Symbol	Bit Position								Symbol	Bit Position							
	B	$\overline{A}$	A	8	4	$\overline{2}$	2	1		B	$\overline{A}$	A	8	4	$\overline{2}$	2	1
A	1	0	1	0	0	1	0	1	&	1	0	1	0	0	1	0	0
B	1	0	1	0	0	0	1	0	≠	0	0	1	1	0	0	1	0
C	1	0	1	0	0	0	1	1	<	1	0	1	1	1	1	0	0
D	1	0	1	0	1	1	0	0	>	0	0	1	1	1	0	1	0
E	1	0	1	0	1	1	0	1	=	0	1	0	1	1	0	1	0
F	1	0	1	0	1	0	1	0	-	1	1	0	0	0	1	0	0
G	1	0	1	0	1	0	1	1	+	1	0	1	1	1	0	1	0
H	1	0	1	1	0	1	0	0	!	1	1	0	1	0	0	1	0
I	1	0	1	1	0	1	0	1	?	0	0	1	1	1	0	1	1
J	1	1	0	0	0	1	0	1	.	1	0	1	1	0	0	1	1
K	1	1	0	0	0	0	1	0	,	0	0	1	1	0	0	1	1
L	1	1	0	0	0	0	1	1	;	1	1	0	1	1	0	1	0
M	1	1	0	0	1	1	0	0	)	1	1	0	1	1	1	0	1
N	1	1	0	0	1	1	0	1	(	1	0	1	1	1	1	0	1
O	1	1	0	0	1	0	1	0	$	1	1	0	1	0	0	1	1
P	1	1	0	0	1	0	1	1	¢	1	0	1	1	0	0	1	0
Q	1	1	0	1	0	1	0	0	%	0	0	1	1	1	1	0	0
R	1	1	0	1	0	1	0	1	#	0	1	0	1	0	0	1	1
S	0	0	1	0	0	0	1	0	@	0	1	0	1	1	1	0	0
T	0	0	1	0	0	0	1	1	/	0	0	1	0	0	1	0	1
U	0	0	1	0	1	1	0	0	¬	1	1	0	1	1	0	1	1
V	0	0	1	0	1	1	0	1	*	1	1	0	1	1	1	0	0
W	0	0	1	0	1	0	1	0	1	1	0	1	1	1	0	1	1
X	0	0	1	0	1	0	1	1	'	0	1	0	1	1	1	0	1
Y	0	0	1	1	0	1	0	0	"	0	1	0	1	1	0	1	1
Z	0	0	1	1	0	1	0	1	—	0	0	1	1	1	1	0	1
									Space	0	0	1	0	0	1	0	0

An auxiliary or second buffer is used for retransmitting a record received in error (when the terminal is operating in the transmit mode) and for receiving a record directly from the communications line (when the terminal is operating in the receive mode). When transmitting, the auxiliary buffer is loaded with the record just transmitted in anticipation of a request for retransmission. Concurrent with this operation, the next record to be transmitted is read from tape and stored in the primary buffer. A record received from the communications facility by the receiving terminal is initially checked for the anticipated block count and stored in the auxiliary buffer. The record stored in the auxiliary buffer is then transferred to the primary buffer, checked for character validity and longitudinal parity, and written on tape. Concurrently with the tape write operation, the next record is received and stored in the auxiliary buffer. After each record is written on tape, the tape is backspaced to the beginning of the record, read forward and a bit-for-bit comparison to the data stored in the primary buffer is performed.

Error signaling in response to incorrect message codes or data transmission errors is performed via the reverse-channel technique. The inherent value of this technique is that it eliminates the time required for line turn-around to allow the receiver to transmit an acknowledge code. Reverse-channel signaling occurs at interrecord intervals only.

.16 First Delivery: . . . . . April 1969.

.17 Availability: . . . . . 8 months.

.2 CONFIGURATION

The Model 7300 and 9300 Data Stations include:

- A magnetic tape drive compatible with IBM 729 Series units (7300) or IBM 2400 Series units (9300),
- A magnetic core buffer,
- A keyboard for entering data, and
- A communications interface.

A data set is required to connect either Data Station to a communications line.

.3 INPUT

.31 Prepared Input

DS-7000 Series Magnetic Tape Drive —

Input medium:	0.5-inch magnetic tape recorded at 556 bits/inch; 200 or 800 bit/inch densities are optional; compatible with IBM 729 Series tape format.
Input code:	6-bit BCD (even parity) or binary (odd parity); see Table III.
Quantity of data:	80 or 100 characters; optionally up to 240 characters in 20-character increments.
Character set:	64 characters; alphanumerics plus special and record format characters.
Rated input speed:	16,680 char/sec (556 bits/inch), 6000 char/sec (200 bits/inch), 24,000 char/sec (800 bits/inch).
Effective speed:	limited by block length and transmission speed; see also Table IV.
Comments:	maximum reel size permitted is seven inches.

DS-9000-Series Magnetic Tape Drive —

Input medium:	0.5-inch magnetic tape recorded at 800 bits/inch; compatible with IBM 2400 Series tape format.
Input code:	8-level EBCDIC code plus odd parity; see Table III.
Quantity of data:	80, 100, or 120 characters; optional record lengths can be switch selected in 20-character increments from 80 to 240 characters.
Character set:	256 characters.
Rated input speed:	24,000 char/sec.
Effective speed:	limited by block length and transmission speed; see also Table IV.
Comments:	maximum reel size permitted is seven inches.

.32 Manual Input

Keyboard (with all Data Stations) —

Method of entry:	49-key keyboard.
Quantity of data:	up to capacity of buffer.
Character set:	64 characters; 26 alpha, 10 numeric, and 27 special.
Comments:	256 code combinations can be produced when the Multiple Code Key is used; keyboard data is entered on tape via the core buffer.

.33 Fixed Input: ..... a data field can be entered into the buffer and automatically or manually duplicated in all subsequent records.

.34 Transaction Code Input: ..... no provisions.

TABLE III: SANGAMO 9000 SERIES TAPE CODE

Char.	Hexa-Decimal Code	Char.	Hexa-Decimal Code	Char.	Hexa-Decimal Code
A	C1	V	E5	!	4F
B	C2	W	E6	&	50
C	C3	X	E7	[	5A
D	C4	Y	E8	$	5B
E	C5	Z	E9	*	5C
F	C6	0	F0	)	5D
G	C7	1	F1	;	5E
H	C8	2	F2	^	5F
I	C9	3	F3	-	60
J	D1	4	F4	/	61
K	D2	5	F5	,	6B
L	D3	6	F6	%	6C
M	D4	7	F7	_	6D
N	D5	8	F8	>	6E
O	D6	9	F9	?	6F
P	D7	Space	40	:	7A
Q	D8	]	4A	#	7B
R	D9	.	4B	@	7C
S	E2	<	4C	'	7D
T	E3	(	4D	=	7E
U	E4	+	4E	"	7F
				MC	00

TABLE IV: SANGAMO 7300 AND 9300 EFFECTIVE BLOCK TRANSMISSION RATES*

Record Length, characters	Effective Transmission Rate, records/min, at a Transmission Speed of			
	1200 bps	1600 bps	2000 bps	2400 bps
80	95	124	150	176
100	78	102	125	147
180	47	62	77	90
240	35	46	57	68

*Sangamo states that these rates can be attained under the following conditions: all alphabetic data; propagation delay of 15 milliseconds; single-bit error rate of 1 in 10^5 bits. The effect of retransmission due to the specified error rate is included.

.35 Message Configurations: . . . . . messages are transmitted in fixed-length records as specified by program; record size can be from one character up to size of buffer. Fields within a record can be skipped and not transmitted. All messages are preceded by idle characters (used to synchronize transmission) and a Start-of-Message characters that incorporates a modulo four block count. Records are terminated with an End-of-Record character repeated three times.

.36 Operating Procedure

Before transmitting a message, predetermined programs and time of transmission should be established between the communicating terminals. Programs cannot be loaded from tape and, therefore, must be entered manually from the keyboard. The sequence of operations in preparing to transmit is:

(1) Load program into memory.

(2) Mount tape reel.

(3) Set control switches on operator panel.

(4) Establish connection by dialing or manually signaling.

(5) Depress Data key on data set.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.43 Output to Magnetic Tape

DS-7000 Series Magnetic Tape Drive —

Tape size:	0.5-inch magnetic tape recorded at 556 bits/inch; 200 or 800 bits/inch densities are optional; compatible with IBM 729 Series tape format.
Tape code:	6-bit BCD (even parity) or binary (odd parity); see Table III.
Rated output speed:	16,680 char/sec (556 bits/inch), 6000 char/sec (200 bits/inch), or 24,000 char/sec (800 bits/inch).
Effective speed:	limited by block length and transmission speed; see also Table IV.
Format control:	extensive tape format control is provided by stored program. See paragraph .15 for description.
Comments:	records are recorded in fixed length format; an 80 or 100 character record is standard; with options, record length can be switch selected in 20 character increments from 20 to 240 characters; maximum tape reel size permitted is seven inches.

DS-9000 Series Magnetic Tape Drive —

Tape size:	0.5-inch magnetic tape recorded at 800 bits/inch; compatible with IBM 2400 Series tape format.
Tape code:	8-level EBCDIC code plus odd parity; see Table III.
Rated output speed:	24,000 char/sec.
Effective speed:	limited by block length and transmission speed; see also Table IV.
Format control:	extensive tape format control is provided by stored program. See Paragraph .15 for description.
Comments:	records are recorded in fixed length format; an 80, 100, or 120 character record is standard; with options records can be switch selected in 20-character increments from 20 to 240 characters. Maximum tape reel size permitted is seven inches.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors

Type of checking:	character and longitudinal parity are checked as each record is read from tape.
Error indication:	indicator lamp is lighted; audible alarm sounds.
Correction procedure:	tape is automatically backspaced and read a second time; tape halts and operator intervention is required when a second error is detected.

.52 Data Transmission Errors

Type of checking:	character validity and longitudinal parity.
Error indication:	indicator lamp is lighted; reverse channel signal is interrupted.
Correction procedure:	automatic retransmissions continue for up to 20 seconds; after this time period, transmission halts, audible alarm sounds, and operator intervention is required.

.53 Data Recording Errors

Type of checking:	each record is re-read and checked bit for bit with the buffer contents. Character and longitudinal parity are also checked.
Error indication:	keyboard is locked, tape halts, lamp is lighted, and audible alarm is sounded.
Correction procedure:	tape is automatically backspaced and data is written a second time; operator intervention is required when error occurs a second time.

.55 Line Malfunctions

Detection:	absence of signal on reverse channel for 20 seconds.
Action:	operation halts.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	1200 or 2000 (optional) bits/sec over the public telephone network; 1600 or 2400 (optional) bits/sec over a leased voice-band line.
Transmission method:	serial by bit.
Transmission code:	modified BCD code (4 or 8 bits per character) see Paragraph .15.
Transmission mode:	half-duplex.
Order of bit transmission:	low order data bit (b1) first.
Synchronization:	synchronous; each record is preceded by idle characters.

.72 Connection to Communications Lines

Communications Lines	Data Set*
Public telephone network operating at the following speeds:	
1200 bits/sec:	Bell System Data-Phone Data Set 202C or equivalent.
2000 bits/sec:	Bell System Data-Phone Data Set 201A or equivalent.

*In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant. Bell System 202C2 and 202D2 Data Sets provide reverse-channel capability. Bell System 201A and 201B Data Sets and Western Union Data Sets do not provide reverse-channel capability, except through the use of a full-duplex line.

Common-carrier leased voice-band line operating at the following speeds:

1600 bits/sec: . . . . . Bell System Data Set 202D, Western Union 1800 Baud Data Modem or equivalent.

2400 bits/sec: . . . . . Bell System Data Set 201B, Western Union, 2400 Baud Data Modem, or equivalent.

.73 Transmission Control

Call initiation: . . . . . manual dialing or signaling.

Call reception: . . . . . operator must establish voice communication and then switch to data mode.

Functional operations: . . . . . under control of stored program; see Paragraph .15 for description.

.74 Multistation Operation: . . . . . no provision.

.8 PHYSICAL SPECIFICATIONS

Component	Sangamo DS-7000/DS-9000 Series Data Stations
Width (inches)	42
Depth (inches)	24
Height (inches)	28
Weight (pounds)	200
Power (KVA)	0.29
Voltage	115
Frequency (Hz)	60
Phases	1
Temperature Range (°F)	36 to 100
Humidity Range (%)	?
Heat (BTU/hr)	750

.9 PRICE DATA

Component or Feature	Monthly Rental, $	Purchase Price, $	Monthly Maintenance, $
Data Station Model 7300	232	9,510	32
Data Station Model 9300	255	10,310	35
Options —			
120-Character Core Memory for Model 7300	10	(2)	NC
240-Character Core (1) Memory for both Models 7300 and 9300	30	(2)	NC
High Speed Communications Interface	30	(2)	NC

(1) 120-Character Core Memory is prerequisite to this option for Model 7300.
(2) Sangamo states it has not established a purchase price for these items.
NC -- No Charge

REPORT UPDATE

NEW 72 CHARACTER-PER-SECOND SENDERS

Tally has introduced a line of three punched tape senders for parallel data transmission at 72 characters per second. The new System 120, 122, and 128 Senders are the same as the System 100, 102, and 108 Senders respectively, except for the increased data transmission rate. The recommended Tally Receiver for the System 120 and 122 Senders is the System 220; the recommended receiver for the System 128 Sender is the System 228. The prices for these units are shown in the accompanying table (next page).

PUNCHED CARD TRANSMITTING TERMINAL

Tally has also introduced a punched card sender, the System 180 Card Transmitter. This unit reads standard 80-column punched cards at 42 cards per minute. Data is translated from the Hollerith card code to a 7-level BCD transmission code which includes an odd character parity bit. Data is transmitted at 42 cards per minute (56 characters per second).

Data is transmitted in blocks. Each block contains the data from one card. A full 80 columns can be transmitted, or the program disc can be utlized to specify deletion of any portion of the card data. A customer-specified block character is automatically inserted after each card record. The transmission format is compatible with Tally parallel punched tape equipment. The recommended Tally Receiver is the System 228 Punched Tape Receiver; Tally has not announced a receiving card punch to date.

The System 180 Card Transmitter pauses momentarily after each card is read and transmitted. If an error is detected at the remote station and signaled via the reverse channel, the System 180 Transmitter halts before the next card is read, and an error indicator lamp is lighted. The operator must manually remove and reinsert the card containing the data that must be retransmitted. After reinserting the card, the operator pushes a reset button to resume transmission.

The input and output hoppers have a maximum capacity of 430 cards. Cards can be loaded or unloaded while the 180 Transmitter is operating.

The System 180 Card Transmitter operates over the public telephone network or a leased voice-band line and is compatible with the Bell System Data Set 402C.

OTHER CHANGES IN TALLY PARALLEL EQUIPMENT

- The minimum leasing period is now 24 months. Other leasing periods include 36, 40, 48, and 65 months. Complete price information, including approximate discounts for extended leases, is shown in the accompanying table.
- New options for some models include cabinet installation with tape reeling provisions, free-standing floor console, and 3000-foot tape supply provisions. The accompanying table shows the prices and applicable models.
- The Tally System 300 Sender/Receiver has been dropped from the standard product line.

TALLY PARALLEL EQUIPMENT PRICE DATA

Component or Feature	Monthly Rental,* $	Purchase Price, $	Monthly Maintenance, $
Punched Tape Senders			
60 Characters per Second:			
System 100	27.90	600	4.00
System 102	33.48	720	4.80
System 108	39.06	840	5.60
72 Characters per Second:			
System 120	33.48	720	4.80
System 122	39.06	840	5.60
System 128	44.64	960	6.40
Punched Card Sender			
System 180	167.40	3600	24.00
Punched Tape Receivers			
60 Characters per Second:			
System 200	91.37	1965	15.00
60 or 72 Characters per Second:			
System 220	136.48	2935	18.00
System 228	180.42	3880	19.00
Options			
Error Detection (System 220)	23.25	500	3.50
Floor Console (Systems 200, 220, and 228)			
3000-Foot Tape Supply** (Systems 200, 220, and 228)	17.44	375	2.50
Cabinet Installation with tape reeling (Systems 100, 102, 108, 120, 122, and 128)	16.97	365	2.44

* These rentals are based on a two-year leasing agreement. Leases are also available for 36, 40, 48 and 65 months. The approximate long-term rental rates are shown below as a percentage of the two-year rate:

36 months — 70.5 percent.
40 months — 64.5 percent.
48 months — 55.5 percent.
65 months — 43.0 percent.

The rental rates do not include maintenance.

** The Floor Console is a prerequisite for the 3000-Foot Tape Supply.

TALLY PARALLEL DATA COMMUNICATIONS EQUIPMENT

.1 GENERAL

.11 Identity: . . . . . System 100, 102, 108, 120, 122, and 128 Senders. System 200, and 228 Receivers.

.12 Manufacturer: . . . . . Tally Corporation
8301 South 180th Street
Kent, Washington 98031

.13 Basic Function: . . . . . transmission of punched tape data over a voice-band line at 60 or 72 char/sec.

.14 Basic Components

Name: . . . . . Tally Bi-directional Tape Reader.
Model number: . . . . . 424.
Function: . . . . . reads punched paper tape at up to 60 or 72 char/sec.

Name: . . . . . Tally Paper Tape Perforator.
Model number: . . . . . 420.
Function: . . . . . punches paper tape at up to 60 char/sec.

Name: . . . . . Tally Paper Tape Perforator.
Model number: . . . . . P-120.
Function: . . . . . punches paper tape at up to 120 char/sec.

.15 Description

In mid-1965 Tally Corporation renamed its line of punched paper tape data communications equipment. Whereas Tally formerly used a Mark Series designation (Mark 1A, Mark 1D, etc.), the firm now uses a System-Series designation and groups the equipment uniformly according to type of device. The Tally Systems are now grouped as follows:

Series 100 — Transmitters
Series 200 — Receivers
Series 300 — Transmitter/Receivers
Series 600 — Magnetic Tape/Paper Tape Conversion Systems
Series 800 — Paper Tape Verify/Duplicate Systems
Series 1000 — Magnetic Tape Data Terminal
Series 4000 — Magnetic Tape Data Terminal

Within the Series 100, 200, and 300 line, Tally offers two basic types of equipment, differing principally in the transmission method. The Tally Equipment which transmits or receives data in a parallel fashion is described in this report; Tally's serial transmission equipment is described in Report 6761.

The Tally Parallel Data Communications Equipment consists of a line of eight punched paper tape senders and receivers that utilize the proven Tally mechanical punched tape readers and punches. The various models operate at 60 or 72 characters per second, but differ in their capability for unattended operation and error checking. Table I contains a summary of the characteristics of the Tally Parallel Data Communications equipment, and also indicates the former Mark series designation for each device.

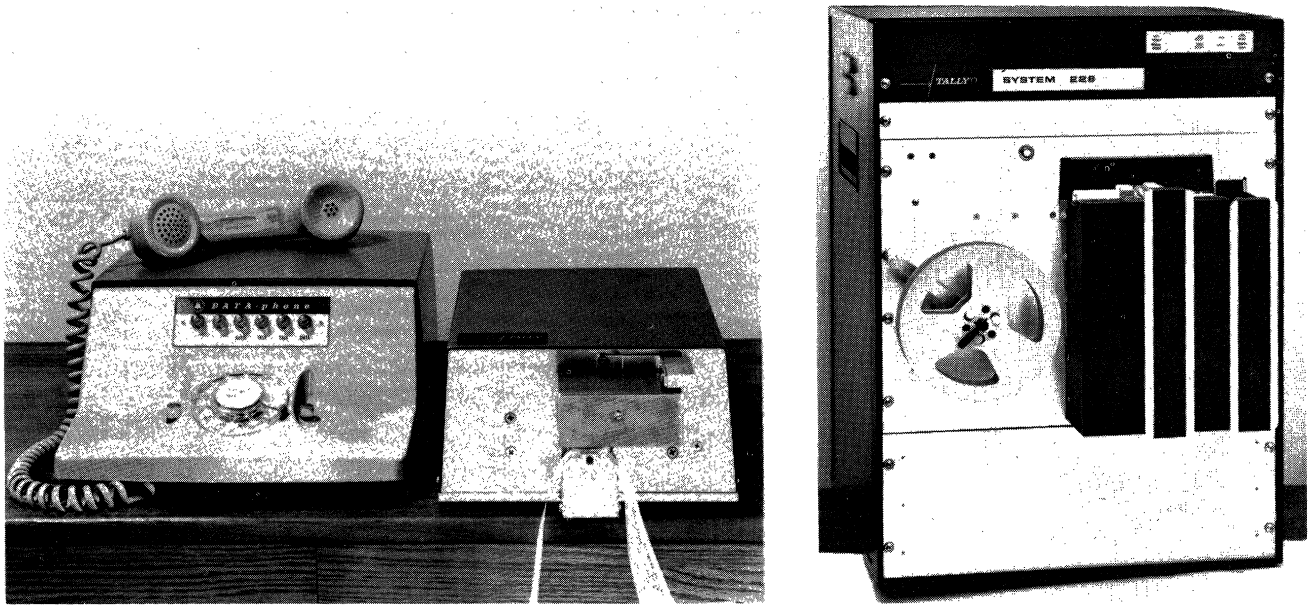


Figure 1. The Tally Series 100 Transmitter (left) and System 228 Receiver (right).

.15 Description (Contd.)

In general, all devices can intercommunicate, although some special features such as error checking and automatic retransmission are not operable with certain combinations. All of these devices operate over a voice-band line and utilize the Bell System 400 Series Data Sets or equivalent data sets where permitted. A special option in the Tally serial equipment permits the serial receivers to receive transmissions from the parallel senders at 60 or 72 characters per second; see Paragraph 6761.15.

Error-checking provisions are included only in the System 228 Receiver. The 228 Receiver can perform odd or even character parity checks on 6-, 7-, or 8-level received data codes. The 228 Receiver can also control the direction of reading of the 108 Sender via the reverse channel of the data set. Upon detection of a parity error, the 228 Receiver punches a specified flag character and controls backspacing and retransmission of the flawed data block by the 108 Sender. Parity information and blocking characters must be included in the data input to the 108 Sender if the checking feature of the 228 Receiver is to be used.

Tally states that due to their error-checking capabilities when used in combination, the System 108 and 128 Sender and 228 Receiver are the devices currently in highest demand.

Tally has discontinued the System 180 Card Transmitter. The former System 180 was rated at 42 cards per minute and translated the Hollerith card code to a 7-level BCD transmission code.

.16 First Delivery

System 100:	January 1964.
System 102:	November 1964.
Systems 108 and 228:	June 1965.
System 200:	January 1963.

.17 Availability: . . . . . 60 days for all systems.

.2 CONFIGURATION

Each device consists of a punched paper tape reader or punch, or both, and the logic necessary to perform the functions indicated in Table I. The particular Tally reader and/or punch used in each model is indicated below:

- Model 424 Tape Reader — modified version used in System 100, 102, 108, 120, 122, and 128 Sender.
- Model 420 Tape Perforator — used in the System 200 Receiver.
- Model P-120 Tape Perforator — used in the System 228 Receiver.

The standard communications facilities over which the Tally parallel equipment can operate, and the data sets required, are specified in Paragraph .72.

TABLE I: CHARACTERISTICS OF TALLY PARALLEL DATA COMMUNICATIONS EQUIPMENT

System (2)	Rated Speed	Send Unattended	Receive Unattended	Start Unattended Sender	Parity Check	Automatic Request Retransmission	Automatic Retransmission	Tape Handling	Recommended Remote Tally Terminals
100	60	No	—	—	No	—	No	Optional	200
102	60	Yes	—	—	No	—	No	Optional	228
108	60	Yes	—	—	No	—	Yes	Optional	228
120	72	No	—	—	No	—	No	Optional	228, 1021, 4031
122	72	Yes	—	—	No	—	No	Optional	228, 1021, 4031
128	72	Yes	—	—	No	—	Yes	Optional	228, 1021, 4031
200	60	—	No	No	No	No	—	Reels	100
228	72	—	Yes	Yes	Yes(1)	Yes	—	Reels	102, 108

(1) Checking is performed by receiving punch.
(2) Series 100 devices are transmitters; Series 200 devices are receivers.

.3 INPUT

.31 Prepared Input

Model 424 Tape Reader (used in Systems 100, 102, 108, 120, 122, and 128 —

Input medium:	fully-punched 11/16-, 7/8-, or 1-inch, 5-, 6-, 7-, or 8-level paper tape. Tape can be of any material, color, thickness, or opacity.
Input code:	any 5-, 6-, 7-, or 8-level code.
Quantity of data:	data blocks can be of any size except when transmitting to a parity-checking receiver; in this case, each block must contain at least 30 data characters.
Rated input speed:	60 or 72 char/sec.
Effective speed:	somewhat less than rated speed, depending on block length.
Comments:	reader uses mechanical star-wheel sensing.

.32 Manual Input: . . . . . no provision.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration: . . . . . 1 to N data characters (no control codes); 30 to N data characters followed by a customer-specified block character (System 108, 128, and 228 in parity-checking mode only).

.36 Operating Procedure

(1) Operator establishes connection with remote station and exchanges instructions with the remote operator.

(2) Both operators select Attended and Send or Receive switch positions on control panel.

(3) Receive operator presses Data button on data set.

(4) Send operator presses Data button on data set upon hearing tone.

(5) Sender and receiver are started automatically.

(6) If the sender runs out of tape, it will wait 30 seconds for possible operator intervention and then automatically terminate the call.

See Paragraph .52 for the resulting action if errors are detected by a System 228 Receiver.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.41 Output to Punched Tape

Model 420 Tape Perforator (used in System 200) —

Tape size:	standard 11/16-, 7/8, or 1-inch.
Rated punching speed:	60 char/sec.
Tape code:	any 5-, 6-, 7-, or 8-level code.
Effective speed:.	up to 60 char/sec, limited by transmission speed of sender.
Format control:.	none.

Model P-120 Tape Perforator (used in System 228) —

Tape size:	standard 11/16-, 7/8-, or 1-inch tape.
Tape code:	any 5-, 6-, 7-, or 8-level code.
Rated punching speed:	120 char/sec.
Effective speed:.	up to 72 char/sec, limited by transmission speed of sender and by data set.
Format control:.	none.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors: . . . . . no provision.

.52 Data Transmission Errors (System 228 Receiver only)

Type of checking:.	switch-selected odd or even character parity check on 6-, 7-, or 8-level codes. Parity is accumulated by sensing the movements of punch pins.
Error indication:.	in System 228, all eight holes of any character received in error are punched (Delete character), a flag character (specified by the user

.52 Data Transmission Errors (System 228 Receiver only) (Contd.)

	when system was ordered) is punched, punching halts, and the receiver signals the sender at the end of the current data block to reverse the tape to the beginning of the block and retransmit.
Correction procedure:	automatic retransmission; if error persists, receiver inhibits parity checking on the fourth transmission of the same data block.
Comments:	parity checking can be inhibited. When checking odd parity, Blank characters (no holes punched) or Delete characters (all holes punched), do not cause a parity error condition.

.53 Data Recording Errors: . . . . . no provision.

The parity checking mechanism of the 220 and 228 Receivers provides an indirect check on data recording; see Paragraph .52.

.55 Line Malfunctions

Detection:	loss of carrier tone is detected.
Action:	automatic disconnect.

.6 CONDITION INDICATORS

The various Tally devices described in this report contain a minimum of condition indicators. In general, the only visual indicators provided are visible off/on switches and lamps for indicating errors.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	60 char/sec (480 bits/sec) or 72 char/sec (576 bits/sec).
Transmission method:	parallel by 8 bits (one character); serial by character.
Transmission code:	8 bits are transmitted for each character; 5-, 6-, and 7-level codes are zero-filled.
Transmission mode:	simplex (sender or receiver).
Synchronization:	the receiver is actuated by the beginning of each transmitted data character.

.72 Connection to Communications Lines

Communications Line	Data Set*
Public switched telephone network:	Bell System Data-Phone Data Set 402C (send) and/or 402D (receive)
Bell System leased voice-band line:	Bell System Data Set 402C (send) and/or 402D (receive)

* Equivalent data sets can be used; see Section 4620 for a current list of modems available from independent manufacturers of telephone equipment, then check with your local common-carrier communications consultant. The 108 Sender and 228 Receiver require the reverse channel feature to enable automatic retransmission upon detection of an error.

.73 Transmission Control

Call initiation: . . . . . manual or unattended, depending on model; see Table I.

Call reception: . . . . . some units require an operator to establish a connection; some units are capable of unattended receiving; some units can start a remote unattended terminal; see Table I.

Functional operations: . . . . . none.

.74 Multistation Operation: . . . . . no provision.

.8 PHYSICAL SPECIFICATIONS

Component:	Senders, System	Receivers, System	
	100, 102, 108, 120, 122, and 128	200	228
Width (inches)	8.81	20	20
Depth (inches)	12.5	22	22
Height (inches)	4.81	15	27
Weight (pounds)	10	75	190
Power (KW)	0.15	0.575	
Voltage	115	115	
Frequency (Hz)	60	60	
Phases	1	1	
Temperature range (°F)	50 to 110	50 to 110	
Humidity range (%)	20 to 80	20 to 80	
Heat (BTU/hr)	392	1962	

* Options permit operation on 230-volt, 50-hertz power.

.9 PRICE DATA

Component or Feature	Monthly Rental,* $	Purchase Price, $	Monthly Maintenance, $
Punched Tape Senders			
60 Characters per Second:			
System 100	27	720	4.00
System 102	36	864	4.80
System 108	45	1008	5.60
72 Characters per Second:			
System 120	35	864	4.80
System 122	44	1008	5.60
System 128	55	1152	6.40
Punched Tape Receivers			
60 Characters per Second:			
System 200	105	2358	15.00
60 or 72 Characters per Second:			
System 228	205	5000	19.00
Options			
Floor Console (Systems 200, and 228)	10	180	—
3000-Foot Tape Supply** (Systems 200 and 228)	25	525	2.50
Cabinet Installation with tape reeling (Systems 100, 102, 108, 120, 122, and 128)	25	438	2.44

* These rentals are based on a one-year leasing agreement and include maintenance.

** The Floor Console is a prerequisite for the 3000-Foot Tape Supply.

TALLY SERIAL DATA COMMUNICATIONS EQUIPMENT

.1 GENERAL

.11	Identity:	System 111 Sender. System 211 Receiver. System 311 Sender/Receiver.
.12	Manufacturer:	Tally Corporation 8301 South 180th Street Kent, Washington 98031
.13	Basic Function:	transmission of punched tape data over a voice-band line at 120 char/sec; reception of punched tape data over a voice-band line at 120 char/sec; or both, depending on model.

.14 Basic Components

Name:	Tally Bi-directional Tape Reader.
Model number:	464A.
Function:	reads punched paper tape at up to 120 char/sec.
Name:	Tally Paper Tape Perforator.
Model number:	P-120.
Function:	punches paper tape at up to 120 char/sec.

.15 Description

The Tally Serial Data Communications Equipment includes a punched paper tape sender, a receiver, and a combination sender/receiver. Each of these units utilize the Tally Model 464 Tape Reader and/or the Tally Model P-120 Tape Perforator. Information about other data communications equipment produced by Tally can be found in Report 6760.

Each of the Tally serial devices transmits or receives data from pre-punched paper tape at 120 characters per second over a voice-band line. The characteristics of each System model are summarized in Table I. The primary difference between the various models, aside from their functional differences, is the capability of some models for error checking and automatic retransmission of data blocks containing detected errors. All models are provided with the capability for handling reels.

The System 111 Sender, 211 Receiver, and 311 Sender/Receiver have error-checking provisions similar to those implemented in the System 108 and 128 Sender and 228 Receiver in the Parallel Equipment line (see Report 6760). The 211 Receiver and 311 Sender/Receiver can optionally perform odd or even character parity checks on 6-, 7-, or 8-level (including parity) received data codes. The receiver portion of either a 211 or a 311 can also control the direction of reading by a 111 Sender or by the sending portion of a 311 Sender/Receiver via the reverse channel of the data set. Upon detection of a parity error, the receiver punches a specified flag character and controls backspacing and retransmission of the data block containing the error. The 111 Sender and 311 Sender/Receiver can optionally be equipped to generate character parity and/or blocking characters for input tapes.

All models in the Tally line of serial equipment can now be optionally equipped to transmit and receive data serially by bit at 60 characters per second in addition to the standard rate of 120 characters per second. The alternate transmission rate is switch-selected.

The parallel receive option allows manual switching to an alternate data set (Bell System 402D Data Set); the deserializing logic is also bypassed. In this mode, a Tally serial receiver or sender/receiver can receive data from a Tally parallel sender (see Report 6760) at 60 or 72 characters per second. In effect, the serial receiver acts as a parallel receiver: any error-checking and retransmission features are fully operative.

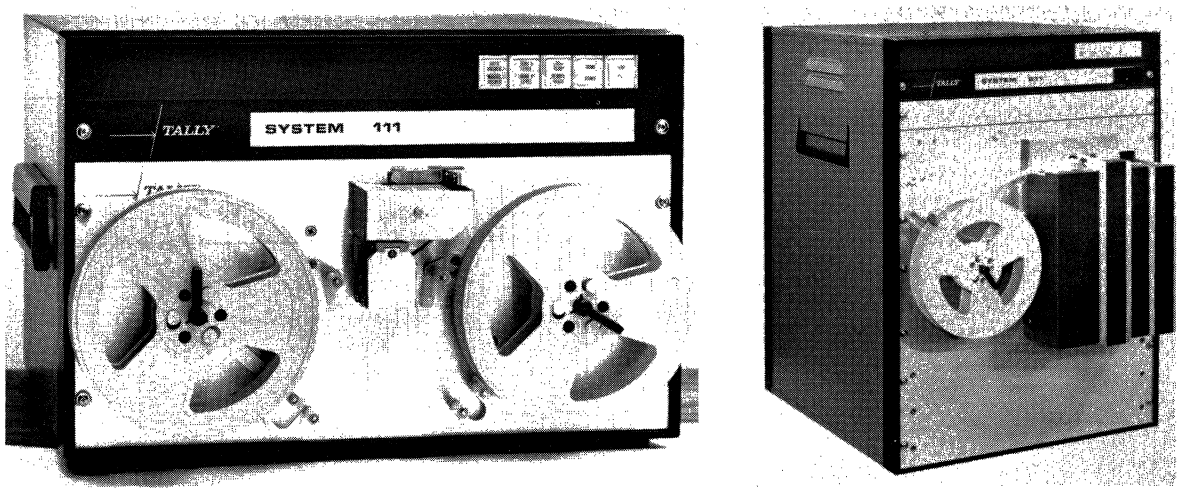


Figure 1. The Tally System III Transmitter (left) and System 211 (right); the System 311 combines both units in one cabinet.

.15 Description (Contd.)

An IBM Selectric Input/Output Typewriter can be connected to a Tally System 311 Sender/Receiver. The typewriter can be used off-line to:

- Generate punched tape via manual keyboard entry, or
- List data from a punched tape being read. (A second, duplicate tape can be punched during listing.)

The rated speed of the Selectric Typewriter is 14.8 characters per second. It incorporates a roll-feed platen with 85 print positions. A platen with 135 printing positions is optionally available.

When not used for punched tape generation or data listing, the typewriter can be used as a normal electric office typewriter.

Tally has discontinued the card-reader option for the System 311 Sender/Receiver. The former option provided rated input capability of 60 cards per minute (80 columns or characters per second) and was used for direct transmission of card data to a remote Tally serial punched tape receiver or for local transcription of punched card data to punched paper tape.

According to Tally, the System 311 Sender/Receiver is currently the most popular model in the serial transmission equipment line.

.16 First Delivery

Systems 111 and 211:	February 1966.
System 311:	October 1965.

.17 Availability: . . . . . 60 to 90 days for all Systems.

.2 CONFIGURATION

Each device consists of a Tally Model 464A Paper Tape Reader or Model P-120 Tape Perforator, or both, and the logic necessary to perform the functions indicated in Table I. The standard communications facilities over which the Tally serial equipment can operate, and the data sets required, are specified in Paragraph .72.

TABLE I: CHARACTERISTICS OF TALLY SERIAL DATA COMMUNICATIONS EQUIPMENT

System	Send Unattended	Receive Unattended	Start Unattended Sender	Parity Check	Automatic Request Retransmission	Automatic Retransmission	Recommended Remote Tally Terminals
Senders							
111	Yes	-	-	No	-	Yes	211, 311, 1021, 4031
Receivers							
211	-	Yes	Yes	Yes(1)	Yes	-	111, 311, 1021, 4031
Sender/Receivers							
311	Yes	Yes	Yes	Yes(1)	Yes	Yes	111, 211, 311, 1021, 4031

(1) Checking is performed by receiving punch.

.3 INPUT

.31 Prepared Input

Model 464A Reader–

Input medium: . . . . . fully-punched 11/16-, 7/8-, or 1-inch, 5-, 6-, 7-, or 8-level paper tape. Tape can be of any material, color, thickness, or opacity.

Input Code: . . . . . any 5-, 6-, 7-, or 8-level code.

Quantity of data: . . . . . 1 to N data characters when parity checking is not used; 30 to N data characters when transmitting to a parity-checking receiver (System 211 or 311). N is limited by capacity of reel, which is approximately 90,000 characters.

Rated input speed: . . . . . 120 char/sec; 60 or 120 char/sec optional.

Effective speed: . . . . . somewhat less than rated speed, depending on block length.

Comments: . . . . . reader uses mechanical star-wheel sensing, 60 or 120 char/sec Speed - Selection option provides manual selection of either speed.

.32 Manual Input (IBM Selectric Typewriter Option)

Keyboard —

Method of entry: . . . . . via 44-key keyboard; additional keys provide special functions such as backspace, carriage return, horizontal tab, etc.

Quantity of data: . . . . . variable.

Character set: . . . . . 44 distinct character codes, in conjunction with upper- and lower-case control code, provide 88 upper and lower case alphabetic, numeric, and special characters.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration: . . . . . 1 to N data characters (no control codes); 30 to N data characters followed by a customer-specified block character (Systems 111, 211, and 311 in parity-checking mode only). N is limited by capacity of reel, which is approximately 90,000 characters.

.36 Operating Procedure

(1) Operator establishes connection with remote station and exchanges instructions with the remote operator.

(2) Both operators select Attended and Send or Receive switch positions on control panel.

(3) Receive operator presses Data button on data set.

(4) Send operator presses Data button on data set upon hearing tone.

(5) Sender and receiver are started automatically.

(6) If the sender runs out of tape, it will wait 30 seconds for possible operator intervention and then automatically terminate the call. If the receiver runs out of tape, the sender will automatically backspace and then terminate the call.

See Paragraph .52 for the resulting action if errors are detected by a System 211 Receiver or 311 Sender/Receiver.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.41 Output to Punched Tape

Model P-120 Perforator —

Tape size:	standard 11/16-, 7/8-, or 1-inch tape.
Tape code:	any 5-, 6-, 7-, or 8-level code.
Rated punching speed:	120 char/sec; 60 or 120 char/sec optional.
Effective speed:	up to 120 char/sec.
Format control:	none.
Comments:	equipped with parity-checking mechanism when used in Systems 211 and 311; 60 or 120 char/sec Speed-Selection option provides manual selection of either speed.

.44 Output to Printer (IBM Selectric Typewriter Option)

Output medium:	friction-fed or pin-fed (optional) roll paper or fanfold forms up to 15.5 inches wide (13-inch writing width).
Character set:	88 printable characters.
Rated printing speed:	14.8 char/sec.
Effective speed:	less than rated speed due to carriage return, line feed, or other format operations.
Format control:	controlled by function codes in incoming data or manually by operator. Controls include line feed, carriage return, case shift, backspace, and horizontal tab.
Comments:	horizontal spacing is 10 char/inch (12 char/inch optional); vertical spacing is 6 lines/inch (8 lines/inch optional).

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors (System 311 only): . . the 311 Sender/Receiver can be operated in a test mode, which allows the receiver portion to receive transmission from the sender. This mode can be used prior to transmission to verify input tapes by means of the parity-checking mechanism described in Paragraph .52, or after transmission to delete data blocks which contained a detected error.

.52 Data Transmission Errors (System 211 Receiver and 311 Sender/Receiver only)

Type of checking: . . . . . switch-selected odd or even character parity check on 6-, 7-, or 8-level codes. Parity is accumulated by sensing the movements of punch pins.

Error indication: . . . . . all eight holes of any character received in error are punched (Delete character), a flag character (specified by the user when system was ordered) is punched, punching halts, and receiver signals sender at the end of the current data block.

Correction procedure: . . . . . automatic retransmission if sender is capable (e.g., System 111 or 311); if error persists, receiver inhibits parity checking on the fourth transmission of the same data block.

Comments: . . . . . parity checking can be inhibited. When checking odd parity, Blank characters (no holes punched) or Delete characters (all 8 holes punched) do not cause a parity error condition.

.53 Data Recording Errors: . . . . . parity-checking mechanism of System 211 and 311 receiver punch also provides an indirect check on data recording; see Paragraph .52.

.54 Equipment Errors (System 311 only): . . the System 311 Sender/Receiver can be operated in a test mode, which allows the receiver portion to receive transmission from the sender. The parity-checking mechanism of the receiver, as described in Paragraph .52, can be used to provide a measure of assurance that the equipment is functioning properly.

.55 Line Malfunctions

Detection: . . . . . loss of carrier tone is detected.

Action: . . . . . automatic disconnect; receiver halts; sender backspaces and halts.

.6 CONDITION INDICATORS: . . . . . lamps are provided to indicate power on, device ready, device busy, and a detected error.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	120/char/sec (1200 bits/sec); optional 60 or 120 char/sec.
Transmission method:	serial by bit.
Transmission code:	any 5-, 6-, 7-, or 8-level code; a total of 10 bits per character are transmitted including start and stop bits; codes of fewer than 8 levels are zero-filled when transmitted.
Transmission mode:	simplex (sender or receiver); half-duplex (sender/receiver).
Order of bit transmission:	low-order bit is transmitted first.
Synchronization:	start-stop; start and stop bits are each 1 bit-time long.

.72 Connection to Communications Lines

Communications Line	Data Set*
Public switched telephone network:	Bell System Data-Phone Data Set 202C.
Common-carrier leased voice-band line:	Bell System Data Set 202C or Western Union 1200 Baud Data Modem.

.73 Transmission Control

Call initiation:	manual.
Call reception:	all models are capable of unattended operation; see Table I.
Functional operations:	none.

.74 Multistation Operation: no provision.

.8 PHYSICAL SPECIFICATIONS

Component:	Sender and Receiver		Sender/Receiver
	System 111	System 211	System 311
Width (inches)	20	20	22
Depth (inches)	22	22	26.378
Height (inches)	13	27	59
Weight (pounds)	75	150	350
Power (KW)	0.460	0.575	0.920
Voltage	115**	115**	115**
Frequency (Hz)	60**	60**	60**
Phases	1	1	1
Temperature range (°F)	50 to 110	50 to 110	50 to 110
Humidity range (%)	20 to 80	20 to 80	20 to 80
Heat (BTU/hr)	1570	1962	3140

* Equivalent data sets can be used; see Section 4620 for a current list of modems available from independent manufacturers of telephone equipment, then check with your local common-carrier communications consultant. Use of the automatic retransmission feature of the System 111, 211, and 311 devices requires the reverse channel feature in data set.

** Operation on 230-volt, 50-hertz power is optional at extra cost.

.9 PRICE DATA

Component or Feature	Monthly Rental, * $	Purchase Price, $	Monthly Maintenance, $
Senders			
System 111 (Options 1, 3, 4, 5, 8 available)	160	3500	15.00
Receivers			
System 211 (Options 1, 2, 3, 6, 8 available)	280	6240	22.50
Sender/Receivers			
System 311 (Options 2, 3, 4, 5, 6, 7, 9 available	400	8628	28.00
Options			
(1) Floor Console	10	180	-
(2) Parallel Receive Capability	30	240	1.00
(3) 60/120 char/sec Speed Selection	15	180	2.00
(4) Parity Generation	30	720	4.00
(5) Automatic Block Code Generation	35	720	4.00
(6) 3000-Foot Perforator Tape Supply**	25	525	2.50
(7) IBM Selectric Typewriter	120	2950	25.00

* These rentals are based on a one-year rental agreement and include maintenance.
** The Floor Console is a prerequisite for the 3000-Foot Tape Supply.

TALLY 1021 DATA TERMINAL

.1 GENERAL

.11 Identity:	Tally 1021 Data Terminal.
.12 Manufacturer:	Tally Corporation 8301 South 180th Street Kent, Washington 98031
.13 Basic Function:	transmission and reception of data over a voice-band communications line at 120 characters per second; input-output options are available; input, transmission, and output operations are performed separately, via internal magnetic tape buffer; can also be used for off-line data transcription or can be connected directly to a computer.

.14 Basic Components

Name:	Data Terminal Controller.
Model number:	1021.
Function:	provides data buffering and control; includes Model 1020 magnetic tape unit as buffer.
Name:	Typewriter Option.
Model number:	1022.
Function:	receives data from internal magnetic tape buffer and prints it; provides keyboard for recording data on internal magnetic tape buffer.
Name:	Paper Tape Reader Option.
Model number:	1023.
Function:	reads data from punched paper tape and records it on internal magnetic tape buffer.
Name:	Serial Interface Option.
Model number:	1025.
Function:	provides interface with serial data set at 120 char/sec.
Name:	Parallel Interface Option.
Model number:	1028P.
Function:	provides interface with parallel data set at 60 or 72 char/sec.
Name:	Serial/Parallel Interface Option.
Model number:	1028SP.
Function:	provides interface with serial or parallel data set at 60, 72, or 120 char/sec.
Name:	Teletype 33 ASR.
Model number:	1033 ASR.
Function:	receives data from internal magnetic tape buffer and prints it; provides keyboard for recording data on internal magnetic tape buffer.
Name:	360 Communications Buffer.
Function:	provides direct interface to System/360 computer.

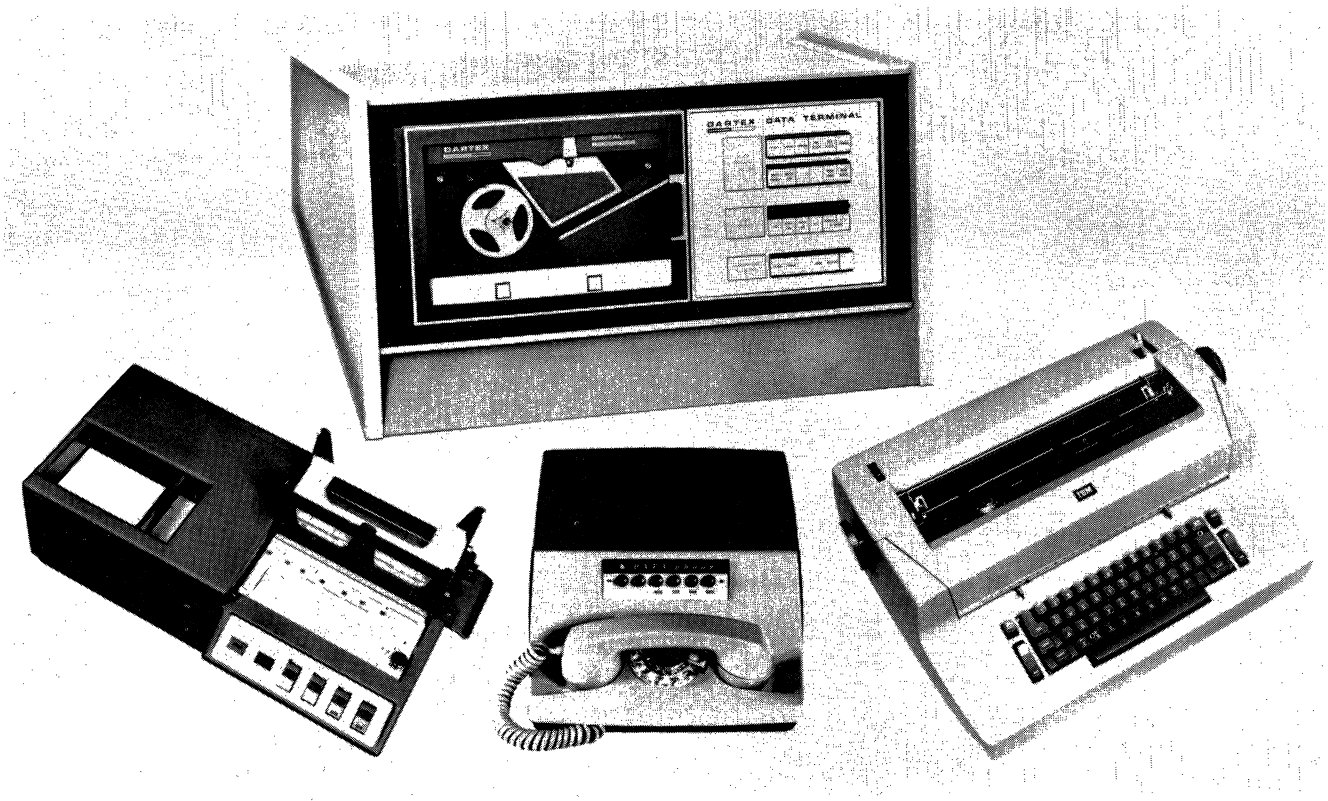


Figure 1. Tally 1021 Data Terminal.

.15 Description

The Tally 1021 Data Terminal, a former product of the Dartex Division of Tally, consists of a buffered controller (basic unit), a limited input/output capability that includes an IBM Selectric typewriter, a Teletype Model 33 ASR, and a Tally paper tape reader, an optional IBM System/360 interface for local operation, and a communications interface option, which provides one of three interfaces: serial (120 char/sec), parallel (60 or 72 char/sec), and a serial-parallel interface that selectively combines the advantages of the two. The optional System/360 interface can be combined with a data communications interface option to create a computer communications environment.

The flexibility of the Tally 1021 can be appreciated when considering that it can be used in both a local and remote environment and that it is compatible with the other data communications devices in the Tally product line.

The basic Tally 1021 Terminal includes an incremental magnetic tape recorder (Tally Model 1020) which is employed as a data buffer. When transmitting over a communications line, data is transferred from the buffer tape in the transmitting terminal to the buffer tape in the receiving terminal. When performing an off-line data transcription operation, data is first recorded on the internal magnetic tape buffer; the tape is rewound and the data is then transferred to the output device. Data cannot be transferred directly between an input-output device and the communications line or between an input device and an output device. This limitation is partially off-set by the flexibility provided by the removable buffer tape reel.

The internal magnetic tape buffer unit handles a removable three-inch reel of 0.25-inch-wide computer-grade magnetic tape. Data is recorded at a density of 800 bits per inch. The tape speed is 40 inches per second when operating continuously or up to 3 inches per second when operating in the start/stop mode.

Each eight-bit character is recorded serially by bit on a single track; a 0.013-inch gap separates each group of bits forming a character. The low-order bit is recorded first, the odd parity bit and an end-of-character bit last. Concurrent with recording the data, a second track is recorded as the complement of the first. Both tracks are read and compared when reading the recorded data to ensure that the data is read correctly. The end-of-character bit is recorded as a "one" on each of the two tracks. Records, consisting of a group of characters, are separated by a 0.125-inch gap; blocks, consisting of one or more records, are separated by a 2.5-inch gap. Block size can be manually established at 16, 32, or 64 records per block when the Model 1029 Block Forming Option is incorporated.

Four tracks are recorded (two "channels"); i.e., two data tracks and two checking tracks. Data is recorded to the end of the first channel; the tape is rewound at 40 inches per second, and recording begins in the second channel. Each three-inch reel of tape has a maximum storage capacity of 280,000 characters (140,000 characters per channel).

Any 5-, 6-, 7- or 8-level code can be used when transcribing data from an input medium.

Although the Terminal can transmit variable-length data records, Tally does not recommend the use of record lengths shorter than 30 characters. Character parity is transmitted with each character.

Error signaling in response to detected transmission errors is performed via the reverse-channel technique. The inherent value of this technique is that the process eliminates the time required for line turn-around to allow the receiver to transmit an acknowledge code. The reverse-channel technique is described in Paragraph 6221.15 in the Report on the Digitronics Reverse-Channel Dial-o-verter Line.

When a transmission error is detected at the receiving terminal, the signal on the reverse channel is interrupted. The interruption is interpreted at the transmitting terminal as a request to retransmit the incorrectly received record. Both transmitting and receiving terminal tapes are automatically reversed to the beginning of the incorrectly received record, and the record is again read and retransmitted. Automatic retransmission of an incorrectly received record will occur up to three times; after-three consecutive errors on the same record, the receiving terminal writes an error flag at the beginning of the record and accepts the record without further error checking. Error checking is resumed with the next record.

The Tally 360 Communications Buffer combines the 1021 Data Terminal, a communications interface and an IBM System/360 interface in a single unit. Input/output operation with the computer is performed at 1600 characters per second via the System/360 Multiplexor Channel. Code translation between the internal EBCDIC code and the Tally 6-level BCD code is provided. Two standard programming packages are available: diagnostic routines and a micro package for the IBM Disc Operating System (DOS).

The Model 1022 Typewriter Option (an IBM Selectric Typewriter) enables keyboard data to be entered directly onto the buffer tape and provides a hard copy when outputting from the buffer. The Selectric Typewriter is rated at 15.5 characters per second. The keyboard provides a 64-character set; each character is encoded in an eight-level BCD code. The standard type element provided is the IBM Type Style No. 1, which contains a 64-character set; an optional type element contains an 88-character set. A pin-feed platen is standard with the 1022 Typewriter Option; the typewriter will accept single sheets of paper or continuous marginally-punched forms. When the typewriter is not in use as a data entry device or as a printer, it can be used as a conventional typewriter, even though the terminal is otherwise occupied.

The Model 1033 ASR Option, a Teletype Model 33 ASR, can be substituted for the Model 1022 Typewriter Option. Teletypewriter operation is similar to the typewriter operation.

Quantity of data:	variable up to tape capacity of 280,000 characters.
Rated input speed:	up to 120 char/sec (start-stop) or 1600 char/sec (continuous).
Effective speed:	limited by block length and transmission speed.
Comments:	this unit serves as the data buffer; all transmission and transcription operations are performed via this unit.

Model 1023 Paper Tape Reader Option —

Input medium:	fully punched 11/16-, 7/8- or 1-inch, 5-, 6-, 7-, or 8-level paper, paper-Mylar, or aluminum-Mylar tape; any color or opacity can be used.
Input code:	any 5-, 6-, 7-, or 8-level code.
Quantity of data:	variable up to capacity of 1020 magnetic tape reel (280,000 characters).
Rated input speed:	120 characters per second.
Effective speed:	limited by block length.
Comments:	data is transferred to the 1020 incremental recorder (tape buffer) from this unit.

.32 Manual Input

Typewriter Option, Model 1022 —

Method of entry:	via a 53-key keyboard.
Quantity of data:	variable.
Character set:	64 characters, including 26 alphabetics, 10 numerics, and 27 special symbols plus space.

.33 Fixed Input: ..... no provision.

.34 Transaction Code Input: ..... no provision.

.35 Message Configuration: ..... data is transmitted in variable-length records; each data record begins with a record-count character and is terminated with a longitudinal parity character; both of these characters are automatically supplied by the terminal logic. The end of the record is recognized by the end-of-record gap.

.36 Operating Procedure

To send or receive a data message, the operator:

- Depresses the Data-Phone selection switch;
- Depresses the Data-Phone Manual or Automatic (unattended) mode switch;
- Depresses the Send or Receive switch if in Manual mode;
- Establishes connection by manual dialing or signaling;
- Ensures that the called terminal is ready (automatic when in unattended mode); and
- Starts the tape action by depressing the data set Data button.

The subsequent transmission operation, including retransmission, is completely automatic. Operator attention is required only if repeated errors are detected or to break the connection when operating in the manual mode.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.43 Output to Magnetic Tape

Model 1020 Digital Magnetic Tape Recorder —
(contained in 1021 Data Terminal)

Tape size:	0.25-inch magnetic tape recorded at 800 bits/inch on a 3-inch diameter reel.
Tape code:	any 5-, 6-, 7-, or 8-level code.
Rated output speed:	up to 120 char/sec (start-stop) or 1600 char/sec (continuously).
Effective speed:	limited by block length and transmission speed.
Format control:	none.

.44 Output to Printer

Model 1022 Typewriter Option —

Output medium:	friction-fed forms up to 15.5 inches in width; pin-fed forms up to 13.75 inches in width.
Character set:	64 characters; optionally 88 characters.
Rated printing speed:	15.5 char/sec.
Effective speed:	less than rated speed due to carriage return, line feed, and other operations.
Format control:	controlled by function codes; functions include line feed (index), carriage return, and horizontal tab.
Comments:	pin-feed platen is standard; 85 or 130 (optional) char/line at 10 char/inch; 6 lines/inch vertical spacing; other vertical spacings are available on request.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors

Model 1020 Magnetic Tape Recorder,
Model 1022 Typewriter Option, and
Model 1023 Paper Tape Reader Option

Type of checking:	1020 checks character validity and character parity; visual check for 1022; 1023 checks character validity.
Error indication:	lamp is lighted; 1022 types wrong character and halts.
Correction procedure:	1020 and 1023 re-read error character up to three times before operator intervention is required; 1020 flags error character; operator depresses error key, backspaces once, and retypes correct character on 1022.

.52 Data Transmission Errors

Type of checking:	character parity.
Error indication:	lamp is lighted after three unsuccessful retransmissions (total of four transmissions) and error record is flagged.

Correction procedure:	incorrectly received record is retransmitted up to three times, error record is flagged, and operation continues.
Comments:	both transmitting and receiving tapes automatically backspace to beginning of record.

.53 Data Recording Errors: no provision for checking.

.55 Line Malfunctions

Detection:	loss of carrier.
Action:	automatic disconnect.

.6 CONDITION INDICATORS

A comprehensive array of indicator lamps provides visual indication of error status, transmission status, and status of all components.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	120 char/sec (1200 bits/sec.)
Transmission method:	serial by bit.
Transmission code:	any 5-, 6-, 7-, or 8-level code can be used; a total of 10 bits are transmitted for each character including parity, start, and stop bits; codes of less than 8 levels are zero-filled.
Transmission mode:	half-duplex.
Order of bit transmission:	low-order bit of each character is transmitted first, parity bits last.
Synchronization:	start and stop bits are transmitted with each character.

.72 Connection to Communications Lines

Communications Line or Service	Data Set*
Public switched telephone network (up to 1200 bits/sec):	Bell System Data-Phone Data Set 202C.**
Common-carrier leased voice-band line (up to 1200 bits/sec):	Bell System Data Set 202C or 202D, or Western Union 1200 Baud Data Modem.**

.73 Transmission Control

Call initiation:	manual dialing or signaling.
Call reception:	capable of unattended operation.
Functional operations:	printer only; carriage return, space, index (line feed), and tab (horizontal).

*Equivalent data sets can be used; see Section 4620 for a current list of modems available from independent manufacturers of telephone equipment, then check with your local common-carrier communications consultant.

**Bell System 202C2 and 202D2 Data Sets provide reverse-channel capability. Western Union Data Sets do not provide reverse-channel capability except through the use of a full-duplex line.

.74 Multistation Operation: . . . . . no provision.

.8 PHYSICAL SPECIFICATIONS

Component	Model 1021 Data Terminal Controller	Model 1022 Typewriter Option	Model 1023 Paper Tape Reader Option
Width (inches	26	17.25	8.75
Depth (inches)	19	15.75	12.5
Height (inches)	13	9.75	5.5
Weight (pounds)	50	52	8
Power (KVA)	0.15	0.15	0.23
Voltage	115	115	115
Frequency (cps)	60	60	60
Phases	1	1	1
Temperature Range (°F.)	50 to 110	50 to 110	50 to 110
Humidity Range (%)	10 to 90	10 to 90	20 to 85
Heat (BTU/hr)	360	360	?

Component	Models 1025, 1028P, or 1028SP Communications Interface	360 Communications Buffer
Width (inches)	Fits in 1021	27
Depth (inches)	Data	30
Height (inches)	Terminal Controller	29
Weight (pounds)		250
Power (KVA)	Power is	0.345
Voltage	supplied	115
Frequency (Hz)	from Data	60
Phases	Terminal	1
Temperature Range (°F.)	50 to 110	50 to 110
Humidity Range (%)	10 to 90	10 to 90
Heat (BTU/hr)	?	?

.9 PRICE DATA

Component or Feature	Monthly Rental, $	Purchase Price, $	Monthly Maintenance, $
Tally 1021 Data Terminal	200	4800	30
Options			
Model 1022 Typewriter	115	2800	20
Model 1023 Paper Tape Reader	25.30	1265	3.75
Model 1025 Serial Interface	75	2100	9.50
Model 1028P Parallel Interface	85	2400	11
Model 1028SP Serial/Parallel Interface	90	2600	12
Interface Options-			
Delete Inhibit	12	300	2
Remote Channel Select	12	300	2
Remote Rewind	12	300	2
Auto Block Gap on BOT	12	300	2
Model 1029 Block Forming Option	30	600	4
Model 1033 ASR (Teletype Model 33 ASR)	100	2100	25
360 Communications Buffer*	700	15,000	58

*Includes 1021, 1025 with Auto Block Gap option, and IBM System/360 interface.

TELETYPE TELESPEED 1200 EDC EQUIPMENT (AT&T DATASPEED TYPE 4)

.1 GENERAL

.11 Identity: . . . . . Telespeed 1200 EDC Tape Sender;
Telespeed 1200 EDC Tape Receiver;
Dataspeed Type 4 Service.

.12 Manufacturer: . . . . . Teletype Corporation
5555 Touhy Avenue
Skokie, Illinois 60076

.13 Basic Function: . . . . . read data from paper tape and transmit it over a voice-band line.
receive data from a voice-band line and punch it into paper tape.

.15 Description

The Teletype Telespeed 1200 EDC equipment line consists of two independent units: a tape sender and a tape receiver. The two units are available separately. This equipment is available from Teletype Corporation on a purchase basis only. The Dataspeed Type 4 Service offered by AT&T utilizes this equipment and is available on a rental basis.

Either chadless or fully-punched tape can be used in the Tape Sender, but the tape recreated by the Tape Receiver is always fully-punched. The Telespeed 1200 EDC components have adjustable heads to accommodate 5-level, 11/16-inch tape or 5-, 6-, 7-, or 8-level, 1-inch tape. By special request, 6-level, 7/8-inch Teletypesetter tape with advanced feed holes can be accommodated.

Data is transmitted over a 2-wire voice-band line at 1050 or 1200 words per minute (105 or 120 characters per second). A 10-bit code, including unity start and stop bits, is transmitted for each character regardless of the number of levels in the tape.

Error signaling via a "reverse channel" characterizes the 1200 EDC equipment. Reverse-channel operation is a monitoring process by which the transmitting device is made immediately cognizant of transmission errors detected at the receiver. This process eliminates the time required for line turn-around to allow the receiver to transmit an acknowledge code. Reverse-channel data sets divide the available bandwidth in a normal voice-grade circuit into a forward data channel and a narrow reverse-signaling channel. Under normal circumstances, when no errors are detected, the receiving terminal allows a continuous tone to be transmitted on the reverse channel. When an error is detected, the signal on the reverse channel is interrupted. The interruption is interpreted by the transmitting device as a request for retransmission of a record.

An extensive error detection and correction (EDC) capability is provided in both the 1200 EDC sending and receiving units.

The sending unit includes a Teletype DX paper tape reader with two read heads. Data is read from tape by one of the heads, and transmitted; the other head is used to generate two check characters which are transmitted at the end of each 80-character record.

The receiving unit contains a Teletype DRPE paper tape punch which includes a read head. As each character is received and punched into paper tape, the read head is used to generate both check characters. The transmitted check characters are compared to the check characters generated at the receiving unit at the end of each record. A retransmission request via the reverse channel occurs when the check characters do not agree.

Error correction is performed automatically by backspacing the tape to the beginning of the record received in error at both sending and receiving units, deleting the incorrectly punched record (by overpunching the complete record) and retransmitting the record.

In addition to the standard error detection and correction capability provided by the Telespeed 1200 EDC units, the units can be equipped to generate and check odd or even character parity in the eighth bit position.

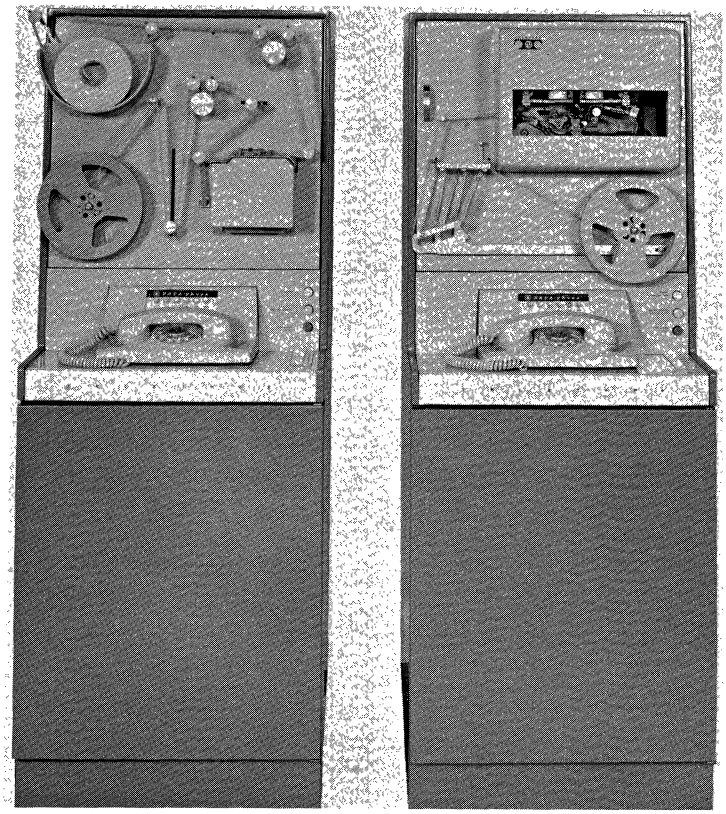


Figure 1: The Teletype Telespeed 1200 EDC Tape Sender (left) and Tape Receiver (right).

Two options are available to provide unattended operation. One option provides the capability to send or receive data from an unattended terminal with no restrictions. The second option, the Protected Unattended Operation feature, requires that the unattended terminal receive a specified data character prior to establishing data communication. With either option, a connection cannot be established if the terminal is in a non-serviceable state due to equipment malfunctions or lack of power.

An optional interface is available which provides a parallel-by-bit data transfer to external devices such as data display equipment.

The Telespeed sender and receiver take-up reel are 7 1/2 inches in diameter with a core diameter of 1-15/16 inches. The reels are made of clear plastic with removable sides. The capacity of these reels is 800 feet of fully-punched tape or 500 feet of chadless tape. A holder (see Figure 1) is provided on the sender to hold the supply tape roll. A supply reel with a 3000-foot tape capacity is provided on the receiver.

.16 First Delivery: . . . . . 1967.

.17 Availability: . . . . . approximately 4 months.

.2 CONFIGURATION

The 1200 EDC sending unit includes a Teletype DX paper tape reader with two read heads. The 1200 EDC receiving unit includes a Teletype DRPE paper tape punch which contains a read head. Telespeed 1200 EDC equipment can be connected to either the public switched telephone network or to a common-carrier leased voice-band line. The data sets required are specified in Paragraph .72.

.3 INPUT

.31 Prepared Input

Telespeed 1200 EDC Tape Sender —

Input medium: . . . . . fully-punched or chadless 7/8, 11/16-, or 1-inch paper tape.
Input code: . . . . . any 5-, 6-, 7-, or 8-level code.
Quantity of data: . . . . . 80 characters per block.
Rated input speed: . . . . . 105 or 120 char/sec.
Effective speed: . . . . . somewhat less than rated speed.
Comments: . . . . . take-up reel can hold 800 feet of fully-punched paper tape or 500 feet of chadless paper tape; a supply reel with a 3000-foot tape capacity is also provided.

.32 Manual Input: . . . . . no provision.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration: . . . . . variable number of 80-character blocks; no control characters are used.

.36 Operating Procedure

(1) Load punched tape.
(2) Establish voice communication and switch to data mode.
(3) Depress Start button.

.37 Entry of Time and Date: . . . . . no provisions.

.4 OUTPUT

.41 Output to Punched Tape

Telespeed 1200 EDC Tape Receiver —

Tape size: . . . . . standard 7/8-, 11/16-, or 1-inch, 5-, 6-, 7-, or 8-level paper tape.
Tape code: . . . . . binary image of received data is punched.
Rated punching speed: . . . . . 105 or 120 char/sec.
Effective speed: . . . . . somewhat less than rated speed.
Format control: . . . . . none.
Comments: . . . . . take-up reel can hold 800 feet of fully-punched paper tape or 500 feet of chadless paper tape.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors: . . . . . no checking.

.52 Data Transmission Errors

Type of checking: . . . . . two check characters (longitudinal parity and spiral parity) are generated at the sending unit and transmitted to the receiving unit at the end of each record; the receiver generates both check characters from the received data, and both pairs of check characters are compared at the end of each received record.
Error indication: . . . . . signal on reverse channel is interrupted when check characters do not compare.
Correction procedure: . . . . . automatic backspacing of tape to beginning of record received in error at both sending and receiving units: receiving unit deletes the error record by over-punching in all channels; then the record is retransmitted.

.53 Data Recording Errors: . . . . . read-after-write check; see Paragraph .52.

.55 Line Malfunctions

Detection: . . . . . reverse-channel signal is interrupted.
Action: . . . . . automatic disconnect or retransmission.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	105 char/sec (1050 bits/sec) or 120 char/sec (1200 bits/sec).
Transmission method:	serial by bit.
Transmission code:	a total of 10 bits are sent for each character, including unity start and stop bits.
Order of bit transmission:	low-order bit each character is transmitted first.
Synchronization:	start and stop bits are transmitted with each character.

.72 Connection to Communications Lines

Communications Line	Data Set*
Public switched telephone network:	Bell System Data-Phone Data Set 202C or 202D
Common-carrier leased voiceband line:	Bell System Data Set 202D or Western Union 1200 Baud Data Modem

.73 Transmission Control

Call initiation:	manual dialing.
Call reception:	operator must establish voice communication and then switch to data mode. unattended operation is optional; see Description.
Functional operations:	none.

.74 Multistation Operation:

no direct provision: but with the Protected Unattended Operation feature, a Telespeed Tape Sender will not respond to a call unless a specified data character is received.

.8 PHYSICAL SPECIFICATIONS

Component	Telespeed 1200 EDC Tape Sender	Telespeed 1200 EDC Tape Receiver
Width (inches)	20.5	20.5
Depth (inches)	24	24
Height (inches)	54	54
Weight (pounds)	325	350
Power (KVA)	0.345	0.771
Voltage	115	115
Frequency (Hz)	60	60
Phases	1	1
Temperature Range (°F)	40-120	40-120
Humidity Range (%)	20-95	20-95
Heat (BTU/hr)	580	443

.9 PRICE DATA

The 1200 EDC equipment is available from Teletype Corporation on a purchase basis only. Current prices, are $4,590 for the Tape Sender and $5,930 for the Tape Receiver. The same equipment is used in the Dataspeed Type 4 Service, offered by AT&T on a rental basis only. Pricing for optional features is available on request from Teletype Corporation.

* In some cases, equivalent data sets can be used; see Sections 4620 and 4640 for a current list of modems available from independent manufacturers of telephone equipment. Bell System 202C2 and 202D2 Data Sets provide reverse-channel capability. Western Union Data Sets do not provide reverse-channel capability except through the use of a full-duplex line.

TELETYPE TELESPEED 1050 EQUIPMENT (AT&T DATASPEED TYPE 2)

.1 GENERAL

.11 Identity: ..... Telespeed 1050 Tape Sender;
Telespeed 1050 Tape Receiver;
Dataspeed Type 2 Service.

.12 Manufacturer: ..... Teletype Corporation
5555 Touhy Avenue
Skokie, Illinois 60076

.13 Basic Function: ..... read data from paper tape and transmit it over a voice-band line.
receive data from a voice-band line and punch it into paper tape.

.15 Description

The Teletype Telespeed 1050 equipment line consists of two independent units: a tape sender and a tape receiver. The two units are available separately. This equipment is available from Teletype Corporation on a purchase basis only. The Dataspeed Type 2 Service offered by AT&T utilizes this equipment and is available on a rental basis. Dataspeed Type 2 Service is described in the section on Common-Carrier Facilities; see Paragraph 3200.51.

Either chadless or fully-punched tape can be used in the Tape Sender, but the tape recreated by the Tape Receiver is always fully-punched. The Telespeed 1050 components have adjustable heads to accommodate 5-level, 11/16-inch tape or 5-, 6-, 7-, or 8-level, 1-inch tape. By special request, 6-level, 7/8-inch Teletypesetter tape with advanced feed holes can be accommodated.

Data is transmitted over a 2-wire voice-band line at 1,050 words per minute (105 characters per second). A 10-bit code, including unity start and stop bits, is transmitted for each character regardless of the number of levels in the tape.

Two options are available to provide unattended operation. One option provides the capability to send or receive data from an unattended terminal with no restrictions. The second option, the Protected Unattended Operation feature, requires that the unattended terminal receive a specified data character prior to establishing data communication. With either option, a connection cannot be established if the terminal is in a non-serviceable state due to equipment malfunctions or lack of power.

All reels mounted on the face of the Dataspeed sender and receiver are 7-1/2 inches in diameter with a core diameter of 1-15/16 inches. The reels are made of clear plastic with removable sides. The capacity of these reels is 800 feet of fully-punched tape or 500 feet of chadless tape. The supply reel on the tape receiver has a capacity of 3,000 feet.

.16 First Delivery: ..... 1960.

.17 Availability: ..... approximately 4 months.

.2 CONFIGURATION

Telespeed 1050 equipment can be connected to either the public switched telephone network or to a common-carrier leased voice-band line. The data sets required are specified in Paragraph .72.

TELETYPE
TELESPEED 1050

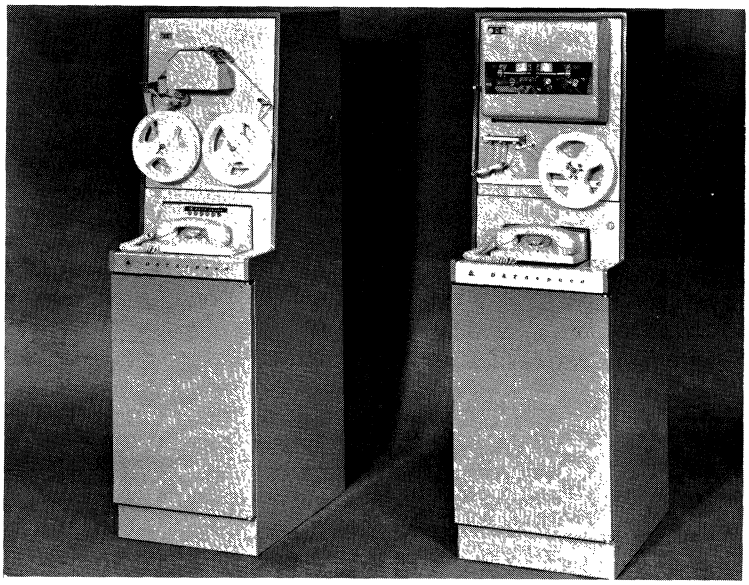


Figure 1. The Teletype Telespeed 1050 Tape Sender (left) and Tape Receiver (right).

.3 INPUT

.31 Prepared Input

Telespeed 1050 Tape Sender —

Input medium:	fully-punched or chadless 11/16-inch or 1-inch paper tape.
Input code:	any 5-, 6-, 7-, or 8-level code.
Quantity of data:	variable.
Rated input speed:	105 char/sec.
Effective speed:	somewhat less than rated speed, depending on block length.
Comments:	supply reel can hold 800 feet of fully-punched paper tape or 500 feet of chadless paper tape.

.32 Manual Input: . . . . . no provision.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration: . . . . . variable number of characters of data; no control characters are used.

.36 Operating Procedure

(1) Load punched tape.

(2) Establish voice-communication and switch to data mode.

(3) Depress Start button.

.37 Entry of Time and Date: . . . . . no provisions.

(Contd.)

.4 OUTPUT

.41 Output to Punched Tape

Telespeed 1050 Tape Receiver —

Tape size:	standard 11/16-inch or 1-inch, 5-, 6-, 7-, or 8-level paper tape.
Tape code:	binary image of received data is punched.
Rated punching speed:	105 char/sec.
Effective speed:	somewhat less than rated speed, depending on block length.
Format control:	none.
Comments:	supply reel has a capacity of 3,000 feet.

.5 ERROR DETECTION AND CORRECTION: optional error detection facilities are provided.

.55 Line Malfunctions

Detection:	line breaks can be detected with optional equipment.
Action:	a lamp is lighted.

.6 CONDITION INDICATORS

Input device available:	none.
Input device busy:	none.
Remote receiver ready:	none.
Remote receiver busy:	none.
Power on:	lamp.
Improper data entry:	none.
Transmission error:	optional.
Recording error:	none.
Line break (Tape Sender only):	lamp.
Low tape (Tape Receiver only):	lamp.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	105 char/sec (1,050 bits/sec).
Transmission method:	serial by bit.
Transmission code:	a total of 10 bits are sent for each character, including unity start and stop bits.
Order of bit transmission:	low-order bit of each character is transmitted first.
Synchronization:	start and stop bits are transmitted with each character.

.72 Connection to Communications Lines

Communications Line	Data Set*
Public switched telephone network:	Bell System Data-Phone Data Set 202C or 202D.
Common carrier leased voice-band line:	Bell System Data Set 202D or Western Union 1200 Baud Data Modem.

.73 Transmission Control

Call initiation: . . . . . manual dialing.
Call reception: . . . . . operator must establish voice communication and then switch to data mode.
unattended operation is optional; see Description.
Functional operations: . . . . . none.

.74 Multistation Operation: . . . . . no direct provision, but with the Protected Unattended Operation feature, a Telespeed Tape Sender will not respond to a call unless a specified data character is received.

* In some cases, equivalent data sets can be used; see Sections 4620 and 4640 for a current list of modems available from independent manufacturers of telephone equipment.

.8 PHYSICAL SPECIFICATIONS

Component	Telespeed 1050 Tape Sender	Telespeed 1050 Tape Receiver
Width (inches)	16	16
Depth (inches)	23.25	23.25
Height (inches)	54.25	54.25
Weight (pounds)	176	176
Power (KVA)	0.250	0.300
Voltage ± 10%	115	115
Frequency (Hz)	60	60
Phases	1	1
Temperature Range (°F)	40-120	40-120
Humidity Range (%)	20-95	20-95
Heat (BTU/hr)	580	443

.9 PRICE DATA

Component or Feature	Purchase Price* $
Telespeed 1050 Tape Sender	1,900
Telespeed 1050 Tape Receiver	2,500
Unattended Operation	—
Protected Unattended Operation	—

* This equipment is available from Teletype Corporation on a purchase basis only. However, the same equipment is used in the Dataspeed Type 2 Service offered by AT&T on a rental basis only. For a description of this service, see Paragraph 3200.51. Pricing for optional features is available on request from Teletype Corporation.

TELETYPE TELESPEED 750 EQUIPMENT
(AT&T DATASPEED TYPE 5)

.1 GENERAL

.11 Identity: . . . . . Telespeed 750 Tape Sender;
Telespeed 750 Tape Receiver;
Dataspeed Type 5 Service.

.12 Manufacturer: . . . . . Teletype Corporation
5555 Touhy Avenue
Skokie, Illinois 60076

.13 Basic Function: . . . . . read data from paper tape and transmit it over a voice-band line.
receive data from a voice-band line and punch it into paper tape.

.15 Description

The Teletype Telespeed 750 equipment line consists of two independent units: a tape sender and a tape receiver. The two units are available separately, and the sender is available in either a table-top version or a cabinet-mounted version. In the table-top version, the electronics are placed in a separate wall-box. This equipment is available from Teletype Corporation on a purchase basis only. The Dataspeed Type 5 Service offered by AT&T utilizes this equipment and is available on a rental basis. Dataspeed Type 5 Service is described in the section on Common-Carrier Facilities; see Paragraph 3200.51.

Either chadless or fully-punched tape can be used in the Tape Sender, but the tape recreated by the Tape Receiver is always fully-punched. The Telespeed 750 components have adjustable heads to accommodate 5-level, 11/16-inch tape or 5-, 6-, 7-, or 8-level, 1-inch tape. By special request, 6-level, 7/8-inch Teletypesetter tape with advanced feed holes can be accommodated.

Data is transmitted in parallel-by-bit, serial-by-character form over a voice-band line at 75 characters per second. A total of eight bits per character is transmitted regardless of the number of levels in the tape.

Two options are available to provide unattended operation. One option provides the capability to send or receive data from an unattended terminal with no restrictions. The second option, the Protected Unattended Operation feature, requires that the unattended terminal receive a specified data character prior to establishing data communication. With either option, a connection cannot be established if the terminal is in a non-serviceable state due to equipment malfunctions or lack of power.

All reels mounted on the face of the Dataspeed sender and receiver are 7-1/2 inches in diameter with a core diameter of 1-15/16 inches. The reels are made of clear plastic with removable sides. The capacity of these reels is 800 feet of fully-punched tape or 500 feet of chadless tape. The supply reel on the tape receiver has a capacity of 3,000 feet.

.16 First Delivery: . . . . . 1964.

.17 Availability: . . . . . approximately 4 months.

.2 CONFIGURATION

Telespeed 750 equipment can be connected to either the public switched telephone network or to a common-carrier leased voice-band line. The data sets required are specified in Paragraph .72.

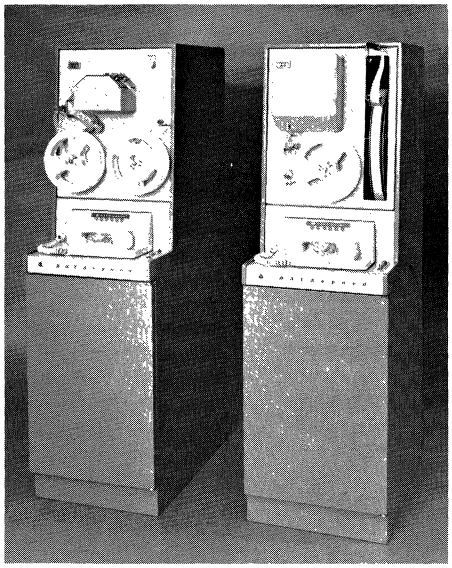


Figure 1. The Teletype Telespeed 750 Tape Sender (left) and Tape Receiver (right).

.3 INPUT

.31 Prepared Input

Telespeed 750 Tape Sender —

Input medium:	fully-punched or chadless 11/16-inch or 1-inch paper tape.
Input code:	any 5-, 6-, 7-, or 8-level code.
Quantity of data:	variable.
Rated input speed:	75 char/sec.
Effective speed:	somewhat less than rated speed, depending on block length.
Comments:	supply reel can hold 800 feet of fully-punched paper tape or 500 feet of chadless paper tape.

.32 Manual Input: . . . . . no provision.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration: . . . . . variable number of characters of data; no control characters are used.

.36 Operating Procedure

(1) Load punched tape.

(2) Establish voice communication and switch to data mode.

(3) Depress Start button.

.37 Entry of Time and Date: . . . . . no provisions.

(Contd.)

.4 OUTPUT

.41 Output to Punched Tape

Telespeed 750 Tape Receiver —

Tape size:	standard 11/16-inch or 1/inch, 5-, 6-, 7-, or 8-level paper tape.
Tape code:	binary image of received data is punched.
Rated punching speed:	75 char/sec.
Effective speed:	somewhat less than rated speed, depending on block length.
Format control:	none.
Comments:	supply reel has a capacity of 3,000 feet.

.5 ERROR DETECTION AND CORRECTION: no error detection facilities are provided except for detection of a line break.

.55 Line Malfunctions

Detection:	line breaks can be detected with Tape Sender only.
Action:	a lamp is lighted.

.6 CONDITION INDICATORS

Input device available:	none.
Input device busy:	none.
Remote receiver ready:	none.
Remote receiver busy:	none.
Power on:	lamp.
Improper data entry:	none.
Transmission error:	none.
Recording error:	none.
Line break (Tape Sender only):	lamp.
Low tape (Tape Receiver only):	lamp.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	75 char/sec (600 bits/sec).
Transmission method:	parallel by bit.
Transmission code:	any code of up to 8 levels.
Synchronization:	the receiver is activated by the beginning of each data character signal. Only a small portion of the total character time is required for detection and interpretation, so no additional bits are required to maintain synchronization.

.72 Connection to Communications Lines

Communications Line	Data Set*
Public switched telephone network:	Bell System Data-Phone Data Set 402C (send) and 402D (receive)
Common-carrier leased voice-band line:	Bell System Data Set 402C (send) and 402D (receive).

.73 Transmission Control

Call initiation:	manual dialing.
Call reception:	operator must establish communication and then switch to data mode.
	unattended operation is optional; see Description.
Functional operations:	none.

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

.74 Multistation Operation

no direct provision, but with the Protected Unattended Operation feature, a Telespeed Tape Sender will not respond to a call unless a specified data character is received.

.8 PHYSICAL SPECIFICATIONS

Component	Telespeed 750 Tape Sender			Telespeed 750 Tape Receiver
	Table-Top			
	Reader	Wall-Box	Cabinet	
Width (inches)	6	13	16	16
Depth (inches)	14	10	23.25	23.25
Height (inches)	4	16	54.25	54.25
Weight (pounds)	15	27	175	175
Power (KVA)		0.250		0.300
Voltage		115		115
Frequency (Hz)		60		60
Phases		1		1
Temperature range (°F)		40-120		40-120
Humidity range (%)		20-95		20-95
Heat (BTU/hr)		580		580

.9 PRICE DATA

Component or Feature	Purchase Price* $
Telespeed 750 Tape Sender:	
Table-top	950
Cabinet-mounted	1,400
Telespeed 750 Tape Receiver	2,600

* This equipment is available from Teletype Corporation on a purchase basis only. However, the same equipment is used in the Dataspeed Type 5 Service offered by AT&T on a rental basis only. For a description of this service, see Paragraph 3200.51. Pricing for optional features is available on request from Teletype Corporation.

TELETYPE MODEL 28 LINE

.1 GENERAL

.11	Identity:	Model 28 Receive-Only Set (RO). Model 28 Keyboard Send-Receive Set (KSR). Model 28 Automatic Send-Receive Set (ASR).
.12	Manufacturer:	Teletype Corporation 5555 Touhy Avenue Skokie, Illinois 60076
.13	Basic Function:	send and receive data over telegraph-grade lines. Different sets provide input from a keyboard or punched paper tape, output to printed copy or punched paper tape, or combinations of these.

.14 Basic Components:

Name:	Receive-Only Page Printer.
Model number:	Model 28 RO.
Function:	receives data and prints it.
Name:	Keyboard Send-Receive Set.
Model number:	Model 28 KSR.
Function:	transmits data from keyboard input; receives data and prints it.
Name:	Automatic Send-Receive Set.
Model number:	Model 28 ASR.
Function:	transmits data from keyboard or punched paper tape input; receives data and punches it into paper tape or prints it.

.15 Description

The Model 28 Line is one of four main lines of data communications equipment manufactured by Teletype. Introduced in 1951, the Model 28 Line has been used in a wide variety of applications and has compiled a long record of reliable service.

The Teletype Model 28 Line consists of an integrated family of message transmission units rated at 100 words per minute (though they are commonly operated at lower standard speeds). The Model 28 equipment uses the five-level Baudot code and is designed for heavy-duty unlimited usage.

The standard Model 28 Line consists of an RO Set, a KSR Set and an ASR Set assembled from the following Model 28 components: a page printer, a manual keyboard, a paper tape reader, and a paper tape punch. On special order, Teletype will provide other sets assembled from these components in almost any configuration.

The Model 28 Keyboard Send-Receive Set (KSR) consists of a manual keyboard for originating messages and a page printer that produces a record, on continuous paper forms, of both incoming and outgoing messages. The three-row keyboard utilizes the "LETTERS-FIGURES" shift characters of the standard Baudot code and is not compatible with standard typewriter keyboards. Printing is by means of a movable, interchangeable typebox that brings the selected character into printing position, after which the single print hammer drives it against the ribbon and paper. The type carriage moves laterally across the form as each line is printed; there is no lateral movement of the platen as in conventional typewriters. Blank paper or multi-part business forms can be used.

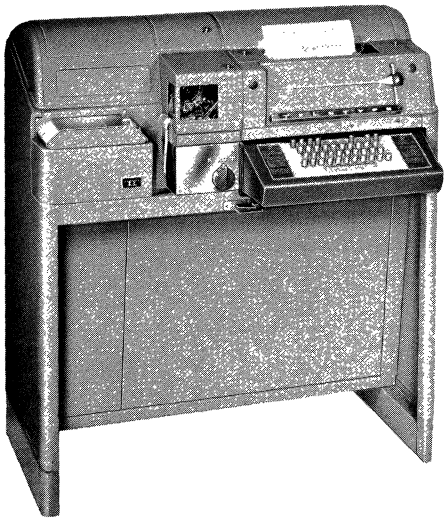


Figure 1. The Teletype Model 28 ASR Set.

.15 Description (Contd.)

The Model 28 Receive-Only Set (RO) contains the same printing and forms-handling mechanism as the Model 28 KSR unit, but has no keyboard; it cannot be used to originate messages. No attendant is needed.

The Model 28 Automatic Send-Receive Set (ASR), combines the keyboard and printing facilities of the KSR with a paper tape reader and punch. The result is a complete low-speed message originating and receiving station in a single compact cabinet. The keyboard, page printer, reader, and punch can be operated in various combinations to perform a wide variety of functions. For example, the keyboard and punch can be used for direct, off-line perforation of tape while the page printer remains free to receive incoming messages or to monitor messages transmitted from the tape reader.

The tape reader and punch use standard 11/16-inch tape in 5-level, chadless form. Several different models of punches and readers are available, including both typing and non-typing punches and single-contact and multi-contact readers. Also available is a pivoted-head reader, used in conjunction with the punch, that can "climb up the tape" and read the last character punched; this enables punched information to be retransmitted in continuous tape form, eliminating the need to tear off individual messages and insert them in the reader.

.16 First Delivery: . . . . . 1951.

.17 Availability: . . . . . approximately 4 months.

.2 CONFIGURATION

The RO Set contains a page printer only. The KSR Set contains a page printer and a keyboard. The ASR Set contains a page printer, a keyboard, a punched paper tape reader, and a punched paper tape reciever. Numerous control unit options are available, depending on the application. Other combinations of the basic page printer, keyboard, punch, and reader units can be obtained from Teletype on special order. Connections to communications facilities are described in Paragraph .72.

(Contd.)

.3 INPUT

.31 Prepared Input

Model 28 Reader (ASR Set only) —

Input medium:	11/16-inch, 5-level, fully-punched or chadless paper tape.
Input code:	5-level Baudot; see Table I.
Quantity of data:	variable.
Character set:	see Table I.
Rated input speed:	10 char/sec max.
Effective speed:	somewhat less than rated speed, depending on block length.
Comments:	several versions of the basic reader are available, including single- and multi-contact readers and a pivoted-head reader which, when used in conjunction with the punch, can "climb up" a tape just punched and read the last character punched.

.32 Manual Input

Model 28 Keyboard (ASR and KSR Sets only) —

Method of entry:	via 32-key keyboard (additional keys provide special functions).
Quantity of data:	variable.
Character set:	58 characters; upper-case letters, digits, special characters and functions; see Table I.

.33	Fixed Input:	no provision.
.34	Transaction Code Input:	no provision.
.35	Message Configuration:	1 to N data characters with control characters interspersed; control characters are keyed in or are in the paper tape input.

.36 Operating Procedure

The operating procedure can vary greatly depending on the optional control features installed and the application. See Paragraphs 3100.31, 3100.32, 3100.41, 3100.42, and 3100.43 for the manner in which Teletype units are being used in services offered by the common carriers.

.37	Entry of Time and Date:	no provision.

.4 OUTPUT

.41 Output to Punched Tape

Model 28 Punch (ASR Set only) —

Tape size:	chadless, 11/16-inch, 5-level.
Tape code:	5-level Baudot; see Table 1.
Rated punching speed:	10 char/sec max.
Effective speed:	somewhat less than rated speed, depending on block length.
Format control:	none.
Comments:	several versions are available, including punches which produce fully-punched tape and punches which also print the data characters.

TABLE I: BAUDOT 5-LEVEL CODE

BIT PATTERN	LETTERS	FIGURES ①	FIGURES ②	FIGURES ③
0 0 0 0 0	BLANK	-	BLANK	≈
0 0 0 0 1	T	5	5	5
0 0 0 1 0	CARRIAGE RET	CARRIAGE RET	CARRIAGE RET	CARRIAGE RET
0 0 0 1 1	0	9	9	9
0 0 1 0 0	SPACE	SPACE	SPACE	SPACE
0 0 1 0 1	H	↓	BLANK	#
0 0 1 1 0	N		7/8	,
0 0 1 1 1	M	ⓘ	.	.
0 1 0 0 0	LINE FEED	LINE FEED	LINE FEED	LINE FEED
0 1 0 0 1	L	↖	3/4	)
0 1 0 1 0	R	4	4	4
0 1 0 1 1	G	↘	&	&
0 1 1 0 0	I	8	8	8
0 1 1 0 1	P	0	0	0
0 1 1 1 0	C	○	1/8	:
0 1 1 1 1	V	⊖	3/8	;
1 0 0 0 0	E	3	3	3
1 0 0 0 1	Z	+	"	"
1 0 0 1 0	D	↗	$	$
1 0 0 1 1	B	⊕	5/8	?
1 0 1 0 0	S	BELL	BELL	BELL
1 0 1 0 1	Y	6	6	6
1 0 1 1 0	F	→	1/4	!
1 0 1 1 1	X	/	/	/
1 1 0 0 0	A	↑	-	-
1 1 0 0 1	W	2	2	2
1 1 0 1 0	J	↙	'	'
1 1 0 1 1	FIG. SHIFT	FIG. SHIFT	FIG. SHIFT	FIG. SHIFT
1 1 1 0 0	U	7	7	7
1 1 1 0 1	Q	1	1	1
1 1 1 1 0	K	←	1/2	(
1 1 1 1 1	LTR. SHIFT	LTR. SHIFT	LTR. SHIFT	LTR. SHIFT

① Weather Set
② Fractions Set
③ Communications Set

(Contd.)

.44 Output to Printer

Model 28 Page Printer (RO, KSR and ASR Sets) —

Output medium:	friction-fed forms, 85 char/line max. pin-fed forms, 80 char/line max.
Character set:	58 characters; upper-case alphabetics, numerics, and specials; see Table I.
Rated printing speed:	10 char/sec max.
Effective speed:	somewhat less than rated speed due to operations such as carriage return, line feed, etc.
Format control:	through the use of special control codes in the received data.

.5 ERROR DETECTION AND CORRECTION: no detection facilities other than visual verification of manual input.

.6 CONDITION INDICATORS: various indicators can be supplied, depending upon the application.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	10 char/sec (74.2 bits/sec).
Transmission method:	serial by bit.
Transmission code:	5-level Baudot code plus start and stop bits for each character.
Transmission mode:	half-duplex or full-duplex.
Order of bit transmission:	low-order bit of each character is transmitted first.
Synchronization:	start and stop bits are transmitted with each character. Start pulse is one bit-time in length; stop pulse is 1.42 bit-times in length.
Comments:	if desired, these units can be obtained for transmission rates of 60, 66, or 75 words/min using a 7.0 or 7.5 unit code.

.72 Connection to Communications Lines

Communications Line	Data Set*
Common-carrier leased telegraph-grade line (up to 75 bits/sec):	none required.
Common-carrier leased narrow-band Data Channels (up to 75 bits/sec):	Bell System Data Set 103F or Western Union 75 Baud Data Modem.

.73 Transmission Control

Call initiation:	manual dialing or signaling.
Call reception:	capable of unattended operation.
Functional operations:	carriage return, line feed, bell, letters shift, and figures shift are initiated by special control codes.

.74 Multistation Operation: various control units permit a wide range of multistation operation techniques. Facilities provided can range from uncontrolled receiving by all stations (broadcast operation) to selective polling and addressing.

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

.8 PHYSICAL SPECIFICATIONS

Component	Model 28 RO	Model 28 KSR	Model 28 ASR
Width (inches)	20.5	20.5	36
Depth (inches)	18.5	23	23
Height with stand (inches)	39	39	39
Weight (pounds)	115	130	260
Power (KW)	0.082	0.085	0.153
Voltage ± 10%	115	115	115
Frequency (Hz), ± 0.45 Hz	60	60	60
Phases	1	1	1
Temperature range (°F)	40-120	40-120	40-120
Humidity range (%)	0-90	0-90	0-90
Heat (BTU/hr)	341	341	461

.9 PRICE DATA

Component or Feature	Approximate Purchase Price* $
Model 28 RO	1,200
Model 28 KSR	1,400
Model 28 ASR	2,300

* This equipment is available from Teletype Corporation on a purchase basis only. However, the same equipment is provided on a rental basis as part of many of the common-carrier switched services and multisatation leased systems; see Paragraphs 3100.3 and 3100.4 in the Common-Carrier Facilities section.

TELETYPE MODEL 32 LINE

.1 GENERAL

.11	Identity:	Model 32 Receive-Only Set (RO). Model 32 Keyboard Send-Receive Set (KSR). Model 32 Automatic Send-Receive Set (ASR).
.12	Manufacturer:	Teletype Corporation 5555 Touhy Avenue Skokie, Illinois 60076.
.13	Basic Function:	send and receive data over telegraph-grade lines. Different sets provide input from a keyboard or punched paper tape, output to printed copy or punched paper tape, or combinations of these.

.14 Basic Components

Name:	Receive-Only Set.
Model number:	Model 32 RO.
Function:	receives data and prints it.
Name:	Keyboard Send-Receive Set.
Model number:	Model 32 KSR.
Function:	transmits data from keyboard input; receives data and prints it.
Name:	Automatic Send-Receive Set.
Model number:	Model 32 ASR.
Function:	transmits data from punched paper tape or keyboard input; receives data and punches it into paper tape or prints it.

.15 Description

The Model 32 Line is one of four main lines of data communications equipment being manufactured by Teletype Corporation. Announced in 1963 as a low-cost supplement to the already-existing Model 28 Line (Report 6801), the Model 32 equipment uses the five-level Baudot code and is intended for "standard-duty" use. All units can be obtained for operation at 60, 66, or 100 words per minute, using a 7.0-, 7.42-, or 7.5-unit code.

The standard Model 32 line consists of an RO Set, a KSR Set, and an ASR Set assembled from the following Model 32 components: a page printer, a manual keyboard, a paper tape reader, and a paper tape punch. On special order, Teletype will provide other sets assembled from these components in almost any configuration.

The Model 32 Keyboard Send-Receive Set (KSR), consists of a manual keyboard for originating messages and a page printer that produces a record, on continuous paper forms, of both incoming and outgoing messages. The three-row keyboard utilizes the "LETTERS-FIGURES" shift characters of the standard Baudot code and is not compatible with standard typewriter keyboards.

The Model 32 Receive-Only Set (RO) contains the same printing and forms-handling mechanism as the Model 32 KSR Set, but has no keyboard; it cannot be used to originate messages. No attendant is needed.

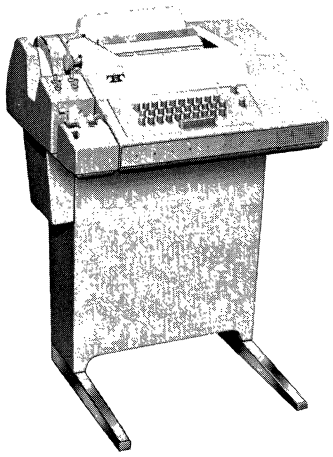


Figure 1. The Teletype Model 32 ASR Set.

.15 Description (Contd.)

The Model 32 Automatic Send-Receive Set (ASR) combines the keyboard and printing facilities of the KSR with a paper tape reader and punch. The result is a complete low-speed message originating and receiving station in a single cabinet only 22 inches wide. The tape reader and punch use standard 5-level, 11/16-inch tape. The punch has a Tape Release button to facilitate tape insertion and removal, and a Backspace button to facilitate error deletion. The punch can be used on-line to produce a tape record of incoming messages, or off-line as a keyboard-actuated tape preparation unit. The mechanical tape reader has a "freewheeling" control that makes it easy to reposition or remove the tape.

The Model 32 units can be equipped with dialing units, pushbutton controls, and data sets to adapt them for use with the public telephone network. They can communicate with unattended remote stations, turning them on, transmitting messages to them, and then turning them off. An automatic answer-back mechanism enables unattended receivers to identify themselves and notify the transmitting station that they are ready to receive messages.

.16 First Delivery: . . . . . 1963.

.17 Availability: . . . . . approximately 4 months.

.2 CONFIGURATION

The RO Set contains a page printer only. The KSR Set contains a page printer and a keyboard. The ASR Set contains a page printer, a keyboard, a punched paper tape reader, and a punched paper tape receiver. Numerous control unit options are available depending on the application. Other combinations of the basic page printer, keyboard, punch, and reader units can be obtained from Teletype on special order. Connections to communications facilities are described in Paragraph .72.

.3 INPUT

.31 Prepared Input

Model 32 Tape Reader (ASR Set only) —

Input medium:	11/16-inch, 5-level, fully-punched paper tape.
Input code:	5-level Baudot; see Table I in Report 6802.
Quantity:	variable.
Character set:	see Table I in Report 6802.
Rated input speed:	10 char/sec max.
Effective speed:	somewhat less than rated speed, depending on block length.

.32 Manual Input

Model 32 (ASR and KSR Sets only) —

Method of entry:	via 3-row, 32-key keyboard (additional keys provide special functions).
Quantity of data:	variable.
Character set:	58 characters: upper-case letters, digits, special characters, and functions; see Table I in Report 6802.

.33 Fixed Input: no provision, except for a 20-character reply to a Figs D inquiry; these characters are set up in the answer-back mechanism and are usually used to identify the station.

.34 Transaction Code Input: no provision.

.35 Message Configuration: 1 to N data characters with control characters interspersed; control characters are keyed in or are in the paper tape input.

.36 Operating Procedure

The operating procedure can vary greatly depending on the optional control features installed and the application.

.37 Entry of Time and Date: no provision.

.4 OUTPUT

.41 Output to Punched Tape

Model 32 Punch (ASR Set only) —

Tape size:	fully-punched, 11/16-inch, 5-level.
Tape code:	5-level Baudot; see Table I in Report 6802.
Rated punching speed:	somewhat less than rated speed, depending on block length.
Format control:	none.

.44 Output to Printer

Model 32 Page Printer (RO, KSR, and ASR Sets) —

Output medium:	friction-fed forms, 72 char/line max. pin-fed forms, 72 char/line max.
Character set:	58 characters; upper-case alphabetics, numerics, and specials; see Table I in Report 6802.
Rated printing speed:	10 char/sec max.
Effective speed:	somewhat less than rated speed due to operations such as carriage return, line feed, etc.
Format control:	through the use of special control codes in the received data.

.5 ERROR DETECTION AND CORRECTION: no detection facilities other than visual verification of manual input.

.6 CONDITION INDICATORS: various indicators can be supplied, depending upon the application.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	10 char/sec (70 to 75 bits/sec, depending on length of stop pulse.)
Transmission method:	serial by bit.
Transmission code:	5-level Baudot code plus start and stop bits for each character.
Transmission mode:	half-duplex or full-duplex.
Order of bit transmission:	low-order bit is transmitted first.
Synchronization:	start and stop bits are transmitted with each character. Start pulse is one bit-time in length; stop pulse is 1.00, 1.42, or 1.50 bit-times in length.

.72 Connection to Communications Lines

Communications Line	Data set*
Common-carrier leased telegraph-grade line (up to 75 bits/sec):	none required.
Common-carrier leased narrow-band Data Channels:	Bell System Data Set 103F or Western Union 75 Baud Data Modem.

.73 Transmission Control

Call initiation:	manual dialing or signaling.
Call reception:	capable of unattended operation.
Functional operations:	carriage return, line feed, bell, letters shift, figures shift, etc. are initiated by special control codes.

.74 Multistation Operation: various control units permit a wide range of multistation operation techniques. Facilities provided can range from uncontrolled receiving by all stations (broadcast operation) to selective polling and addressing.

.8 PHYSICAL SPECIFICATIONS

Component:	Model 32 RO	Model 32 KSR	Model 32 ASR
Width (inches)	18.625	18.625	22
Depth (inches)	18.5	18.5	18.5
Height with stand (inches)	32.875	32.875	32.875
Weight (lbs)	51	52	56
Power (KW)	0.058	0.058	0.075
Voltage, ±10%	115	115	115
Frequency (Hz), ±0.45 Hz	60	60	60
Phases	1	1	1
Temperature range (°F)	40-120	40-120	40-120
Humidity range (%)	0-90	0-90	0-90
Heat (BTU/hr)	320	320	370

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

.9 PRICE DATA

Component or Feature	Purchase Price* $
Model 32 RO	400-500
Model 32 KSR	450-550
Model 32 ASR	650-750

* This equipment is available from Teletype Corporation on a purchase basis only.

TELETYPE MODEL 33 LINE

.1 GENERAL

.11 Identity: . . . . . Model 33 Receive-Only Set (RO).
Model 33 Keyboard Send-Receive Set (KSR).
Model 33 Automatic Send-Receive Set (ASR).

.12 Manufacturer: . . . . . Teletype Corporation
5555 Touhy Avenue
Skokie, Illinois 60076

.13 Basic Function: . . . . . send and receive data over telegraph-grade lines. Different sets provide input from a keyboard or punched paper tape, output to printed copy or punched paper tape, or combinations of these.

.14 Basic Components

Name: . . . . . Receive-Only Set.
Model number: . . . . . Model 33 RO.
Function: . . . . . receives data and prints it.

Name: . . . . . Keyboard Send-Receive Set.
Model number: . . . . . Model 33 KSR.
Function: . . . . . transmits data from keyboard input; receives data and prints it.

Name: . . . . . Automatic Send-Receive Set.
Model number: . . . . . Model 33 ASR.
Function: . . . . . transmits data from punched paper tape or keyboard input; receives data and punches it into paper tape or prints it.

.15 Description

The Model 33 Line is one of four main lines of data communications equipment being manufactured by Teletype Corporation. Announced in 1963 as a low-cost companion to the Model 35 Line (Report 6805), the Model 33 equipment has the same general appearance and design as the 5-level Model 32 Line described on page 6803:01; the difference is that the Model 33 units use the 8-level, 11.0-unit USASCII code and standard, 4-row typewriter keyboards. The Model 33 equipment is incompatible with the 5-level equipment in the Model 28 and Model 32 lines. All Model 33 units are designed for "standard-duty" use at speeds of 60, 66, or 100 words per minute.

The standard Model 33 Line consists of an RO Set, a KSR Set, and an ASR Set assembled from the following Model 33 components: a page printer, a manual keyboard, a paper tape reader, and a paper tape punch. On special order, Teletype will provide other sets assembled from these components in almost any configuration.

The Model 33 Keyboard Send-Receive Set (KSR), consists of a manual keyboard for originating messages and a page printer that produces a record, on continuous paper forms, of both incoming and outgoing messages. The four-row keyboard is compatible with standard typewriter keyboards.

The Model 33 Receive-Only Set (RO) contains the same printing and forms-handling mechanism as the KSR Set, but has no keyboard; it cannot be used to originate messages. No attendant is needed.

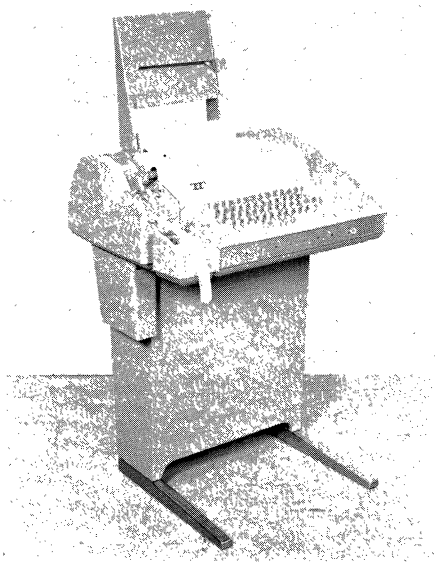


Figure 1. The Teletype Model 33 ASR Set.

.15 Description (Contd.)

The Model 33 Automatic Send-Receive Set (ASR) combines the keyboard and printing facilities of the KSR with a paper tape reader and punch. The result is a complete low-speed message originating and receiving station in a single cabinet only 22 inches wide. The paper tape reader and punch use standard 8-level, 1-inch tape. The punch has a Tape Release button to facilitate tape insertion and removal, and a Backspace button to facilitate error deletion. The punch can be used on-line to produce a tape record of incoming messages, or off-line as a keyboard-actuated tape preparation unit. The mechanical tape reader has a "freewheeling" control that makes it easy to reposition or remove the tape.

The Model 33 units can be equipped with dialing units, pushbutton controls, and data sets for use with telephone lines. They can communicate with unattended remote stations, turning them on, transmitting messages to them, and then turning them off. An automatic answer-back mechanism enables unattended receivers to identify themselves and notify the transmitting station that they are ready to receive messages.

.16 First Delivery: . . . . . 1963.

.17 Availability: . . . . . approximately 4 months.

.2 CONFIGURATION

The RO Set contains a page printer only. The KSR Set contains a page printer and a keyboard. The ASR Set contains a page printer, a keyboard, a punched paper tape reader, and a punched paper tape punch. Numerous control unit options are available, depending on the application. Other combinations of the basic page printer, keyboard, punch, and reader units can be obtained from Teletype on special order. Connection to communications facilities are described in Paragraph .72.

.3 INPUT

.31 Prepared Input

Model 33 Tape Reader (ASR Set only) —

Input medium:	1-inch, fully-punched, 8-level paper tape.
Input code:	USASCII; see Table I.
Quantity of data:	variable.
Character set:	see Table I.
Rated input speed:	10 char/sec max.
Effective speed:	somewhat less than rated speed, depending on block length.

.32 Manual Input

Model 33 Keyboard (ASR and KSR Sets only) —

Method of entry:	via 4-row, 45-key keyboard (additional keys provide special functions).
Quantity of data:	variable.
Character set:	96 characters: upper-case letters, digits, special characters, and control codes; see Table I and Table II.
Comments:	the layout of the keys is similar to that of a standard typewriter keyboard.

.33 Fixed Input: ..... no provision, except for a 20-character reply to an ENQ (WRU) inquiry; these characters are set up in the answer-back mechanism and are usually used to identify the station.

.34 Transaction Code Input: ..... no provision.

.35 Message Configuration: ..... 1 to N data characters with control characters interspersed; control characters are keyed in or are in the paper tape input.

.36 Operating Procedure

The operating procedure can vary greatly depending on the optional control features installed and the application. See Paragraphs 3100.31, 3100.32, 3100.41, 3100.42, and 3100.43 for the manner in which Teletype units are being used in services offered by the common carriers.

.37 Entry of Time and Date: ..... no provisions.

.4 OUTPUT

.41 Output to Punched Tape

Model 33 Punch (ASR Set only) —

Tape size:	1-inch, fully-punched, 8-level paper tape.
Tape code:	8-level USASCII; see Table I.
Rated punching speed:	10 char/sec max.
Effective speed:	somewhat less than rated speed, depending on block length.
Format control:	none.

TABLE I: USASCII (UNITED STATES OF AMERICA STANDARD CODE FOR INFORMATION INTERCHANGE)

Bits 4, 3, 2, 1	Bits 7, 6, 5							
	000	001	010	011	100	101	110	111
0000	NUL	DLE	SP	0	@	P	UNUSED	
0001	SOH	DC_1	!	1	A	Q		
0010	STX	DC_2	"	2	B	R		
0011	ETX	DC_3	#	3	C	S		
0100	EOT	DC_4	$	4	D	T		
0101	ENQ	NAK	%	5	E	U		
0110	ACK	SYN	&	6	F	V		
0111	BEL	ETB	'	7	G	W		
1000	BS	CAN	(	8	H	X		
1001	HT	EM	)	9	I	Y		
1010	LF	SUB	*	:	J	Z		
1011	VT	ESC	+	;	K	[		
1100	FF	FS	,	<	L	\		¦
1101	CR	GS	-	=	M	]		}
1110	SO	RS	.	>	N	Λ		~
1111	SI	US	/	?	O	—		DEL

Note: The eighth bit (not shown) is transmitted as even parity by Teletype Models 33 and 35.

.44 Output to Printer

Model 33 Page Printer (RO, KSR, and ASR Sets) —

Output medium: . . . . . friction-fed forms, 72 char/line max.
pin-fed forms, 72 char/line max.

Character set: . . . . . 64 printable characters: upper-case alphabetics, numerics, specials, and control codes.

Rated printing speed: . . . . . 10 char/sec max.

Effective speed: . . . . . somewhat less than rated speed due to operations such as carriage return, line feed, etc.

Format control: . . . . . through the use of special control codes in the received data.

.5 ERROR DETECTION AND CORRECTION: . . even parity is generated and transmitted; no detection facilities except for visual verification of manual input.

(Contd.)

TABLE II: USASCII CONTROL CODE IDENTIFICATION AND GENERATION (1)

Code	Identity	Generation (2)		
		S	C	L
ACK	Acknowledge		*	F
BEL	Bell		*	G
BS	Backspace		*	H
CAN	Cancel		*	X
CR	Carriage Return		*	M
DC_1	Device Control		*	Q
DC_2	Device Control		*	R
DC_3	Device Control		*	S
DC_4	Device Control (Stop)		*	T
DEL	Delete		Rub-Out	
DLE	Data Link Escape		*	P
EM	End of Medium		*	Y
ENQ	Enquiry		*	E
EOT	End of Transmission		*	D
ESC	Escape	*	*	K
ETB	End of Transmission Block		*	W
ETX	End of Text		*	C
FF	Form Feed		*	L
FS	File Separator	*	*	L
GS	Group Separator	*	*	M
HT	Horizontal Tab		*	I
LF	Line Feed		*	J
NAK	Negative Acknowledge		*	U
NUL	Null	*	*	P
RS	Record Separator	*	*	N
SI	Shift In		*	O
SO	Shift Out		*	N
SOH	Start of Heading		*	A
STX	Start of Text		*	B
SUB	Substitute		*	Z
SYN	Synchronous Idle		*	V
US	Unit Separator	*	*	O
VT	Vertical Tab		*	K

(1) These control codes are presently generated and interpreted by Model 33 and 35 Teletype equipment.

(2) Control character generation, in most cases, is performed by simultaneously depressing the Control (C) key and the appropriate letter (L) key; the Shift (S) key must be depressed in addition to the control and letter keys where specified. Separate keys are also provided for Carriage Return, Escape, and Line Feed codes.

.6 CONDITION INDICATORS: . . . . . various indicators can be supplied, depending upon the application.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed: . . . . . 10 char/sec (110 bits/sec).
Transmission method: . . . . . serial by bit.
Transmission code: . . . . . 8-level USASCII plus start and stop bits for each character.
Transmission mode: . . . . . half-duplex or full-duplex.
Order of bit transmission: . . . . . start bit followed by character bits, low-order bit first, and stop bits.
Synchronization: . . . . . start and stop bits are transmitted with each character. Start pulse is one bit-time in length; stop pulse is two bit-times in length.

.72 Connection to Communications Lines

Communications Line	Data Set*
Western Union 180 Baud leased service:	Western Union 180 Baud Data Modem
Bell System or Western Union Type 1006 Data Channel:	Bell System Data Set 103F or Western Union 180 Baud Data Modem

.73 Transmission Control

Call initiation:	manual dialing or signaling.
Call reception:	capable of unattended operation.
Functional operations:	carriage return, line feed, bell, horizontal tab, vertical tab, etc. are initiated by special control codes.

.74 Multistation Operation: various control units permit a wide range of multistation operation techniques. Facilities provided can range from uncontrolled receiving by all stations (broadcast operation) to selective polling and addressing.

.8 PHYSICAL SPECIFICATIONS

Component	Model 33 RO	Model 33 KSR	Model 33 ASR
Width (inches)	18.625	18.625	22
Depth (inches)	18.5	18.5	18.5
Height with stand (inches)	32.875	32.875	32.875
Weight with stand (pounds)	51	56	56
Power (KW)	0.092	0.110	0.110
Voltage, ±10%	115	115	115
Frequency (Hz), ±0.45 Hz	60	60	60
Phases	1	1	1
Temperature Range (°F)	40-120	40-120	40-120
Humidity Range (%)	0-90	0-90	0-90
Heat (BTU/hr)	409	409	682

.9 PRICE DATA

Component or Feature	Approximate Purchase Price** $
Model 33 RO	500-600
Model 33 KSR	550-650
Model 33 ASR	700-850

* In some cases, equivalent data sets can be used; see Sections 4620 and 4640 for a current list of modems available from independent manufacturers of telephone equipment.

** This equipment is available from Teletype Corporation on a purchase basis only. However, the same equipment is provided on a rental basis as part of many of the common-carrier switched services and multistation leased systems; see Paragraphs 3100.3 and 3100.4 in the Common-Carrier Facilities section.

TELETYPE MODEL 35 LINE

.1 GENERAL

.11 Identity: . . . . . Model 35 Receive-Only Set (RO).
Model 35 Keyboard Send-Receive Set (KSR).
Model 35 Automatic Send-Receive Set (ASR).

.12 Manufacturer: . . . . . Teletype Corporation
5555 Touhy Avenue
Skokie, Illinois 60076

.13 Basic Function: . . . . . send and receive data over telegraph-grade lines. Different sets provide input from a keyboard or punched paper tape, output to printed copy or punched paper tape, or combinations of these.

.14 Basic Components

Name: . . . . . Receive-Only Set.
Model number: . . . . . Model 35 RO.
Function: . . . . . receives data and prints it.

Name: . . . . . Keyboard Send-Receive Set.
Model number: . . . . . Model 35 KSR.
Function: . . . . . transmits data from keyboard input, receives data and prints it.

Name: . . . . . Automatic Send-Receive Set.
Model number: . . . . . Model 35 ASR.
Function: . . . . . transmits data from punched paper tape or keyboard input; receives data and punches it into paper tape or prints it.

.15 Description

The Model 35 Line is one of four main lines of data communications equipment manufactured by Teletype Corporation. Announced in 1963, the Model 35 equipment uses the 8-level, 11.0-unit USASCII code and is designed for heavy-duty, unlimited usage at a speed of 100 words per minute. The Model 35 equipment is compatible with the less-expensive, lighter-duty Teletype Model 33 Line (Report 6804), but is incompatible with the 5-level Teletype Model 28 and Model 32 equipment.

The standard Model 35 Line consists of an RO Set, a KSR Set, and an ASR Set assembled from the following Model 35 components: a page printer, a manual keyboard, a paper tape reader, and a paper tape punch. On special order, Teletype will provide other sets assembled from these components in almost any configuration.

The Model 35 Keyboard Send-Receive Set (KSR) consists of a manual keyboard for originating messages and a page printer that produces a record, on continuous paper forms, of both incoming and outgoing messages. The four-row keyboard is compatible with standard typewriter keyboards. Both friction-feed and sprocket-feed platens are available.

The Model 35 Receive-Only Set (RO) contains the same printing and forms-handling mechanism as the KSR Set, but has no keyboard; it cannot be used to originate messages. No attendant is needed.

The Model 35 Automatic Send-Receive Set (ASR) combines the keyboard and printing facilities of the KSR with a paper tape reader and punch. The result is a complete low-speed message

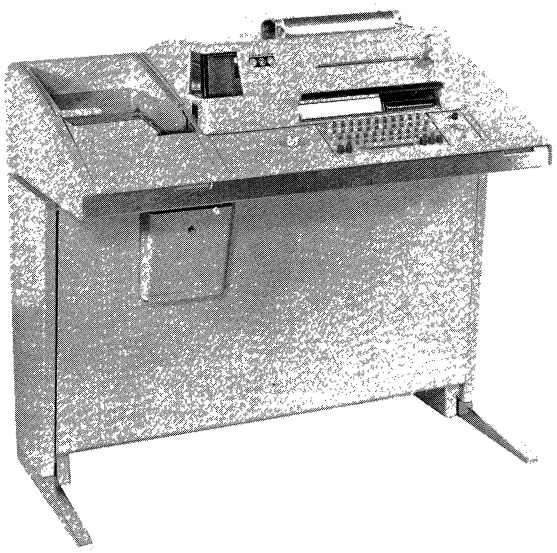


Figure 1. The Teletype Model 35 ASR Set.

.15 Description (Contd.)

originating and receiving station in a single compact cabinet. The reader and punch use standard 1-inch, 8-level tape. A mode-switching panel contains controls that permit two separate operations to be performed at the same time without interfering with each other (e.g., keyboard-activated tape punching in combination with printing of incoming messages).

The Model 35 units can be equipped with dialing units, pushbutton controls, and data sets for use with telephone lines. They can communicate with unattended remote stations, turning them on, transmitting messages to them, and then turning them off. An automatic answer-back mechanism enables unattended receivers to identify themselves and notify the transmitting station that they are ready to receive messages.

.16 First Delivery: . . . . . 1963.

.17 Availability: . . . . . approximately 4 months.

.2 CONFIGURATION

The RO Set contains a page printer only. The KSR Set contains a page printer and keyboard. The ASR Set contains a page printer, a keyboard, a punched paper tape reader and a punched paper tape receiver. Numerous control unit options are available, depending on the application. Other combinations of the basic page printer, keyboard, punch, and reader units can be obtained from Teletype on special order. Connections to communications facilities are described in Paragraph .72.

(Contd.)

.3 INPUT

.31 Prepared Input

Model 35 Tape Reader (ASR Set only) —

Input medium:	1-inch, fully-punched, 8-level paper tape.
Input code:	8-level USASCII, see Table I in Report 6804.
Quantity of data:	variable.
Character set:	see Table I in Report 6804.
Rated input speed:	10 char/sec max.
Effective speed:	somewhat less than rated speed, depending on block length.

.32 Manual Input

Model 35 Keyboard (ASR and KSR Sets only) —

Method of entry:	via 4-row, 45-key keyboard (additional keys provide special functions).
Quantity of data:	variable.
Character set:	96 characters: upper-case letters, digits, special characters and control codes; see Table I and Table II in Report 6804.

.33 Fixed Input:	no provision, except for a 20-character reply to an "ENQ" (WRU) inquiry; these characters are set up in the answer-back mechanism and are usually used to identify the station.
.34 Transaction Code Input:	no provision.
.35 Message Configuration:	1 to N data characters with control characters interspersed; control characters are keyed in or are in the paper tape input.

.36 Operating Procedure

The operating procedure can vary greatly depending on the optional control features installed and the application. See Paragraphs 3100.31, 3100.32, 3100.41, 3100.42, and 3100.43 for the manner in which Teletype units are being used in services offered by the common carriers.

.37 Entry of Time and Date:	no provisions.

.4 OUTPUT

.41 Output to Punched Tape

Model 35 Punch (ASR Set only) —

Tape size:	1-inch, fully-punched, 8-level paper tape.
Tape code:	8-level USASCII; see Table I in Report 6804.
Rated punching speed:	10 char/sec max.
Effective speed:	somewhat less than rated speed, depending on block length.
Format control:	none.

.44 Output to Printer

Model 33 Page Printer (RO, KSR, and ASR Sets) —

Output medium:	friction-fed forms, 85 char/line max. pin-fed forms, 80 char/line max.
Character set:	64 printable characters: upper-case alphabetics, numerics and specials; see Table I in Report 6804.
Rated printing speed:	10 char/sec max.
Effective speed:	somewhat less than rated speed due to operations such as carriage return, line feed, etc.
Format control:	through the use of special control codes in the received data.

.5 ERROR DETECTION AND CORRECTION: even parity is generated and transmitted; no detection facilities except for visual verification of manual input.

.6 CONDITION INDICATORS: various indicators can be supplied, depending upon the application.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	10 char/sec (110 bits/sec.)
Transmission method:	serial by bit.
Transmission code:	8-level USASCII plus start and stop bits for each character.
Transmission mode:	half-duplex or full-duplex.
Order of bit transmission:	start bit followed by character bits, low-order bit first, and stop bits.
Synchronization:	start and stop bits are transmitted with each character. Start pulse is one bit-time in length; stop pulse is two bit-times in length.

.72 Connection to Communications Lines

Communications Line	Data Set*
Western Union 180 Baud Data Channel:	Western Union 180 Baud Data Modem.
Bell System or Western Union Type 1006 Data Channel:	Bell System Data Set 103F or Western Union 180 Baud Data Modem.

.73 Transmission Control

Call initiation:	manual dialing or signaling.
Call reception:	capable of unattended operation.
Functional Operations.	carriage return, line feed, bell, horizontal tab, vertical tab, etc. are initiated by special control codes.

.74 Multistation Operation: various control units permit a wide range of multistation operation techniques. Facilities provided can range from uncontrolled receiving by all stations (broadcast operation) to selective polling and addressing.

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

.8 PHYSICAL SPECIFICATIONS

Component	Model 35 R/O	Model 35 KSR	Model 35 ASR
Width (inches)	20	20	40
Depth (inches)	24	24	24
Height with stand (inches)	38.5	38.5	38.5
Weight with stand (pounds)	164	180	320
Power (KW)	0.116	0.120	0.207
Voltage, ±10%	115	115	115
Frequency (Hz), ±0.45 Hz	60	60	60
Phases	1	1	1
Temperature Range (°F)	40-120	40-120	40-120
Humidity Range (%)	0-90	0-90	0-90
Heat (BTU/hr)	409	409	682

.9 PRICE DATA

Component or Feature	Approximate Purchase Price* $
Model 35 RO	1,300-1,400
Model 35 KSR	1,600-1,800
Model 35 ASR	2,600-2,800

* This equipment is available from Teletype Corporation on a purchase basis only. However, the same equipment is provided on a rental basis as part of many of the common-carrier switched services and multistation leased systems; see Paragraphs 3100.3 and 3100.4 in the Common-Carrier Facilities section.

TELETYPE MODEL 37

.1 GENERAL

.11	Identity:	Model 37 Receive-Only Set (RO). Model 37 Keyboard Send-Receive Set (KSR). Model 37 Automatic Send-Receive Set (ASR).
.12	Manufacturer:	Teletype Corporation 5555 Touhy Avenue Skokie, Illinois 60076
.13	Basic Function:	send and receive data over telegraph-grade lines. Different sets provide input from a keyboard or punched paper tape, output to printed copy or punched paper tape, or combinations of these.

.14 Basic Components

Name:	Receive-Only Set.
Model number:	Model 37 RO.
Function:	receives data and prints it.
Name:	Keyboard Send-Receive Set.
Model number:	Model 37 KSR.
Function:	transmits data from keyboard input, receives data and prints it.
Name:	Automatic Send-Receive Set.
Model number:	Model 37 ASR.
Function:	transmits data from punched paper tape or keyboard input; receives data and punches it into paper tape or prints it.

.15 Description

The Model 37 Line is one of five main lines of data communications equipment manufactured by Teletype Corporation. Announced in 1966, the Model 37 equipment uses a 7-level, 10-unit code and is designed for heavy-duty, unlimited usage at speeds up to 150 words per minute.

The standard Model 37 Line consists of an RO Set, a KSR Set, and an ASR Set assembled from the following Model 37 components: a page printer, a manual keyboard, a paper tape reader, and a paper tape punch. On special order, Teletype will provide other sets assembled from these components in almost any configuration.

The Model 37 Keyboard Send-Receive Set (KSR) consists of a manual keyboard for originating messages and a page printer that produces a record, on continuous paper forms, of both incoming and outgoing messages. The four-row keyboard is compatible with standard typewriter keyboards. Both friction-feed and sprocket-feed platens are available.

The Model 37 Receive-Only Set (RO) contains the same printing and forms-handling mechanism as the KSR Set, but has no keyboard; it cannot be used to originate messages. An attendant is not required.

Figure 1. The Teletype Model 37 ASR Set.

.15 Description (Contd.)

The Model 37 Automatic Send-Receive Set (ASR) combines the keyboard and printing facilities of the KSR with a paper tape reader and punch. The result is a complete low-speed message originating and receiving station in a single compact cabinet. The paper tape reader and punch use standard 1-inch, 5 to 8-level tape. A mode-switching panel contains controls that permit two separate operations to be performed at the same time without interfering with each other (e.g., keyboard-activated tape punching in combination with printing of incoming messages). The Model 37 units can be equipped with dialing units, pushbutton controls, and data sets for use with telephone lines. They can communicate with unattended remote stations, turning them on, transmitting messages to them, and then turning them off. An automatic answerback mechanism enables unattended receivers to identify themselves and notify the transmitting station that they are ready to receive messages.

Four features distinguish the Model 37 from earlier Teletype sets (see Reports 6802 through 6805):

(1) It is faster; it can receive and print data at up to 15 characters per second.

(2) It can generate and print all of the 128 character codes contained in the U.S.A. Standard Code for Information Interchange (USASCII, formerly ASCII).

(3) The appearance and arrangement of the keyboard have been altered to conform to that of a conventional typewriter, as shown in the photograph.

(4) Forward and reverse line feeds can be executed a half-line at a time.

The capability for transmitting and receiving 128 different code combinations, including both upper-case and lower-case letters, will greatly aid in applications such as on-line text editing, which is now being implemented in some time-sharing computer arrangements. The Model 37 will also be available for operation with any 5-, 6-, 7-, or 8-level code, including odd or even parity, and can print in two colors if desired.

(Contd.)

.15 Description (Contd.)

Other features provided with the new keyboard include two Shift keys, two Control keys, a Shift Lock key, and elimination of the need for a Repeat key. Characters can be repeated by depressing the appropriate keys below their normal down positions. Control codes can be generated from either the upper or lower case shift. Since line feeds can be executed a half-line at a time in either direction, scientific symbols having subscripts and superscripts, as well as charts, can be printed.

The revised keyboard reduces the amount of training required to convert a typist to a teletypewriter operator. It also makes it more convenient to use the Model 37 for off-line copy preparation since an ordinary typist can operate it.

.16 First Delivery: . . . . . 1968.

.17 Availability: . . . . . 6 months.

.2 CONFIGURATION

The RO Set contains a page printer only. The KSR Set contains a page printer and a keyboard. The ASR Set contains a page printer, a keyboard, a punched paper tape reader and a punched paper tape receiver. Numerous control unit options are available, depending on the application. Other combinations of the basic page printer, keyboard, punch, and reader units can be obtained from Teletype on special order. Connections to communications facilities are described in Paragraph .72.

.3 INPUT

.31 Prepared Input

Model 37 Paper Tape Reader (ASR Set only) —

Input medium:	1-inch, fully-punched, 8-level paper tape.
Input code:	7-level USASCII plus even parity; see Table I.
Quantity of data:	variable.
Character set:	see Table I.
Rated input speed:	15 char/sec max.
Effective speed:	somewhat less than rated speed, depending on block length.

.32 Manual Input

Model 37 Keyboard (ASR and KSR Sets only) —

Method of entry:	via 4-row, 64-key keyboard (additional keys provide special functions).
Quantity of data:	variable.
Character set:	128 characters: upper-case and lower-case letters, digits, special characters, and control codes; see Tables I and II.

.33 Fixed Input: . . . . . no provision, except for a 20-character reply to an "ENQ" inquiry; these characters are set up in the answer-back mechanism and are usually used to identify the station.

.34 Transaction Code Input: . . . . . no provision.

TABLE I: USASCII (UNITED STATES OF AMERICA STANDARD CODE FOR INFORMATION INTERCHANGE)

Bits 4, 3, 2, 1	Bits 7, 6, 5							
	000	001	010	011	100	101	110	111
0000	NUL	DLE	SP	0	@	P	\	p
0001	SOH	DC_1	!	1	A	Q	a	q
0010	STX	DC_2	"	2	B	R	b	r
0011	ETX	DC_3	#	3	C	S	c	s
0100	EOT	DC_4	$	4	D	T	d	t
0101	ENQ	NAK	%	5	E	U	e	u
0110	ACK	SYN	&	6	F	V	f	v
0111	BEL	ETB	'	7	G	W	g	w
1000	BS	CAN	(	8	H	X	h	x
1001	HT	EM	)	9	I	Y	i	y
1010	LF	SUB	*	:	J	Z	j	z
1011	VT	ESC	+	;	K	[	k	{
1100	FF	FS	,	<	L	\	l	¦
1101	CR	GS	-	=	M	]	m	}
1110	SO	RS	.	>	N	^	n	~
1111	SI	US	/	?	O	—	o	DEL

Note: The eighth bit (not shown) is always transmitted as even parity by Teletype Models 33, 35, and 37.

.35 Message Configuration: . . . . . 1 to N data characters with control characters interspersed; control characters are keyed in or are in the paper tape input.

.36 Operating Procedure

The operating procedure can vary greatly depending on the optional control features installed and the application. See Paragraphs 3100.31, 3100.32, 3100.41, 3100.42, and 3100.43 for the manner in which Teletype units are being used in services offered by the common carriers.

.37 Entry of Time and Date: . . . . . no provisions.

.4 OUTPUT

.41 Output to Punched Paper Tape

Model 37 Punch (ASR Set only) —

Tape size: . . . . . 1-inch, fully-punched, 8-level paper tape.
Tape code: . . . . . 7-level USASCII plus even parity.
Rated punching speed: . . . . . 15 char/sec max.
Effective speed: . . . . . somewhat less than rated speed, depending on block length.
Format control: . . . . . none.

(Contd.)

TABLE II: USASCII CONTROL CODE IDENTIFICATION AND GENERATION(1)

Code	Identity	Generation(2) S	C	L
ACK	Acknowledge		*	F
BEL	Bell		*	G
BS	Backspace		BS	
CAN	Cancel		*	X
CR	Carriage Return		Return	
DC_1	Device Control		*	Q
DC_2	Device Control		*	R
DC_3	Device Control		*	S
DC_4	Device Control (Stop)		*	T
DEL	Delete		Delete	
DLE	Data Link Escape		*	P
EM	End of Medium		*	Y
ENQ	Enquiry		*	E
EOT	End of Transmission		*	D
ESC	Escape		Prefix	
ETB	End of Transmission Block		*	W
ETX	End of Text		*	C
FF	Form Feed		*	L
FS	File Separator		*	-
GS	Group Separator		*	-
HT	Horizontal Tab		TAB	
LF	Line Feed		LF	
NAK	Negative Acknowledge		*	U
NUL	Null		NUL	
RS	Record Separator		*	-
SI	Shift In		*	O
SO	Shift Out		*	N
SOH	Start of Heading		*	A
STX	Start of Text		*	B
SUB	Substitute		*	Z
SYN	Synchronous Idle		*	V
US	Unit Separator		*	-
VT	Vertical Tab		*	K

(1) These control codes are presently generated and interpreted by the Model 37 Teletype equipment.

(2) Control character generation, in most cases, is performed by simultaneously depressing the Control (C) key and the appropriate letter (L) key; the Shift (S) key must be depressed in addition to the control and letter keys where specified. Some functions are provided by discrete keys.

.44 Output to Printer

Model 37 Page Printer (RO, KSR, and ASR Sets) —

Output medium: . . . . . friction-fed forms, 82 char/line max.; pin-fed forms, 84 char/line max.

Character set: . . . . . 94 printable characters: upper-case and lower-case alphabetics, numerics and specials; see Table I.

Rated printing speed: . . . . . 15 char/sec max.

.44 Output to Printer (Contd.)

Effective speed:	somewhat less than rated speed due to operations such as carriage return, line feed, etc.
Format control:	through the use of special control codes in the received data.

.5 ERROR DETECTION AND CORRECTION: even parity accompanies each character generated from keyboard; visual verification of manual input.

.6 CONDITION INDICATORS: various indicators can be supplied, depending upon the application.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	15 char/sec (150 bits/sec.).
Transmission method:	serial by bit.
Transmission code:	7-level USASCII plus even parity, start, and stop bits for each character. (11 bits/char.)
Transmission mode:	Simplex, half-duplex, or full-duplex depending on model.
Order of bit transmission:	start bit followed by character bits, low-order bit first, and stop bits.
Synchronization:	asynchronous; start and stop bits are transmitted with each character. Start pulse is one bit-time in length; stop pulse is two bit-times in length.

.72 Connection to Communications Lines

Communications Line	Data Set*
Bell System or Western Union Type 1006 Data Channel (150 bits/sec):	Western Union 180 Baud Data Modem or Bell System Data Set 103F.

.73 Transmission Control

Call initiation:	manual dialing or signaling.
Call reception:	capable of unattended operation.
Functional Operations:	carriage return, line feed, bell, horizontal tab, vertical tab, etc. are initiated by special control codes.

.74 Multistation Operation: various control units permit a wide range of multistation operation techniques. Facilities provided can range from uncontrolled receiving by all stations (broadcast operation) to selective polling and addressing.

*In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

(Contd.)

.8 PHYSICAL SPECIFICATIONS

Component	Model 37 RO	Model 37 KSR	Model 37 ASR
Width (inches)	32.5	32.5	44.5
Depth (inches)	24.5	27.5	27.5
Height with stand (inches)	36.25	36.25	36.25
Weight with stand (pounds)	221	214	340
Power (KW)	0.200	0.300	0.550
Voltage	115	115	115
Frequency (Hz)	60	60	60
Phases	1	1	1
Temperature Range (° F)	40-120	40-120	40-120
Humidity Range (%)	0-90	0-90	0-90
Heat (BTU/hr)	409	409	682

.9 PRICE DATA

Component or Feature	Approximate Purchase Price* $
Model 37 RO	1,977-2,162
Model 37 KSR	2,325
Model 37 ASR	3,870

* This equipment is available from Teletype Corporation on a purchase basis only. However, the same equipment is provided on a rental basis as part of many of the common-carrier switched services and multistation leased systems; see Paragraphs 3100.3 and 3100.4 in the Common-Carrier Facilities section.

TELETYPE PUSH BUTTON DATA GENERATOR

.1 GENERAL

.11 Identity: . . . . . Push Button Data Generator (PBDG).

.12 Manufacturer: . . . . . Teletype Corporation
5555 Touhy Avenue
Skokie, Illinois 60078.

.13 Basic Function: . . . . . generates 1 to 24 characters of fixed data per pushbutton.

.15 Description

The Teletype Push Button Data Generator (PBDG) is a novel unit designed to facilitate the transmission of fixed data such as addresses, code numbers, identifications, and part order numbers.

The basic PBDG unit contains 12 nonlighted pushbuttons. Depression of each button can cause from 1 to 24 characters of data to be generated. The fixed data is set up in the unit by changeable wiring for each pushbutton. Any number of basic 12-button modules can be combined to provide unlimited fixed message transmission capabilities.

The unit can transmit either a 5-level or 8-level code; code changes are accomplished by changing diode matrix cards. The fixed message can be automatically interrupted to allow entry of variable data from an associated keyboard (teletypewriter), after which the remainder of the fixed message is automatically transmitted.

The PBDG can also be used in conjunction with a Teletype teleprinter. Up to two modules (24 pushbuttons) can be incorporated into the housing of the printer console, as shown in the photograph on the next page. Additional units require a separate cabinet. Cabinets are available for accommodating up to eight modules (96 pushbuttons).

The PBDG can also respond to control codes in incoming messages and transfer the fixed data to the associated printer unit. This is particularly advantageous when receiving data in a fixed format; the PBDG can be programmed to supply the header information and thus reduce the amount of information that needs to be transmitted by the remote facility.

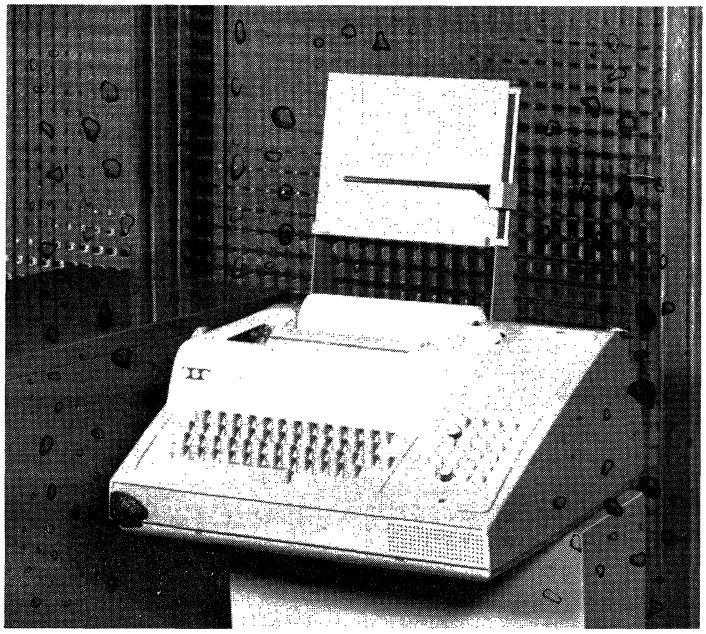


Figure 1. Teletype Push Button Data Generator mounted in the cabinet of a Model 33 KSR Set.

TELETYPE INKTRONIC LINE

.1 GENERAL

.11 Identity: . . . . . Teletype Inktronic Receive-Only Set (RO). Teletype Inktronic Keyboard Send-Receive Set (KSR).

.12 Manufacturer: . . . . . Teletype Corporation
5555 Toughy Avenue
Skokie, Illinois 60076.

.13 Basic Function: . . . . . print data received locally from a computer (direct connection) or remotely over a voice-band line; print data entered at keyboard while sending it over voice-grade line.

.15 Description

The Teletype Inktronic RO and KSR Sets, the first members of a new high-speed non-impact line of printers, electrostatically deflect successive electrically-charged jets of ink onto standard teletypewriter paper to form 120 characters per second, or 1200 words per minute; see Figure 1. This rapid printing rate, which is roughly twelve times that of most mechanical terminals, and the virtually noiseless operation of the equipment are both made possible by the elimination of nearly all moving mechanical parts and the absence of mechanical impact. Control information that shapes the character patterns traced by the tiny ink jets is stored in a transformer-core memory system (core-rope translator). Any number of alphanumeric characters up to 64, including space can be stored, and in accordance with the specified line code the translator will space them at up to 80 characters per line and provide automatic line-feed carriage return after the 80th (or last) character if desired. An option that holds the maximum number of characters to 72 is available. The horizontal and vertical spacing is ten characters per inch and six lines per inch respectively. The memory core, or "font", can be replaced in the field if transmission in a different language or symbol set is desired.

When the machines are printing 80-character lines at the rate of 1200 words per minute, a standard 400-foot roll of 8.5-inch-wide paper will last about five hours; a pint of the special ink will suffice for roughly 200 rolls of paper. Although multiple copies cannot be produced, reproductions can be made with office copiers at no loss of definition.

The Inktronic KSR Set incorporates a four-row keyboard similar to that of a conventional typewriter, and as easy to operate. The complete 128-character standard USASCII code set can be generated from the keyboard. Controls are provided for on-line, real-time communication with a computer as well as for tape-to-tape monitoring, straight computer printout, and communication with other terminals.

The Inktronic RO Set also can be used for computer printout, either local or remote, or as a monitor for tape-to-tape systems such as those employing Teletype Telespeed equipment with operating speeds of 750, 1050, or 1200 words per minute, or as a terminal for communicating over voice-grade channels. When used remotely, the RO operates in the simplex mode using a voice-band line.

Figure 1. The Teletype Inktronic RO Set.

.15 Description (Contd.)

A noteworthy characteristic of the Inktronic Printers is their unrestricted message format. Unlike most high-speed printers, which normally store characters in a buffer until printing them simultaneously to produce a full print line, the Inktronic Printer can print each character as it is received. It can also intermingle short and long printed lines without the use of "fill" characters.

As can be seen from Figure 2, the principle of Teletype Inktronic printing resembles that of an electrostatic oscilloscope. The significant difference is that the electron beam of the oscilloscope is replaced in the Printer with a stream of negatively charged ink particles. These particles are electrostatically deflected to trace each character on paper in a manner corresponding to the action of an electron beam tracing patterns on the oscilloscope phosphor-coated face. A series of liquid-ink jets are drawn from the ink-supply nozzle by high-potential electrical pulses applied between the valving electrode (in proximity with the nozzle) and the ink supply. The ink jets are deflected first vertically and then horizontally by varying electrical potentials across each pair of deflection electrodes. Interlinking black dots are thus traced to form the desired characters. The nozzles and the valving and deflection electrodes are, of course, completely stationary. This non-impact printing technique limits the printed output to one copy, but results in greater reliability, as well as in faster and quieter operation, compared with conventional teleprinters.

The Printers use a friction-feed platen. According to the company, sprocket feed will also become available. Electronic and mechanical assembles are of modular construction to simplify maintenance. Extensive use of solid-state integrated circuits helps reduce the size, weight, and cost of the equipment.

(Contd.)

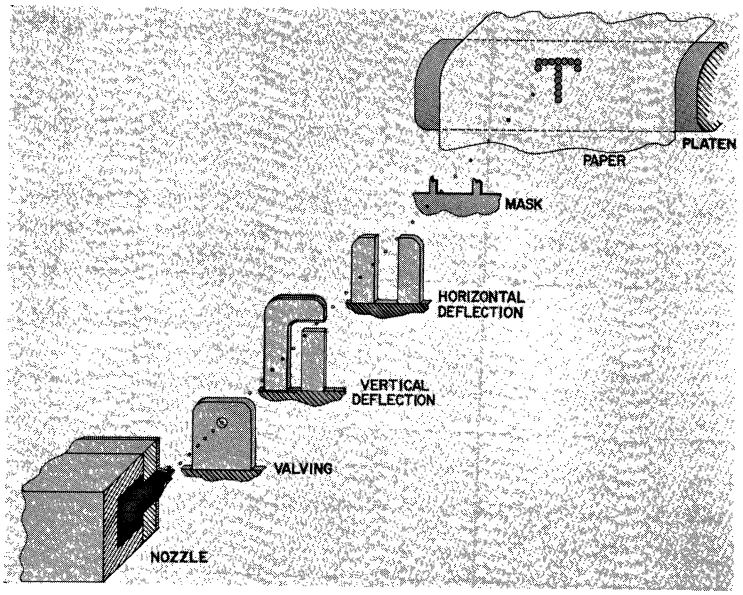


Figure 2. Teletype Inktronic Printing Technique.

.15 Description (Contd.)

The RO Set utilizes either 5-level, 10-unit Baudot code or 7-level, 10-unit USASCII code, plus parity. The KSR set utilizes only the 7-level, 10-unit USASCII code.

The RO Set is available with a parallel communications interface compatible with the Bell System Data Set 402D, or with a serial communications interface.

.16 First Delivery: . . . . . December, 1968 (RO Set).
First quarter, 1970 (KSR Set).

.17 Availability: . . . . . About 6 months (RO Set).

.2 CONFIGURATION

The RO Set contains a page printer, a transformer-core memory, and associated electronic circuits.

The KSR Set contains a page printer, a transformer-core memory, associated electronic circuits, and a four-row keyboard. Numerous control unit options are available, depending on the application. Connections to communications facilities are described in Paragraph .72.

.3 INPUT

.31 Prepared Input: . . . . . no provision.

.32 Manual Input

Inktronic Keyboard (KSR Set only) —

Method of entry: . . . . . via 4-row, 64-key keyboard (additional keys provide special functions).
Quantity of data: . . . . . variable.
Character set: . . . . . 128 characters: upper- and lower-case alphabetics, numerics, special characters, and control codes; see Table I in Report 6806.

.33 Fixed Input: . . . . . no provision, but a 14-bit binary identification code can be transmitted by the RO Set to initiate a transmission.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration: . . . . . 1 to N data characters with interspersed control characters keyed in.

.36 Operating Procedure

Both RO and KSR Sets provide straightforward controls for function selection, namely, tape-to-tape monitoring, direct computer printout, and in the case of the KSR model, real-time computer communications. Operation of the KSR keyboard resembles that of a conventional typewriter.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.44 Output Printer

Inktronic RO and KSR Sets —

Output medium: . . . . . Friction-fed forms, 72 (optional) or 80 char/line max.

Character Set —

Baudot (RO Set only): . . . . . 58 printable characters: upper-case alphabetics, numerics, and special characters; see Report 6802 Table I.

USASCII (RO or KSR Set): . . . . . 64 printable characters: upper-case alphabetics, numerics, and special characters; see Report 6804 Table I.

Rated printing speed: . . . . . 120 char/sec max.

Effective speed: . . . . . slightly less than rated speed due to operations such as carriage return and line feed, or reduced to limit set by transmission rate. Restricted to 75 char/sec when Bell System Data set 402D or equivalent used.

Format control: . . . . . through the use of special control codes in the received data.

.5 ERROR DETECTION AND CORRECTION: . even parity accompanies each character generated from keyboard; visual verification of manual input.

.6 CONDITION INDICATORS

The Printers have six indicator lamps to indicate the following conditions of the equipment:

BRAKE (lamp and switch) : . . . . . depressing switch interrupts supervisory channel and signals that transmission should stop.

TRANSMIT-START : . . . . . when depressed, discrete call generator is activated to signal for start of transmission.

PRINTER ON : . . . . . when depressed, printer motor and high-voltage circuits are energized.

LOW PAPER ALARM : . . . . . indicates low paper supply.

PAPER ADVANCE : . . . . . initiates repetitive paper feeding action.

READY : . . . . . interlock and paper alarm are in ready state and printer can operate.

(Contd.)

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	120 char/sec (1200 bits/sec).
Transmission method:	serial by bit or parallel by bit, serial by character depending on communications interface.
Transmission code —	
RO Set:	5-level, 10-unit Baudot (each character includes two start and three stop bits) or 7-level, 10-unit USASCII (each character includes even parity and unity start and stop bits).
KSR Set:	7-level, 10-unit USASCII (each character includes even parity and unity start and stop bits.
Transmission mode:	simplex (RO) or half-duplex (KSR).
Order of bit transmission:	start bit(s) followed by character bits, low-order bit first, and stop bits.
Synchronization:	asynchronous; 5-level, 10-unit Baudot code includes two start and three stop bits; 7-level, 10-unit USASCII code includes unity start and stop bits. When the parallel communications interface is used, start and stop bits are not employed.

.72 Connection to Communication Lines

Communications Line	Data Set*
Bell System or Western Union Type 3002 Data Channel (1200 bits/sec):	Western Union 1200 Baud Data Modem or Bell System Data Set 202D.
Bell System or Western Union Type 3002 Data Channel (75 char/sec):	Bell System Data Set 402D.
Public Telephone Network (1200 bits/sec):	Bell System Data Set 202C.
Public Telephone Network (75 char/sec):	Bell System Data Set 402D.

.73 Transmission Control

Call initiation:	Manual dialing or signaling.
Call reception:	Capable of unattended operation.
Functional operations:	Carriage return, line feed, bell, horizontal tab, vertical tab, and so on are initiated by special control codes.

.74 Multistation Operation:

various techniques and optional accessories are available for selective polling and addressing.

*In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

.8 PHYSICAL SPECIFICATIONS

Component	Inktronic RO	Inktronic KSR
Width (inches)	18	36
Depth (inches)	27	29
Height with stand (inches)	47	33
Weight with stand (lbs.)	325	350
Power (KW)	0.600	0.600
Voltage, ±0.5 Hz	115	115
Frequency, (Hz) ±0.5 Hz	60	60
Phases	1	1
Temperature Range (°F)	40-110	40-110
Humidity Range (%)	0-95	0-95
Heat (BTU/hr)	1800	1800

.9 PRICE DATA

Component or Feature	Purchase Price, $ (approximate)*
Inktronic RO —	
Serial Interface	5450
Parallel Interface	5300
Inktronic KSR	5800

*This equipment is available from Teletype Corp. on a purchase basis only. However, this equipment is available on a rental basis as part of many of the common-carrier switched services and multistation leased systems; see Paragraphs 3100.3 and 3100.4 in the Common-Carrier Facilities section.

ULTRONIC SYSTEMS MT 3000 MAGNETIC TAPE TERMINAL

.1 GENERAL

.11 Identity: . . . . . MT 3000 Magnetic Tape Terminal.

.12 Manufacturer: . . . . . Ultronic Systems Corporation
Mt. Laurel Industrial Park
Moorestown, New Jersey 08057

.13 Basic Function: . . . . . reads data from magnetic tape and transmits it over a voice-band or broad-band line; receives data from a voice-band or broad-band line and records it on magnetic tape.

.14 Basic Units

Name: . . . . . Magnetic Tape Terminal.
Model number: . . . . . MT 3000-7.
Function: . . . . . transmission or reception of magnetic-tape data; 7-track tape format is compatible with IBM 729 Series Magnetic Tape Units.

Name: . . . . . Magnetic Tape Terminal.
Model number: . . . . . MT 3000-9.
Function: . . . . . transmission or reception of magnetic-tape data; 9-track tape format is compatible with IBM 2400 Series Magnetic Tape Units.

.15 Description

The MT 3000 Magnetic Tape Terminal can transmit or receive data over a common-carrier leased voice- or broad-band line or the public switched telephone network. The terminal operates in half-duplex mode and is used to communicate with a remote MT 3000 Magnetic Tape Terminal or an equivalent device. A wide range of transmitting speeds, including 1200, 2000, 2400, and 40,800 bits per second, can be switch-selected.

The MT 3000 is available in two models. The MT 3000-7 contains a 7-track tape drive and is compatible with the IBM 729 tape format. The MT 3000-9 contains a 9-track tape drive and is compatible with the IBM 2400 Series tape format.

The MT 3000 Magnetic Tape Terminal is a buffered terminal consisting of a magnetic tape handler, a basic 1024-character buffer memory, and circuits for both transmitting and receiving data. Code translation is not provided. Any 6-level (MT 3000-7) or 8-level (MT 3000-9) code can be handled.

The MT 3000 provides two switch-selected recording densities. Recording densities can be specified to be either 200 and 556 bits per inch or 556 and 800 bits per inch. The tape speed is 36 inches per second (standard) or 45 inches per second (optional). The MT 3000 can operate as a transmit terminal or a receive terminal. Mode selection is controlled by a selector switch on the operator panel. Data is read from or written on magnetic tape in the form of variable-length records. Record length is limited only by the memory buffer size of the transmitting or receiving terminal.

When the MT 3000 operates in the transmit mode, data is read from magnetic tape, checked for correct character and longitudinal parity, and transferred to the buffer memory. When the buffer memory contains a complete record, the record is transferred from the buffer memory, serialized, and transmitted. The transmitted record includes odd or even character parity and a longitudinal parity character generated from the transmitted data. Control characters are automatically inserted into each record prior to transmission.

When the MT 3000 operates in the receive mode, data received serially by bit is assembled, checked for correct character and longitudinal parity, and transferred to the buffer memory. Data is transferred from the buffer memory and written on tape immediately after the last character of the transmitted record is received. Control characters are stripped from the data written on tape. A read-after-write check is performed on the written data.

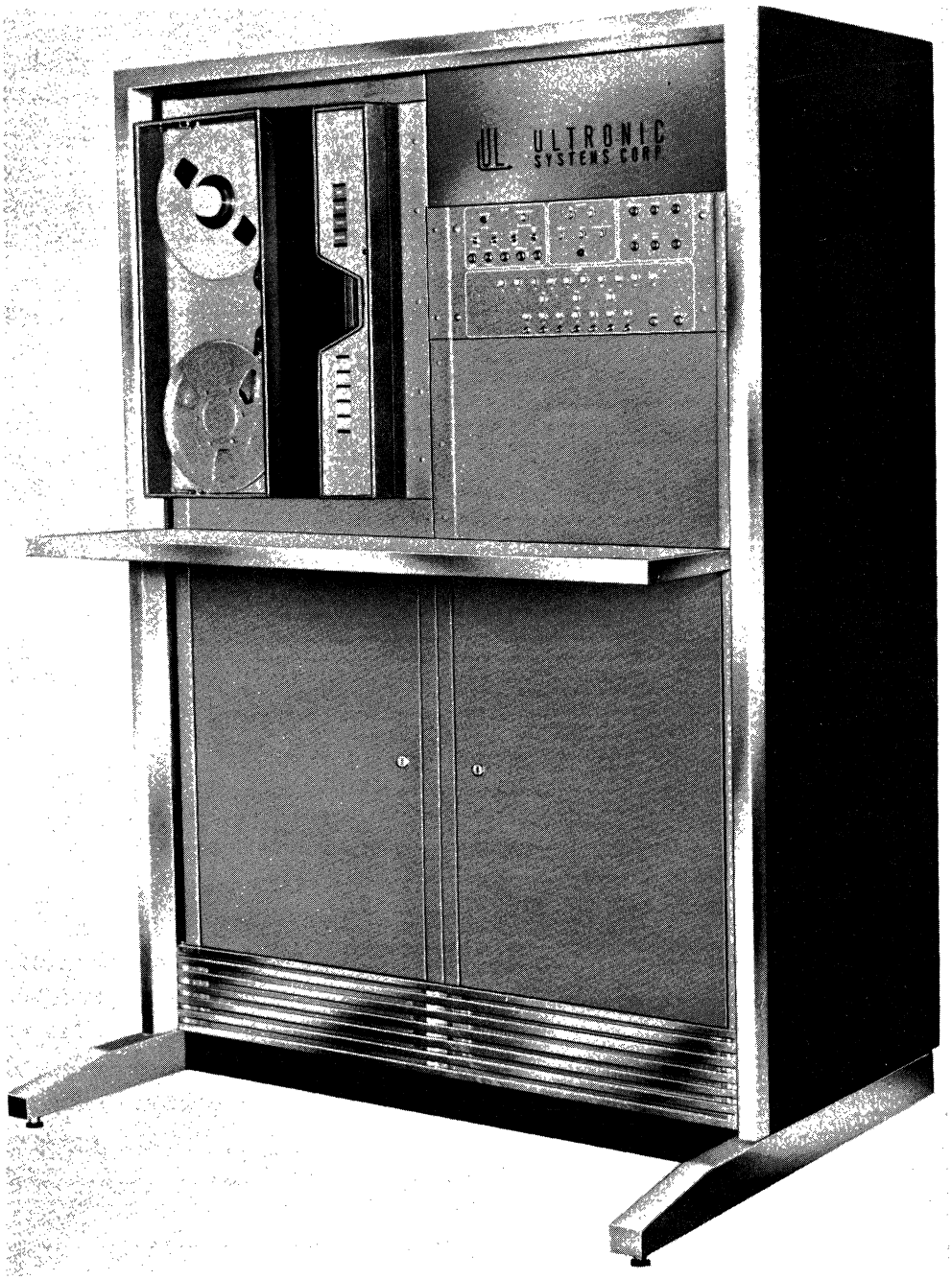


Figure 1. Ultronic MT 3000 Magnetic Tape Terminal

The receiving terminal acknowledges each record received by responding to the transmitting terminal with a positive or negative reply message. When a data transmission error is detected, the receiving terminal sends a negative reply immediately after the last character of the the transmitted record is received. The positive reply occurs after the received record has been written on tape and the read-after-write check has been satisfied. Operator intervention is required after three unsuccessful attempts to write a correctly received record on tape. In this case the record is not acknowledged, the transmitting terminal times out, and the operator is alerted.

(Contd.)

The transmitting terminal transfers the next record from tape to the buffer memory immediately after the last character of the previous record is transmitted. The record is not transmitted until the transmitting terminal receives a positive reply from the receiving terminal which indicates that the previously transmitted record has been successfully written on tape.

A negative acknowledgement is recognized by the transmitting terminal as a request to retransmit a previously transmitted record. The transmitting terminal responds to the negative acknowledgement only after the next record has been completely transferred to the buffer memory. The terminal responds by backspacing the tape to the beginning of the previous record; the record is then transferred to the buffer memory and retransmitted to the receiving terminal. Retransmission is automatically executed up to three times before operator intervention is required.

Optional features for the MT 3000 Terminal include:

- Master Terminal Data Director — allows an MT 3000-9 Terminal to select records for transmission based on an address header contained in each record. Selection is accomplished via switches located on the operator panel; only the records containing the selected address are transmitted. Up to 10 different address codes can be specified.
- Record Counter — provides a digital counter located on the operator panel; the number of successful transmissions is accumulated by this counter. The basic counter capacity is 1024 and can be expanded. This feature is standard in the MT 3000-9.
- Increased Tape Speed — allows the MT 3000-7 or MT 3000-9 to operate with a tape speed of 45 inches per second.
- Optional Buffer Size — allows the MT 3000-7 or MT 3000-9 to employ a buffer other than the 1024-character buffer included in the basic terminal. Buffer sizes available are 512, 2048, 4096, or 8192 character positions.

.16 First Delivery: . . . . . June 1964.

.17 Availability: . . . . . 4 to 5 months.

.2 CONFIGURATION

Both models of the MT 3000 Magnetic Tape Terminal include:

- A magnetic tape drive,
- Up to 8192 characters of buffer memory, and
- Control circuits necessary to transmit and receive data.

Both MT 3000 models operate at tape speeds of 36 inches per second (basic) or 45 inches per second (optional). The standard buffer size is 1024 characters; optional buffer sizes include 512, 2048, 4096, and 8192 characters.

See Paragraph .72 for the standard communications facilities that can be used and the data sets required.

.3 INPUT

.31 Prepared Input

MT 3000-7 Magnetic Tape Terminal —

Input medium: . . . . . 0.5-inch magnetic tape recorded at 200, 556, or 800 bits/inch; 7-track tape format is compatible with IBM 729 Series Magnetic Tape Units.

Input code: . . . . . any 6-level code; 6 data bits plus one parity bit per character; even or odd parity can be switch-selected.

Quantity of data: . . . . . 512, 1024, 2048, 4096, or 8192 characters per record, depending on buffer size.

Rated input speed —
At 36 inches/sec tape speed and
the following recording densities —
200 bits/inch: . . . . . 7200 char/sec.
556 bits/inch: . . . . . 20,700 char/sec.
800 bits/inch: . . . . . 28,800 char/sec.

.31 Prepared Input (Contd.)

At 45 inches/sec tape speed (optional) and the following recording densities —
200 bits/inch: . . . . . 9000 char/sec.
556 bits/inch: . . . . . 25,000 char/sec.
800 bits/inch: . . . . . 36,000 char/sec.
Effective speed: . . . . . varies widely depending on the communications facility, transmission speed, and record size.
Comments: . . . . . high or low recording density can be switch-selected on operator panel; only two recording densities per tape terminal are provided (200/556 or 556/800 bits per inch).

MT 3000-9 Magnetic Tape Terminal —

Input medium: . . . . . 0.5-inch magnetic tape recorded at 200, 556, or 800 bits/inch; 9-track tape format is compatible with IBM 2400 Series Magnetic Tape Units.
Input code: . . . . . any 8-level code; 8 data bits per character; even or odd parity can be switch-selected.
Quantity of data: . . . . . 512, 1024, 2048, 4096, or 8192 characters per record, depending on buffer size.
Rated input speed —
At 36 inches/sec tape speed and the following recording densities —
200 bits/inch: . . . . . 7200 char/sec.
556 bits/inch: . . . . . 20,700 char/sec.
800 bits/inch: . . . . . 28,800 char/sec.
At 45 inches/sec tape speed (optional) and the following recording densities —
200 bits/inch: . . . . . 9000 char/sec.
556 bits/inch: . . . . . 25,000 char/sec.
800 bits/inch: . . . . . 36,000 char/sec.
Effective speed: . . . . . varies widely depending on the communications facility, transmission speed, and record size.
Comments: . . . . . high or low recording density can be switch-selected on operator panel; only two recording densities per tape terminal are provided (200/556 or 556/800 bits per inch).

.32 Manual Input: . . . . . no provision.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration

Data is transmitted in variable-length records under control of the transmitting device. Record length is limited only by the transmitting or receiving memory buffer capacity; the standard buffer size is 1024 character positions. Each data record includes a Start-of-Message (SOM) character, a Start-of-Record (SOR) character, data, an End-of-Message (EOM) character, and a Longitudinal Parity Check (LPC) character. The SOR character is followed by a numeric one or two which identifies the record sequence. Each transmitted record is acknowledged by a positive or negative reply sent by the receiving terminal. The reply sequence is SOM, SOR (1 or 2), EOM, and LPC. If the reply is negative, the numeric identifier will be the same as the identifier following the SOR in the incorrectly received record. A message is terminated by an End-of-File (EOF) character.

.37 Entry of Time and Date: . . . . . no provision.

(Contd.)

.4 OUTPUT

.41 Output to Magnetic Tape

MT 3000-7 Magnetic Tape Terminal —

Tape size: . . . . . 0.5-inch magnetic tape recorded at 200, 556, or 800 bits/inch; 7-track tape format is compatible with IBM 729 Series Magnetic Tape Units.

Tape code: . . . . . any 6-level code; 6 data bits plus one parity bit per character; even or odd parity can be switch-selected.

Rated output speed —
- At 36 inches/sec tape speed and the following recording densities —
  - 200 bits/inch: . . . . . 7200 char/sec.
  - 556 bits/inch: . . . . . 20,700 char/sec.
  - 800 bits/inch: . . . . . 28,800 char/sec.
- At 45 inches/sec tape speed (optional) and the following recording densities —
  - 200 bits/inch: . . . . . 9000 char/sec.
  - 556 bits/inch: . . . . . 25,000 char/sec.
  - 800 bits/inch: . . . . . 36,000 char/sec.

Effective speed: . . . . . varies widely depending on the communications facility, transmission speed, and record size.

Format control: . . . . . none.

Comments: . . . . . high or low recording density can be switch-selected on operator panel; only two recording densities per tape terminal are provided (200/556 or 556/800 bits per inch).

MT 3000-9 Magnetic Tape Terminal —

Tape size: . . . . . 0.5-inch magnetic tape recorded at 200, 556, or 800 bits/inch; 9-track tape format is compatible with IBM 2400 Series Magnetic Tape Units.

Tape code: . . . . . any 8-level code; 8 data bits plus one parity bit per character; even or odd parity can be switch-selected.

Rated output speed —
- At 36 inches/sec tape speed and the following recording densities —
  - 200 bits/inch: . . . . . 7200 char/sec.
  - 556 bits/inch: . . . . . 20,700 char/sec.
  - 800 bits/inch: . . . . . 28,800 char/sec.
- At 45 inches/sec tape speed (optional) and the following recording densities —
  - 200 bits/inch: . . . . . 9000 char/sec.
  - 556 bits/inch: . . . . . 25,000 char/sec.
  - 800 bits/inch: . . . . . 36,000 char/sec.

Effective speed: . . . . . varies widely depending on the communications facility, transmission speed, and record size.

Format control: . . . . . none.

Comments: . . . . . high or low recording density can be switch-selected on operator panel; only two recording densities per tape terminal are provided (200/556 or 556/800 bits per inch).

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors

Type of checking: . . . . . character and longitudinal parity checking.

Error indication: . . . . . indicator lamp is lighted and an audible alarm is sounded.

.51 Data Entry Errors (Contd.)

Correction procedure:. . . . . the data block is automatically re-read up to three times (four read operations); if all attempts are unsuccessful, tape halts and operator intervention is required.

.52 Data Transmission Errors

Type of checking:. . . . . character and longitudinal parity are checked only in receive mode.
Error indication:. . . . . indicator lamp is lighted and audible alarm is sounded.
Correction procedure:. . . . . retransmission of record up to three times (four transmissions); if all attempts are unsuccessful, data transmission is interrupted and operator intervention is required.

.53 Data Recording Errors

Type of checking:. . . . . read-after-write character and longitudinal parity checks.
Error indication:. . . . . indicator lamp is lighted; audible alarm is sounded.
Correction procedure:. . . . . data is automatically rewritten up to two times; operator intervention is required if error occurs after second rewrite.
Comments:. . . . . operator can skip to new portion of tape and attempt to rewrite data.

.55 Life Malfunctions

Detection:. . . . . when acknowledgement to transmitted record is not received within three minutes.
Action:. . . . . transmission halts; operator intervention is required.

.6 CONDITION INDICATORS

A comprehensive array of indicator lamps on both models of the MT 3000 Magnetic Tape Terminals provides visual indication of error status, transmission status, memory status, and end-of-file status.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed —
MT 3000-7:. . . . . 171.4, 285.7, 342.8, or 5820.5 char/sec, corresponding to 1200, 2000, 2400, or 40,800 bits/sec, respectively; transmission speed depends on communications line, data sets, and receiving terminal.
MT 3000-9:. . . . . 133.3, 222.2, 266.6, or 4533.3 char/sec, corresponding to 1200, 2000, 2400, or 40,800 bits/sec, respectively; transmission speed depends on communications line, data sets, and receiving terminal.
Transmission method:. . . . . serial by bit.
Transmission code —
MT 3000-7:. . . . . 6 data bits plus one parity bit per character; a total of 7 bits are transmitted for each character.
MT 3000-9:. . . . . 8 data bits plus one parity bit per character; a total of 9 bits are transmitted for each character.
Transmission mode:. . . . . half-duplex.
Order of bit transmission:. . . . . low-order bit of each character is transmitted first.
Synchronization:. . . . . synchronous; SOM character at beginning of each data block is used as sync character.

(Contd.)

Comments: . . . . . other transmission rates from 3000 to 6000 bits/sec are available for special applications.

.72 Connection to Communications Lines

Communications Line	Data Set*
Public switched telephone network at the following speeds —	
1200 bits/sec (150 char/sec):	Bell System Data-Phone Data Set 202C.
2000 bits/sec (250 char/sec):	Bell System Data-Phone Data Set 201A.
Common-carrier leased voice-band line at the following speeds —	
1200 bits/sec (150 char/sec):	Bell System Data Set 202C, Western Union 1200 Baud Data Modem, or Ultronic Systems Data Pump.
2000 bits/sec (250 char/sec):	Bell System Data Set 201A.
2400 bits/sec (300 char/sec):	Bell System Data Set 201B or Western Union 2400 Baud Data Modem.
Telpak A (40,800 bits/sec):	requires a Telpak Channel Terminal A-2, which includes a data set.

.73 Transmission Control

Call initiation: . . . . . manual dialing or signaling.
Call reception: . . . . . attended operation; operator must establish voice communication and then switch to data mode.
Functional operations: . . . . . none; except request retransmission.

.74 Multistation Operation: . . . . . no provision.

.8 PHYSICAL SPECIFICATIONS

Component	MT 3000 Magnetic Tape Terminal*
Width (inches)	50
Depth (inches)	24
Height (inches)	73
Weight (pounds)	1000
Power (KVA)	1.2
Voltage	115 or 208/230
Frequency (cps)	50 or 60
Phases	1
Temperature Range (°F)	60 to 90
Humidity Range (%)	40 to 70
Heat (BTU/Hr)	9000

* Physical size of the MT 3000-7 and MT 3000-9 Magnetic Tape Terminals is identical.

* In some cases, equivalent data sets can be used; check with the local common-carrier communications consultant.

.9 PRICE DATA

Ultronic Systems is currently reviewing the price structure for the MT 3000 Magnetic Tape Terminals, and a firm price structure is not available. The data in the following table represents approximate current pricing; prices are negotiable based on quantity and individual situations. Maintenance charges are individually negotiated based on geographical location.

Component or Feature	Monthly Rental, $	Purchase Price, $
MT 3000-7 Magnetic Tape Terminal (with 1024-character buffer)	1,400	45,000
MT 3000-9 Magnetic Tape Terminal (with 1024-character buffer)	1,700	59,000
Optional Features		
Record Counter (MT 3000-7 option)	25	995
Master Terminal Data Director (MT 3000-9 option) —		
5 address selections	25	995
10 address selections	50	1,990
Optional tape speed (45 inches/sec)	NC	NC
Buffer size options —		
512 characters	?	?
2048 characters	?	?
4096 characters	?	?
8192 characters	?	?

NC — No Charge.

UNIVAC 1004 CARD PROCESSOR

.1 GENERAL

.11 Identity: . . . . . UNIVAC 1004 Card Processor, Models I, II, and III.
Data Line Terminal Type 1 (DLT-1).
Data Line Terminal Type 2 (DLT-2).
Data Line Terminal Type 3 (DLT-3).

.12 Manufacturer: . . . . . UNIVAC Division, Sperry Rand Corporation
Post Office Box 8100
Philadelphia, Pennsylvania 19101

.13 Basic Function: . . . . . compact, free-standing, plugboard-programmed computer;
can transmit or receive data over voice-band communications facilities.

.14 Basic Components

Name: . . . . . UNIVAC 1004 Card Processing System.
Model number: . . . . . Models I, II, and III.
Function: . . . . . small plugboard-programmed computer system.

Name: . . . . . Data Line Terminal.
Model number: . . . . . Type 1.
Function: . . . . . provides a 1004 with the ability to communicate with a remote 1004 or larger UNIVAC computer system over a voice-band line.

Name: . . . . . Data Line Terminal.
Model number: . . . . . Type 2.
Function: . . . . . provides a 1004 with the ability to communicate with a remote 1004 or a Digitronics D520 Magnetic Tape Terminal over a voice-band line.

Name: . . . . . Data Line Terminal.
Model number: . . . . . Type 3.
Function: . . . . . similar to Type 1, but permits data transmission to be overlapped with processing or input-output operations.

.15 Description

The UNIVAC 1004 is a compact, plugboard-programmed computer which, with the inclusion of a Data Line Terminal Type 1, Type 2, or Type 3, can function as a communications terminal over either the public switched telephone network or common-carrier leased voice-band facilities. A number of other Data Line Terminals are available on a "Request Price Quotation" (RPQ) basis; different models enable transmission over Telpak A at 40,800 bits per second, permit communication with IBM Synchronous Terminals such as the IBM 1013, 7702, etc., and enable communication with various military networks.

There are two basic models of the 1004. The 1004 I utilizes core storage with an 8.0-microsecond cycle time and comes equipped with a 400-card-per-minute card reader and a 400-line-per-minute line printer. The 1004 II uses faster core storage (6.5-microsecond cycle time) and comes equipped with a 615-card-per-minute reader and a 600-line-per-minute printer. Additional peripheral equipment that can be connected to either the 1004 I or 1004 II includes

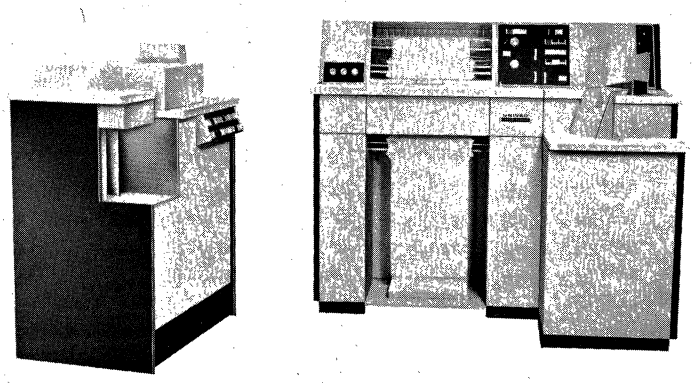


Figure 1. The UNIVAC 1004 Card Processor. Integral units include card reader, line printer, and processor; the card punch stands alone.

.15 Description (Contd.)

a card punch (200 cards per minute), a second card reader (400 cards per minute), a card/read punch unit (200 cards per minute), a paper tape reader (400 characters per second), and a paper tape punch (110 characters per second).

A special model of the processor, the 1004 III, permits the inclusion of additional peripheral equipment. The 1004 III is similar to the 1004 II but can also control one or two Uniservo Magnetic Tape Units with a peak data transfer rate of 33,664 characters per second.

Each model of the UNIVAC 1004 has 961 alphameric character positions of core storage standard, with an additional 961 positions optional. Each core position contains six data bits. Core storage cycle time is 8.0 microseconds in the UNIVAC 1004 I and 6.5 microseconds in the UNIVAC 1004 II and III.

The plugboard of the basic machine has a capacity for 31 program steps (expandable to 62). Each step can specify two operand addresses, and multiple operations can be performed in a single program step. Arithmetic operations include add and subtract (both algebraic and absolute) and compare. Multiply and divide operations require the use of wired subroutines. Seven types of transfer processes are provided, including several with editing facilities. Input-output areas are assigned fixed locations in core storage. Input-output commands can be combined in the same step with other operations.

Operands can be of any length up to the capacity of core storage. Operand length is specified by the operand addresses wired in each program step. Instructions are executed at the rate of about 6,500 instructions per second in the 1004 I processor and about 9,000 instructions per second in the 1004 II and III.

The UNIVAC 1004 can be used with more than one coding system. It normally operates with either the standard UNIVAC XS-3 code (80-column) or with the Remington Rand 90-column card code. Models of each processor are available that can use both codes under control of the plugboard wiring. When the code to be used is program-selectable, it is possible to use

(Contd.)

.15 Description (Contd.)

both codes within a single program. This allows, for instance, reading a mixture of 80-column cards, and 90-column cards or reading 80-column cards and punching 90-column cards. Codes other than the XS-3 and the 90-column codes can be automatically translated to either of these codes by a special Translate Feature, provided that there are no more than 6 data bits per character in the original code.

The Data Line Terminal Type 1 (DLT-1) permits a 1004 to communicate with a UNIVAC 418, 490, 1050, 1107, 1108, or another 1004. Data is transferred from or received into the core storage of the 1004 via the DLT-1 and the appropriate communications facilities. The data is transmitted as a binary image of the data in core storage, but with a parity bit appended to each character. Synchronization is maintained by the data signals (synchronous transmission). The transmission rate is 285 characters per second (2,000 bits per second) over the public telephone network and 342 characters per second (2,400 bits per second) over common-carrier leased voice-band lines.

The DLT-2 is similar to the DLT-1 except that an eighth bit is added to each character. The eighth bit is a synchronizing bit, and it permits a 1004 equipped with a DLT-2 to communicate with a Digitronics D520 Magnetic Tape Terminal (see page 6216:01). Two 1004's equipped with DLT-2's can also communicate with each other. The addition of the extra bit reduces the transmission rate to 250 or 300 characters per second for the public telephone network or common-carrier leased voice-band lines, respectively.

The transmission characteristics of the DLT-3 are similar to those of the DLT-1; with the DLT-3, however, data transmission operations can be overlapped with processing or input-output operations.

Data is transmitted in a half-duplex mode; i.e., in either direction, but in only one direction at a time. Full-duplex communications facilities can be used, however, to maintain synchronization in both directions at once and thereby reduce the turnaround time. This reduction in turnaround time can be important when transmitting small blocks of data, since a confirmation that the previous message was received without detecting an error is necessary before the next message can be transmitted; this requires two "turnarounds" or reversals of the direction of transmission.

The effective transmission speed depends on the amount of data per transmission and the amount of computation necessary prior to transmission. Maximum message lengths are restricted to the size of core storage, either 961 or 1,922 characters. Data read from punched cards can be transmitted at approximately 180 cards per minute; if the receiving terminal is a 1004 using the card punch for output, transmission is limited to 125 cards per minute.

In addition to the parity bit that is transmitted for each character, a longitudinal parity check character is transmitted with each message. Detected errors result in an "error" acknowledgement return. This activates a special hub on the 1004 plugboard, permitting retransmission of data received in error. A count can be made of the retransmissions to limit their number.

In October, 1965, UNIVAC announced the 1005; this system is identical with the 1004 except that the newer 1005 is a stored-program computer with 2,048 or 4,096 core memory locations. The 1005 is offered in the same three basic models as the 1004 and utilizes the same peripheral devices. The performance of the 1005 for data communications applications will be similar to that of the 1004.

.16 First Delivery: . . . . . March 1963.

.17 Availability: . . . . . no longer actively marketed; available on an "as returned" basis only.

.2 CONFIGURATION

A UNIVAC 1004 system intended to serve as a communications terminal includes the following units:

- One 1004 Model I, II, or III Processor with built-in console and 961-character core memory. An additional 961 characters of core memory are optional.
- One Card Reader — peak speed is 400 cpm in 1004 I; 615 cpm in 1004 II and III.
- One Printer — peak speed is 400 lpm in 1004 I; 600 lpm in 1004 II and III.
- One Data Line Terminal, any type.

Other peripheral equipment that can be connected to a 1004 includes:

- One Card Punch or Card Read/Punch (200 cpm).
- One additional Card Reader (400 cpm).
- One Paper Tape Reader (400 cps).
- One Paper Tape Punch (110 cps).
- One or two Uniservo Magnetic Tape Units (on 1004 III only).

The requirements for connection to various communications facilities are listed in Paragraph .72.

.3 INPUT

.31 Prepared Input

1004 I Card Reader and Auxiliary Card Reader —

Input medium:	IBM 80-column or UNIVAC 90-column cards, depending on model.
Input code:	standard 80-column Hollerith or 90-column card code; see Tables I and II.
Quantity of data:	1 to 80 or 1 to 90 characters.
Character set:	see Tables I and II.
Rated input speed:	400 cards/min.
Effective speed:	depends on amount of data transmitted, amount of computation per record, and the communications facilities. a speed of approximately 180 cards/minute can be attained when transmitting data from two fully-punched cards at a time over half-duplex facilities.
Comments:	80-column or 90-column versions are available; a column binary feature is available for the 80-column model which treats each 12-row card column as containing two 6-bit characters, permitting up to 160 characters to be recorded on a card.

(Contd.)

TABLE I: UNIVAC 1004
80-COLUMN DATA CODES

80-Col. Card Code	Printable Characters	XS-3 Code	80-Col. Card Code	Printable Characters	XS-3 Code
12-1	A	01 0100	7	7	00 1010
12-2	B	01 0101	8	8	00 1011
12-3	C	01 0110	9	9	00 1100
12-4	D	01 0111	12	&	01 0000
12-5	E	01 1000	11	- (minus)	00 0010
12-6	F	01 1001	12-0	?	01 0011
12-7	G	01 1010	11-0	! (exclam.)	10 0011
12-8	H	01 1011	0-1	/	11 0100
12-9	I	01 1100	2-8	+	11 0011
11-1	J	10 0100	3-8	#	01 1101
11-2	K	10 0101	4-8	@	10 1110
11-3	L	10 0110	5-8	: (colon)	01 0001
11-4	M	10 0111	6-8	>	11 1110
11-5	N	10 1000	7-8	' (apos.)	10 0000
11-6	O	10 1001	12-3-8	. (period)	01 0010
11-7	P	10 1010	12-4-8	⌑	11 1101
11-8	Q	10 1011	12-5-8	[	00 1111
11-9	R	10 1100	12-6-8	<	01 1110
0-2	S	11 0101	12-7-8	=	01 1111
0-3	T	11 0110	11-3-8	$	10 0010
0-4	U	11 0111	11-4-8	*	10 0001
0-5	V	11 1000	11-5-8	]	00 0001
0-6	W	11 1001	11-6-8	; (semi-col)	00 1110
0-7	X	11 1010	11-7-8	Δ	10 1111
0-8	Y	11 1011	0-2-8	≠	11 0000
0-9	Z	11 1100	0-3-8	, (comma)	11 0010
0	0	00 0011	0-4-8	%	11 0001
1	1	00 0100	0-5-8	(	10 1101
2	2	00 0101	0-6-8	\	00 1101
3	3	00 0110	0-7-8	)	11 1111
4	4	00 0111			
5	5	00 1000	Blank	Space N.P.	00 0000
6	6	00 1001			

Reproduced from UNIVAC 1004 Card Processor — 80 Column, Publication UT 2543 REV. 1A, page 4.

TABLE II: UNIVAC 1004
90-COLUMN DATA CODES

PRINTED CHARACTERS	90-COLUMN CARD CODE	PRINTED CHARACTERS	90-COLUMN CARD CODE
A	1-5-9	7	7
B	1-5	8	7-9
C	0-7	9	9
D	0-3-5	&	0-1-3-5-7
E	0-3	(- minus)	0-3-5-7
F	1-7-9	?	0-1-3
G	5-7	! (exclam.)	0-3-7-9
H	3-7	/	3-5-7-9
I	3-5	+	1-5-7-9
J	1-3-5	#	0-1-5-7
K	3-5-9	@	0-1-3-7
L	0-9	: (colon)	1-3-7-9
M	0-5	>	0-3-5-7-9
N	0-5-9	' (apos.)	0-1-5-7-9
O	1-3	. (period)	1-3-5-9
P	1-3-7	⌑	0-1-3-9
Q	3-5-7	[	0-5-7-9
R	1-7	<	0-1-5-9
S	1-5-7	=	0-1-3-5-7-9
T	3-7-9	$	0-1-3-5-9
U	0-5-7	*	0-1
V	0-3-9	]	1-3-5-7
W	0-3-7	; (semi-colon)	1-3-5-7-9
X	0-7-9	Δ	0-1-7
Y	1-3-9	≠	0-1-7-9
Z	5-7-9	, (comma)	0-3-5-9
0	0	%	0-1-5
1	1	(	0-1-9
2	1-9	\	0-1-3-7-9
3	3	)	0-1-3-5
4	3-9		
5	5	SPACE N.P.	BLANK
6	5-9		

Reproduced from UNIVAC 1004 Card Processor — 90 Column, Publication UT 2541 REV. 1B, page 4.

1004 II/III Card Reader —

Input medium: . . . . . IBM 80-column or UNIVAC 90-column cards, depending on model.

Input code: . . . . . standard 80-column Hollerith or 90-column card code; see Tables I and II.

Quantity of data: . . . . . 1 to 80 or 1 to 90 characters.

Character set: . . . . . see Tables I and II.

Rated input speed: . . . . . 615 cards/min.

Effective speed: . . . . . depends on amount of data transmitted, amount of computation per record, and the communications facilities.
a speed of approximately 180 cards/minute can be attained when transmitting data from two fully-punched cards at a time over half-duplex facilities.

Comments: . . . . . 80-column or 90-column versions are available; a column binary feature is available for the 80-column model which treats each 12-row card column as containing two 6-bit characters, permitting up to 160 characters to be recorded on a card.

1004 Paper Tape Reader —

Input medium:	fully-punched 11/16, 7/8, or 1-inch, 5-, 6-, 7-, or 8-level paper tape.
Input code:	any 5-, 6-, 7-, or 8-level code. The 7- and 8-level codes require two core storage locations to store each character if more than 6 data bits are used per character.
Quantity of data:	limited by core storage size to 960 or 1,920 characters for 5- or 6-level codes, and to 480 or 960 characters for 7- and 8-level codes (see above).
Rated input speed:	400 char/sec.
Effective speed:	depends on the amount of data transmitted, the amount of computation per record, and the communications facilities.
Comments:	odd or even parity can be checked on 7- and 8-level paper tape input.

1004 III Uniservo Magnetic Tape Unit —

Input medium:	0.5-inch, IBM 729-compatible magnetic tape.
Input code:	any 6-bit code.
Quantity of data:	limited by the size of core storage to 960 or 1,920 characters.
Rated input speed:	8,416, 23,396, or 33,664 char/sec at recording densities of 200, 556, or 800 bits/inch, respectively.
Effective speed:	depends on block length, recording density, amount of computation per record, and communications facilities.
Comments:	magnetic tape reading or writing cannot be overlapped with computation or data transmission.

.32 Manual Input: limited capability via console switches.

.33 Fixed Input: five different alphabetics (C, D, G, R, and T) and six different special characters (. , $ * - +) can be emitted under control of the plugboard wiring. a character of any bit configuration can be emitted by the bit generators under control of the plugboard wiring.

.34 Transaction Code Input: no provision.

.35 Message Configuration

DLT-1 and DLT-3:	five-character header including synchronizing codes and a start-of-message code, followed by the data, an end-of-message code and a longitudinal parity character, making a total of 7 characters plus the data. The synchronization and LPC characters are automatically supplied by the DLT-1 or -3. The acknowledge message is in the same format, with fewer data characters.
DLT-2:	five space codes followed by the data, an end-of-block code, a longitudinal parity character, and two space codes. Special formats are used for the control messages, usually consisting of seven characters.

(Contd.)

.36 Operating Procedure

(1) Operators establish connection through manual dialing or signaling.

(2) Receiving-terminal operator conditions the terminal to receive.

(3) Phones are switched to data mode.

(4) Transmitting terminal is started.

(5) After transmission, voice communication is again established and the phones are "hung up."

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.41 Output to Punched Tape

1004 Paper Tape Punch —

Tape size:	fully-punched 11/16, 7/8, or 1-inch, 5-, 6-, 7-, or 8-level paper tape.
Tape code:	any 5-, 6-, 7-, or 8-level code. The 7 and 8-level codes require two core storage locations to store each character if more than 6 data bits are used per character.
Rated punching speed:	110 char/sec.
Effective speed:	depends on the amount of data transmitted, the amount of computation per record, and the communications facilities.
Format control:	as specified by the plugboard wiring in the 1004 processor.
Comments:	odd or even parity can be generated and punched on 7- or 8-level paper tape output.

.42 Output to Punched Cards

1004 Card Punch or Card Read/Punch —

Card type and size:	IBM 80-column or UNIVAC 90-column cards, depending on model.
Card code:	standard 80-column Hollerith or 90-column card code; see Tables I and II.
Rated punching speed:	200 cards/min.
Effective speed:	depends on amount of data transmitted, amount of computation per record, and communications facilities; a speed of approximately 125 cards/min can be attained when receiving data from two fully-punched cards at a time over half-duplex facilities.
Format control:	as specified by the 1004 processor plugboard.
Comments:	80-column or 90-column versions are available; a reading station ahead of the punching station is available; a column binary feature is available for the 80-column model which treats each 12-row card column as containing two 6-bit characters, permitting up to 160 characters to be recorded on a card.

.43 Output to Magnetic Tape

1004 III Uniservo Magnetic Tape Unit . .	see Paragraph .31.

.44 Output to Printer

1004 I Printer —

Output medium:	pin-fed, fanfold forms from 4 to 22 inches wide; 132 printing positions per line.
Character set:	see Tables I and II.
Rated printing speed:	400 lines/min.
Effective speed:	depends on amount of data transmitted, amount of computation per record, and communications facilities.
Format control:	three-column paper tape loop controls vertical format; plugboard programming controls horizontal format.
Comments:	can be field-modified to the higher printing speed of the 1004 II/III printer.

1004 II/III Printer —

Output medium:	pin-fed, fanfold forms from 4 to 22 inches wide; 132 printing positions per line.
Character set:	see Tables I and II.
Rated printing speed:	600 lines/min.
Effective speed:	depends on amount of data transmitted, amount of computation per record, and communications facilities.
Format control:	three-column paper tape loop controls vertical format; plugboard programming controls horizontal format.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors

Type of checking	character validity on card input; character and longitudinal parity on magnetic tape input; optional character parity on 7- or 8-level paper tape input.
Error indication:	light; machine halts if programmed recovery fails.
Correction procedure:	manual intervention to correct source, if programmed recovery fails.

.52 Data Transmission Errors

Type of checking:	character and longitudinal parity.
Error indication:	return of error-control code and an impulse from the error hub on the 1004 plugboard.
Correction procedure:	as specified by the plugboard wiring; usually retransmission.

(Contd.)

.53 Data Recording Errors

Type of checking:	weighted hole-count check on punched-card input; no checking on paper tape or printer output; read-after-write character and longitudinal parity check on magnetic tape output.
Error indication:	light; machine halts if programmed recovery fails.
Correction procedure:	manual intervention, if programmed recovery fails.

.55 Line Malfunctions: ..... no special provisions for checking.

.6 CONDITION INDICATORS

Numerous lamps are provided on the console for monitoring the internal functions of the processor, but no indicators are specifically oriented towards data communications functions.

.7 DATA TRANSMISSION

.71 Basic Characteristics*

Rated transmission speed:	2,000 bits/sec over public switched telephone network; 2,400 bits/sec over leased common-carrier voice-band line.
Transmission method:	serial by bit.
Transmission code —	
DLT-1 and DLT-3:	a total of 7 bits are transmitted for each character (a 6-bit binary image of a core storage location and a parity bit.)
DLT-2:	same as DLT-1, except that an additional bit is transmitted for each character, making a total of 8 bits per character.
Transmission mode:	half-duplex.
Order of bit transmission:	low-order bit of each character is transmitted first, parity last.
Synchronization:	synchronous; i.e., synchronization is maintained by the data signals; external synchronization required.

* Unless otherwise specified, all entries apply to Data Line Terminals Type 1, 2, and 3.

.72 Connection to Communications Lines

Communications Line**	Data Set*
Public switched telephone network or common-carrier leased voice-band line (2,000 bits/sec):	Bell System Data-Phone Data Set 201A.
Common-carrier leased voice-band line (2,400 bits/sec):	Bell System Data Set 201B.

.73 Transmission Control

Call initiation:	manual dialing or signaling.
Call reception:	operator must establish voice communication and then switch to data mode.
Functional operations:	no direct control, but incoming data could be used to control operations through appropriate plugboard programming.

.74 Multistation Operation: no provision.

.8 PHYSICAL SPECIFICATIONS

Component	1004 Processor*** (all models)	Auxiliary Card Reader	Card Punch or Card Read/Punch	Uniservo (first and control)	Uniservo (second)
Width (inches)	71	31	42	52	27
Depth (inches)	63	24	25	32	32
Height (inches)	55	42	49	72.5	72.5
Weight (pounds)	2,021	415	870	920	470
Power (KVA)	3.0	0.3	1.5	1.4	1.0
Heat (BTU/hr)	8,500	683	3,500	5,200	4,700

General Requirements

Operating temperature:	50 to 90° F.
Relative humidity:	20 to 85%.
Power:	208-230 volt, 60-cycle, 1-phase, 3-wire AC.

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

** Other Data Line Terminals are available on special request for operation over Telpak A at 40,800 bits/sec.

*** The standard card reader and paper tape reader and punch, and the Data Line Terminal (any type) are housed in or on the Processor cabinet and are included in these figures.

(Contd.)

.9 PRICE DATA

Component or Feature	Monthly Rental, $	Purchase Price, $	Monthly Maintenance, $
1004 I Card Processor, 80- or 90-column* (includes 400 cpm Reader, 400 lpm Printer, 31 program steps, and 951 positions of core storage; 8 μsec cycle time)	975	46,000	225
1004 II Card Processor, 80- or 90-column* (includes 615 cpm Reader, 600 lpm Printer, 31 program steps, and 961 positions of core storage; 6.5 μsec cycle time)	1035	51,000	300
1004 III Card Processor, 80- or 90-column* (includes 615 cpm Reader, 600 lpm Printer, 31 program steps, and 961 positions of core storage; 6.5 μsec cycle time)	1035	51,000	300
Data Line Terminal Type 1, Type 2, or Type 3 (max. of one)	150	8000	60
Card Punch — 80-column, 200 cpm	215	12,000	100
Card Punch — 90-column, 200 cpm	215	12,000	100
Card Read/Punch — 80-column, 200 cpm	320	18,000	150
Card Read/Punch — 90-column, 200 cpm	320	18,000	150
Auxiliary Card Reader — 400 cpm	150	7200	40
Paper Tape Reader — 400 cps	140	6000	20
Paper Tape Punch — 110 cps	225	10,000	35
First Uniservo and Control	400	17,350	115
Second Uniservo	240	10,470	70
Optional Features			
Auxiliary Core Storage (961 locations)	95	2950	5
Processor, Expansion Kit* (includes 16 additional program steps and additional plugboard facilities; (one max)	235	10,000	25
Processor, Expansion Kit* (includes 15 additional program steps and additional plugboard facilities; one max; requires the 16-Step Expansion Kit)	95	4000	10
80/90-Column Read (processor must include 62 program steps)	140	6000	20
Code Conversion	95	4000	10
Short Card Feeding	30	1000	10
Code Image Read (column-binary; 80-column only)	20	1000	7
Code Image Punch (column-binary; 80-column only)	23	1000	5

* UNIVAC markets many models of the 1004 I, II, and III Card Processors; these models are combinations of the basic 80- or 90-column Card Processors listed here, the Processor Expansion Kits, and the 80/90-Column Read feature. These models follow the configuration rules presented for the optional features, and the price for each model is the sum of the separate component prices.

UNIVAC WORD TERMINAL SYNCHRONOUS

.1 GENERAL

.11 Identity: . . . . . UNIVAC Word Terminal Synchronous (WTS).

.12 Manufacturer: . . . . . UNIVAC Division
Sperry Rand Corporation
Box 8100
Philadelphia, Pa. 19101

.13 Basic Function: . . . . . enables UNIVAC computers to transmit and receive data over a single voice- or broad-band communications line; different interfaces are provided for connection to the various computers.

.15 Description

The UNIVAC Word Terminal Synchronous (WTS) serves as an interface between a UNIVAC 418 or 1100 Series computer and a single voice-band or broad-band communications line.

The WTS enables transmission and reception of data in a six-level (plus parity) character code at rates of 2,000 bits per second over the public switched telephone network, 2,400 bits per second over a leased voice-band line, or 40,800 bits per second over a broad-band line. Data is transferred between the WTS and the associated computer one word at a time. The WTS disassembles words for serial transmission to a remote terminal and assembles words received serially from a remote terminal. Once initiated the transmission or reception of a message proceeds independently of the main program in the associated computer system; an interrupt is generated only upon completion of a message.

A word parity check is performed on data transferred between the WTS and the associated computer system. The WTS performs character and message parity checking on data received from a remote terminal, and inserts character parity bits and longitudinal check characters in data transmitted to a remote terminal.

.16 First Delivery: . . . . . September 1965 (with UNIVAC 1107).

.17 Availability: . . . . . 4 months.

.2 CONFIGURATION

A basic UNIVAC Word Terminal Synchronous (WTS) consists of a Data Communications Terminal Control Unit, a Word Terminal Synchronous Module (18- or 36-bit interface), a power supply, and either a voice-band or a broad-band adapter. Unattended answering and automatic dialing are optional features.

Each WTS fully occupies one computer input-output channel.

Connections to standard communications facilities are described in Paragraph .72.

.3 INPUT

All input to the WTS is transferred from the associated UNIVAC computer under control of the computer program. Input to the computer can be from the console keyboard, punched cards, punched paper tape, or magnetic tape or drum.

.35 Message Configuration:. . . . . each message is preceded by a start-of-message character and followed by an end-of-message character; message length is dependent upon the remote terminal and computer core storage availability and is determined by the stored program in the associated computer.

.36 Operating Procedure

In attended operation, the operator establishes a connection manually by dialing or signalling and switches the data set to data mode. The WTS is then ready for transmission or reception. Further action is controlled by the stored program in the associated computer system.

Programmed automatic dialing and unattended operation features are optional.

.4 OUTPUT

All output from the WTS is transferred to the associated UNIVAC computer under control of the computer program. Output from the computer can be printed copy, punched cards, punched paper tape, or magnetic tape or drum.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors

Type of checking:. . . . . word parity checking is performed on data transferred to the WTS from the associated computer.
Error indication:. . . . . interrupt is generated.
Correction procedure: . . . . . as programmed.

.52 Data Transmission Errors

Type of checking:. . . . . character and message parity checking.
Error indication:. . . . . interrupt is generated.
Correction procedure: . . . . . under computer program control; usually retransmission.

.53 Data Recording Errors

Type of checking:. . . . . word parity check is performed on data transferred from the WTS to the associated computer.
Error indication:. . . . . interrupt is generated.
Correction procedure: . . . . . as programmed.

.55 Line Malfunctions

Detection:. . . . . failure to receive any data within a predetermined period of time; time out is controlled by circuitry and is adjustable.
Action:. . . . . interrupt is generated.

.6 CONDITION INDICATORS:. . . . . lamps and/or switches are provided to indicate power on, physical faults, and activity of terminal.

(Contd.)

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	2,000, 2,400, or 40,800 bits/sec.
Transmission method:	serial by bit.
Transmission code:	any 6-level code (plus parity); a total of 7 bits are transmitted for each character.
Transmission mode:	half-duplex or full-duplex.
Order of bit transmission:	low-order bit is transmitted first.
Synchronization:	synchronous; i.e., maintained by the interpretation of special characters sent prior to sending data.

.72 Connection to Communications Lines

Communications Line	Data Set*
Public switched telephone network (2,000 bits/sec):	Bell System Data-Phone Data Set 201A.
Common-carrier leased voice-band line (2,400 bits/sec):	Bell System Data Set 201B or Western Union 2400 Baud Data Modem.
Common-carrier leased broad-band line (40,800 bits/sec):	Bell System Data Set 301B.

.73 Transmission Control

Call initiation:	manual dialing or signaling, or optional programmed automatic dialing.
Call reception:	capable of unattended operation.
Functional operations:	no direct control, but incoming data can be interpreted to control operations with appropriate programming.

.74 Multistation Operation:

no provision other than facilities offered by programming in the associated computer; it would depend on the remote terminal's ability to respond to messages, and would require program analysis of responses.

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* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

.8 PHYSICAL SPECIFICATIONS

Component	UNIVAC Word Terminal Synchronous
Width (inches)	24
Depth (inches)	24
Height (inches)	72
Weight (pounds)	600
Power (KVA)	1
Voltage	208;120
Frequency (cps)	60;60
Phases	3;1
Temperature range (°F)	55 to 85
Humidity range (%)	30 to 70
Heat (BTU/hr)	4,500

.9 PRICE DATA

Component or Feature	Monthly Rental, $	Purchase Price, $	Monthly Maintenance, $
Data Communication Terminal Control Unit	190	8380	80
Word Terminal Synchronous Module includes one of the following interfaces:	325	14,210	160
18-bit interface (for 418 Series)			
36-bit interface (for 1100 Series)			
Voice-Band Adapter	5	225	NC
Broad-Band Adapter	5	225	NC
Power Supply	80	3335	30
Options			
Unattended Answering	5	225	NC
Automatic Dialing	40	1670	15

NC — No charge.

UNIVAC COMMUNICATIONS TERMINAL SYNCHRONOUS

.1 GENERAL

.11 Identity: . . . . . UNIVAC Communications Terminal Synchronous (CTS).

.12 Manufacturer: . . . . . UNIVAC Division
Sperry Rand Corporation
Box 8100
Philadelphia, Pa. 19101

.13 Basic Function: . . . . . enables UNIVAC computers to transmit and receive data over a single voice- or broad-band communications line; different interfaces are provided for connection to the various computers.

.15 Description

The UNIVAC Communications Terminal Synchronous (CTS) serves as an interface between a UNIVAC 1100 Series or 418-2 Series computer and a single communications line. The CTS enables transmission and reception of data in a 5-, 6-, 7-, or 8-level (plus parity) character code at rates of 2,000 bits per second over the public switched telephone network, 2,400 bits per second over a leased voice-band line, or 40,800 bits per second over a broad-band line. Data is transferred between the CTS and the associated computer one character at a time, and is stored in the computer memory one message character per computer word. Once initiated, the transmission or reception of a message proceeds independently of the main program in the associated computer system; an interrupt is generated only upon completion of a message.

The CTS imposes a greater demand on the central processor than does the Word Terminal Synchronous (see Report 6861), but is less expensive.

Character parity is checked on data received from a remote terminal, and character parity bits are automatically inserted in data transmitted to the remote terminal.

.16 First Delivery: . . . . . June 1965 (with UNIVAC 1107).

.17 Availability: . . . . . 3 months.

.2 CONFIGURATION

A basic CTS consists of a Data Communications Terminal Control Unit, a Communications Terminal Synchronous Module, and a power supply. A broad-band adapter, an unattended operation feature, and an automatic dialing feature are optional.

Each CTS fully occupies one computer input-output channel.

Connections to standard communications facilities are described in Paragraph .72.

.3 INPUT

All input to the CTS is transferred from the associated UNIVAC computer under control of the computer program. Input to the computer can be from the console keyboard, punched cards, punched paper tape, or magnetic tape or drum.

.35 Message Configuration: . . . . . each message preceded by a start-of-message character and followed by an end-of-message character; message length is dependent upon terminal equipment and computer core storage availability, and is determined by the stored program in the associated computer.

.36 Operating Procedure

In attended operation, the operator establishes a connection manually by dialing or signalling, and switches the data set to data mode. The CTS is then ready for transmission or reception, and all further action is under control of the stored program in the associated computer system.

Programmed automatic dialing and unattended operation features are optional.

.4 OUTPUT

All output from the CTS is transferred to the associated UNIVAC computer under control of the computer program. Output from the computer can be printed copy, punched cards, punched paper tape, or magnetic tape or drum.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors: . . . . . no checking is performed on data transferred to the CTS from the computer.

.52 Data Transmission Errors

Type of checking: . . . . . character parity checking only.
Error indication: . . . . . interrupt is generated.
Correction procedure: . . . . . under computer program control; usually retransmission.

.53 Data Recording Errors: . . . . . no checking of data transferred to the computer from the CTS.

.55 Line Malfunctions

Detection: . . . . . failure to receive any data within a predetermined period of time; time out is controlled by circuitry and is adjustable.
Action: . . . . . interrupt is generated.

.6 CONDITION INDICATORS: . . . . . lamps and/or switches are provided to indicate power on, physical faults, and activity of terminal.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed: . . . . . 2,000, 2,400, or 40,800 bits/sec.
Transmission method: . . . . . serial by bit.
Transmission code: . . . . . any 5-, 6-, 7-, or 8-level code (plus parity).
Transmission mode: . . . . . half-duplex or full-duplex.
Order of bit transmission: . . . . . low-order bit is transmitted first.
Synchronization: . . . . . synchronous; i.e., synchronization is maintained by the interpretation of special characters sent prior to sending data.

(Contd.)

.72 Connection to Communications Lines

Communications Line	Data Set*
Public switched telephone network (2,000 bits/sec):	Bell System Data Phone-Data Set 201A.
Common-carrier leased voice-band line (2,400 bits/sec):	Bell System Data Set 201B or Western Union 2400 Baud Data Modem.
Common-carrier leased broad-band line (40,800 bits/sec):	Bell System Data Set 301B.

.73 Transmission Control

Call initiation:	manual dialing or signaling, or optional programmed automatic dialing.
Call reception:	capable of unattended operation.
Functional operations:	no direct control, but incoming data can be interpreted to control operations with appropriate programming.

.74 Multistation Operation: no provision other than facilities offered by programming in the associated computer; it would depend on the remote terminal's ability to respond to messages, and would require program analysis of responses.

.8 PHYSICAL SPECIFICATIONS

Component:	UNIVAC Communication Terminal Synchronous
Width (inches)	24
Depth (inches)	24
Height (inches)	72
Weight (pounds)	600
Power (KVA)	1
Voltage	208;120
Frequency (cps)	60;60
Phases	3;1
Temperature range (°F)	55 to 85
Humidity range (%)	30 to 70
Heat (BTU/hr)	4,500

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

.9 PRICE DATA

Component or Feature	Monthly Rental, $	Purchase Price, $	Monthly Maintenance, $
Data Communications Terminal Control Unit	190	8380	80
Communication Terminal Synchronous Module	190	8380	80
Power Supply	80	3335	30
Options			
Broad-Band Adapter	80	3335	30
Unattended Answering	5	225	NC
Automatic Dialing	41	1670	15

NC — No charge

UNIVAC DCT 2000

.1 GENERAL

.11 Identity: . . . . . Data Communication Terminal, DCT 2000.

.12 Manufacturer: . . . . . UNIVAC Division
Sperry Rand Corporation
Box 8100
Philadelphia, Pennsylvania 19101

.13 Basic Function: . . . . . transmission and reception of data over a voice-band line with a wide variety of UNIVAC computer systems at up to 343 char/sec.

.14 Basic Components

Name: . . . . . Control Unit.
Model number: . . . . . USASCII or DLT 1/3.
Function: . . . . . provides basic control and buffering functions.

Name: . . . . . High-Speed Printer.
Function: . . . . . prints alphanumeric information at up to 250 lines per minute.

Name: . . . . . Card Reader/Punch.
Function: . . . . . reads cards at 200 cards/min or punches cards at 75 to 200 cards/min.

Name: . . . . . Paper Tape Subsystem.
Function: . . . . . reads punched paper tape at 300 characters per second or punches paper tape at 110 characters per second.

.15 Description:

The DCT 2000 Data Communication Terminal is the first of a series of terminals to be announced by UNIVAC. The DCT 2000 is primarily intended for use as a remote terminal for a computer, but direct communication between two DCT 2000 terminals is possible.

The basic DCT 2000 consists of a control unit and a 250 line-per-minute line printer. The printer has a standard complement of 80 print positions and is capable of printing 63 separate characters. A 128-character-position printer carriage is available as an option. A card reader/punch is available that reads 80-column cards at up to 200 cards per minute and punches from 75 to 200 cards per minute depending on the number of columns punched.

The input/output capabilities of the basic DCT 2000 can be augmented by adding the Paper Tape Subsystem, which connects to the optional Peripheral Input-Output channel and provides both paper tape punching and/or reading capabilities. The subsystem accommodates 5- through 8-level paper tape and permits any paper tape code to be read or punched limited only by the I/O channel capacity. Punching is performed at 110 characters per second, reading at 300 characters per second. Data is transferred serially between the Paper Tape Subsystem and the DCT 2000 under control of a read or punch command. Character parity is generated when punching and checked when reading by the paper tape control unit; parity does not accompany data transferred between the Paper Tape Subsystem and the DCT 2000. A patch-board translator permits interchanging the code levels of data transferred between the Subsystem and the DCT 2000 interface to accommodate punching or reading various paper tape codes. The patch-board translator also permits the selection of odd, even, or no parity, Delete and Read Error character configurations for the respective punch and read operations, and prevents erroneous control-code recognition at the DCT 2000 when reading 5-level paper tape.

UNIVAC states that additional types of input/output units will be announced for use with the DCT 2000 in the future. The Peripheral Input-Output Channel feature provides for the addition of up to four units to the basic terminal.

Figure 1. The UNIVAC DCT 2000 Data Communication Terminal Shown With the Paper Tape Subsystem (right).

.15 Description (Contd.)

The DCT 2000 operates over the public telephone network at 2,000 bits per second or over a leased voice-band line at 2,000 or 2,400 bits per second. Communications take place in a half-duplex mode, but full-duplex communications facilities can be used to maintain synchronization in both directions at the same time; this reduces the turnaround time and consequently provides higher effective performance.

Two control units are available. One utilizes the 8-level USASCII transmission code (7 data bits plus parity); the other uses the 7-level UNIVAC XS-3 transmission code (6 data bits plus parity). The second control unit is compatible with a remote UNIVAC 1004 equipped with a Data Line Terminal (DLT) Type 1 or Type 3, and with other devices using the XS-3 code. The DLT Control Unit incorporates certain features that are options with the USASCII Unit; see the listing of options at the end of this Description.

Communications between a DCT 2000 and a remote terminal take place as a series of data messages and acknowledgement messages. The control unit contains two 128-character buffers, which are alternated between input/output and transmission. Each message contains 80 or 128 data characters, as selected by the operator. The block length can be different for transmission and reception, and is independent of the peripheral device. A Short Block feature is available; see the listing of options below.

Character parity and longitudinal parity are generated and transmitted for each data block. Error detection and automatic retransmission are standard in the DLT 1/3 Control Unit and optional in the USASCII Control Unit.

One feature of the DCT 2000 is of particular interest when operating as a remote terminal to a computer system. The DCT 2000 expects an acknowledgement reply to each data block transmitted; if a reply is not received within a fixed period of time, the DCT 2000 will retransmit the data block continuously until a positive acknowledgement is received or until the terminal operator intervenes. The retransmissions continue even though a connection may be broken and re-established. This technique allows the remote computer to temporarily ignore a particular DCT 2000 during a peak period and pick up again when it has time.

Protection against message redundancy is provided by the Duplicate Block Protection feature, which insures that the same message block is not received twice due to an unsolicited retransmission initiated by a no-response condition. This technique employs the fifth bit of the SEL character position within the message header as a block identifier. During normal

(Contd.)

.15 Description (Contd.)

message transmission, this identifier bit is toggled between alternate binary states once for each block except when the block is retransmitted. Block-duplication detection is performed by comparing the block identifier bit of the present message with that of the previous message. Both identifier bits having the same state indicates a retransmission. The duplicate block is accepted only when the Terminal had requested the retransmission (NAK response) and discarded if an ACK response was issued last.

The optional features currently available for a DCT 2000 Terminal include:

- Wide Print Carriage — Expands the number of print positions in the High-Speed Printer from 80 to 128.
- Printer Form Control — Allows vertical tabulation and skipping to the top of the next page to be initiated by special data characters within the received message text (USASCII version), or within the message header (DLT 1/3 version). Actual skipping is controlled by a paper tape loop form control mechanism in the printer. All skips are performed immediately after printing the data block containing the special forms control character.
- Card Code Translater/Print Bar - Permits conversion of several common card codes including EBCDIC and Scientific "H" codes to DCT 2000 code for both reading and punching operations. The card code character set must correspond to the print bar character set. Data is printed and transmitted in the DCT 2000 code. There are two conditions that determine translator and print bar requirements: card code and card-code character set. A translator is required to translate between the card code and the DCT 2000 code; a print bar is required only when the existing printer character set does not correspond to the card-code character set. UNIVAC provides a wide variety of translators with corresponding print bars that are available free of charge with the initial order, or as a field change at extra cost. See Paragraph .9 for pricing.
- Error Detection and Retransmission — Provides checking of character and longitudinal parity, and automatic retransmission. If no response or a negative acknowledge is received from the remote terminal after transmitting a data block, the DCT 2000 will automatically retransmit that data block. The retransmissions will be repeated until a successful transmission is accomplished or until the operator intervenes. A lamp is lighted and an audible alarm is sounded after the second retransmission. A bit is changed in one of the control characters when retransmitting a data block because of no response from the remote terminal; this allows the remote terminal to identify duplicated data blocks. The DLT 1/3 Control Unit includes this feature as standard equipment.
- Telephone Alert — Permits a DCT 2000 operator to signal the remote operator. This is usually used when alternate vocal communication is permitted (e.g., the public telephone network) to indicate that verbal communication is desired.
- Select Character Capability — Permits the remote transmitting terminal to specify, by a control character in the message heading, which of up to six output devices of the local DCT 2000 is to be used. The local operator can override this control and specify the output unit.
- Short Block Capability — Permits the data block to contain less than the 80 or 128 characters as selected by the switches on the Operator Panel. End of data is indicated by a special control character contained in the input data. This feature applies only to the USASCII Control Unit; the DLT 1/3 has, as a standard feature, the capability to receive short blocks but cannot transmit short blocks.
- Unattended Answering — Permits the DCT 2000 to automatically answer a call from a remote location, to transmit or receive data in response to transmissions from the remote terminal, and to disconnect when the call is finished.
- Peripheral Input/Output Channel - Permits up to four additional peripheral devices to be connected to the DCT 2000. This feature is not required to connect the first card reader/punch.

.15 Description (Contd.)

- Transmit/Receive Monitor — Permits data to be printed by the high-speed printer while being transmitted or received by the card reader/punch.
- Off-Line Listing - Permits data from a deck of cards to be printed without being transmitted. The Transmit/Receive Monitor feature is required as a prerequisite for this feature.
- Punch Check and Alternate Stacker — Provides echo checking to verify the actuation of the punch dies. If an error is detected, the card in error is routed to an auxiliary stacker, also provided with this feature, and a new card is punched.

All features are applicable to both control units except where noted. All features can be field-installed.

.16 First Delivery: . . . . . first quarter, 1967.

.17 Availability: . . . . . approximately 4 months.

.2 CONFIGURATION

The basic DCT 2000 is available in two versions: USASCII and DLT 1/3. The DLT 1/3 is intended primarily for use as a remote terminal with a UNIVAC 1004 Card Processor equipped with a Data Line Terminal Type 1 or Type 3 (see Report 6860). The features included in each version are indicated below:

- USASCII version - includes the USASCII Control Unit, the 250-line-per-minute High-Speed Printer, and either an EIA RS 232A or a MIL STD 188B electrical interface.
- DLT 1/3 version — includes the DLT 1/3 Control Unit, the 250-line-per-minute High-Speed Printer, the Error Detection and Retransmission feature, the Short Block capability for receive operations only, and an EIA RS 232A electrical interface.

The basic DCT 2000 can be expanded to include the Card Reader/Punch and/or the Paper Tape Subsystem. The Card Reader/Punch reads 80-column cards at up to 200 cards per minute and punches from 75 to 200 cards per minute depending on the number of columns punched. The Paper Tape Subsystem punches and reads 5- through 8-level paper tape. Punching is performed at 110 characters per second, reading at 300 characters per second.

The options available for each of these versions are fully described in Paragraph .15.

Either version of the DCT 2000 can operate over the public telephone network or a common-carrier leased voice-band line, at 2,000 or 2,400 bits per second, respectively. Connections to standard communications facilities and the required data sets are described in Paragraph .72.

.3 INPUT

.31 Prepared Input

Paper Tape Reader -

Input medium:	fully-punched or chadless 11/16-, 7/8-, or 1-inch paper tape; available with a three-position adjustable tape guide; transmissivity must not exceed 40%.
Input code:	any 5-, 6-, 7-, or 8-level code.
Quantity of data:	variable.
Rated input speed:	300 char/sec. (10 characters per inch).
Effective Speed:	less than rated speed, depending upon block length, transmission speed, and speed of receiving device.
Comments:	undirectional tape read (left to right); hole detection is performed photoelectrically; optional features include tape spooler and 5-inch reels.

(Contd.)

.31 Prepared Input (Contd.)

Card Reader/Punch —

Input medium:	standard 80-column cards.
Input code:	see Table II.
Quantity of data:	up to 80 characters per card.
Rated input speed:	200 cards/min.
Effective speed:	90 to 200 cards/min, depending on transmission speed and whether a half- or full-duplex line is used.
Comments:	this unit provides one 1200-card input hopper, one 850-card stacker, and one 850-card alternate stacker (optional with Punch Check feature). simultaneous card reading and card punching not possible.

.32 Manual Input: . . . . . no provision announced to date.

.33 Fixed Input: . . . . . no provision.

.34 Transaction Code Input: . . . . . any one of the six Select characters can be selected for transmission by the DCT 2000 operator.

.35 Message Configuration

USASCII Control Unit:

A data message consists of four SYN characters followed by the SOH, SEL, and STX control characters, 80 or 128 data characters, the ETX control character, and the Block Parity (BP) character. The BP character is always generated and transmitted. The number of data characters, 80 or 128, is set by switches and can be different for transmit and receive operations. The size of the data block is independent of the input or output block; non-used positions in a data block are space-filled. If the Short Block feature is incorporated, the size of the data block is controlled by an EM character in the data field; the EM character counts as a data character. When transmitting, the EM character must be punched into the card. A response or special message consists of four SYN characters followed by two ACK, NAK, BEL or XMIT START/NO DATA characters. All control characters, with the exception of EM, are automatically generated and transmitted by the control unit. The total length of a data message will typically be 89 or 137 characters, including the SYN characters. The total length of a response or special message will be 6 characters, including the SYN characters. See Table III for definitions of the control characters.

DLT 1/3 Control Unit:

All messages have the same general format: four SYN characters followed by the SOM character, the message, and the EOM and Block Parity (BP) characters. The message portion of a data message consists of a message control character followed by 80 or 128 data characters (as specified by a switch setting) when transmitting, and 1 to 128 data characters when receiving. The message portion of all other messages consists of a single response or special control character. All control characters are automatically generated and transmitted by the control unit. The total length of a data message will typically be 88 or 136 characters, including the SYN characters. The total length of a response or special message will be 8 characters, including the SYN characters. See Table III for a definition of the control characters.

Parity does not accompany data transferred between the Paper Tape Subsystem and the DCT 2000. When reading from paper tape, the transfer of standard NULL (no punching, all 0's) or DELETE (all positions punched, all 1's) codes to the DCT 2000 is normally inhibited. The DELETE code is wired on the plugboard translator and can be any bit configuration. When tapes punched in other than DCT 2000 code are read, the data being transferred to a remote USASCII - compatible DCT 2000 should not contain SYN characters since they are deleted from the message. The short block feature on the DCT 2000 maintenance panel should be disabled when reading such tapes. The plugboard translator provides for interchanging the pin connections between the interface channel and the paper tape channels.

.36 Operating Procedure

The operator prepares the terminal by loading the card reader/punch (with data cards if data is to be transmitted or with blank cards if data is to be received and punched), by loading the high-speed printer with forms if required, and by setting the switches on the Operations Control Panel to conform with the desired operating procedure. Calls are initiated manually. Calls are answered manually, or automatically if the Unattended Answering feature is incorporated. The subsequent transmission and reception of data are largely automatic and require little operator attention, if any. If the Error Detection and Retransmission feature is incorporated, retransmission of data blocks containing errors is automatic.

If the errors are persistent, retransmission continues until a successful transmission is accomplished or until the operator intervenes. A lamp is lighted and an audible alarm sounded after the second retransmission of the same data block. The connection is broken by the operator in the attended mode, or automatically after a lapse of 30 seconds without receiving data in the unattended mode. An important operating characteristic of the DCT 2000 in the attended mode is that the terminal remains active, even if the connection is accidentally broken, until the operator intervenes. Thus the remote site could reinitiate a call, even by redialing over the public telephone network, and the DCT 2000 would pick up where it left off. The message being transmitted at the time of the interruption would be automatically retransmitted. One of the control characters in the message heading is altered for retransmissions, permitting detection of message block duplication.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.41 Output to Punched Tape

Paper Tape Punch -

Tape size:	11/16- or 1-inch oiled paper tape. (compatible paper-MYLAR-paper sandwich tape is available from UNIVAC).
Tape code:	any 5-, 6-, 7-, or 8-level code.
Rated punching speed:	110 char/sec. (10 characters per inch).
Effective speed:	less than rated speed, limited by block length, transmission speed, and speed of sending device.
Comments:	punching provided with five levels of tape characters using 11/16-inch paper tape, or five, six, seven, or eight levels using 1-inch paper tape; adjustable tape guide and winder included; capable of starting and stopping between characters.

.42 Output to Punched Cards

Card Reader/Punch —

Card type and size:	standard 80-column card.
Card code:	Hollerith; see Table II.
Rated punching speed:	75 to 200 cards/min, depending on the number of columns punched.
Effective speed:	75 fully-punched cards/min; up to 200 partially-punched cards/min, depending on number of columns punched, transmission speed, and whether a half- or full-duplex line is used.
Format control:	none.
Comments:	see Comments, Paragraph .31.

.44 Output to Printer

High-Speed Printer —

Output medium:	pin-fed continuous forms up to 22 inches wide and 14 inches long; maximum printed line length is 80 characters or 128 characters (optional).

(Contd.)

Character set:	see Tables I and II.
Rated printing speed:	250 single-spaced lines/min.
Effective speed:	70 to 250 lines/min, depending on the number of characters per line, the transmission speed, and whether a half- or full-duplex line is used.
Format control:	via special control codes in received data; operations include form skipping and vertical tab (optional); line feed and carriage return occur automatically at end of line.
Comments:	uses a horizontally oscillating type-bar mechanism.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors

Type of checking:	no checking of data read from cards; card detector verifies that a card is in position; character parity check on data read from paper tape.
Error indication:	light, buzzer, and machine halt; characters read in error from paper tape are replaced with a special flagging character wired on the plugboard translator; when STOP ON ERROR switch is enabled detection of a parity error or torn tape halts read operations.
Correction procedure:	manual intervention.
Comments:	UNIVAC does not recommend use of the STOP ON ERROR switch in the unattended mode since rereading the entire tape is the only means of recovery from a halt condition.

.52 Data Transmission Errors

Type of checking:	character parity (odd) and block or longitudinal parity checking are standard with the DLT 1/3 Control Unit and optional with the USASCII Control Unit. Character parity bits and the block parity character are transmitted whether or not the checking feature is incorporated. Control characters at beginning of data block are checked for validity. Length of data block is checked to verify that it is 80 or 128 characters (depending on the switch setting) or that an EM (end of message) character is present.
Error indication:	transmission of a negative acknowledgement (NAK) or no response within 4.5 seconds.
Correction procedure:	automatic retransmission; if error is persistent, retransmissions continue and a lamp is lighted and an audible alarm sounded until a successful transmission is accomplished or the operator intervenes.
Comments:	protection against receiving a redundant message block is provided by the Duplicate Block Protection feature; see Paragraph .15.

.53 Data Recording Errors

Type of checking:	echo check to verify that the correct punch dies were activated (optional).
Error indication:	card in error is ejected into reject stacker.
Correction procedure:	automatic repunching of card.

.54 Equipment Malfunctions: . . . . . diagnostic facility allows operator to completely check out the functioning of each DCT 2000 component up to the data set; a diagnostic generator is provided, and the transmit section can be looped into the receive section.

.55 Line Malfunctions: . . . . . line malfunctions can be isolated indirectly by verifying the proper functioning of the terminal components via the diagnostic facility (see Paragraph .54).

TABLE I. UNIVAC DCT 2000
USASCII DATA CODES (1)

Bits 4, 3, 2, 1	Bits 7, 6, 5(2) 010	011	100	101	110
0000	Space	0		P	@
0001	!	1	A	Q	
0010	¤	2	B	R	
0011	#	3	C	S	
0100	$	4	D	T	
0101	%	5	E	U	
0110	&	6	F	V	
0111	'	7	G	W	
1000	(	8	H	X	
1001	)	9	I	Y	
1010	*	:	J	Z	
1011	+	;	K	[	
1100	,	<	L	\	
1101	-	=	M	]	
1110	.	>	N	△	
1111	/		O	¥	

(1) See Table III for control codes. The same card code is used for both USASCII and XS-3 characters; see Table II.

(2) The eighth bit is an odd parity bit.

TABLE II: UNIVAC DCT XS-3
DATA CODES (1)

80-Col. Card Code	Printable Characters	XS-3 Code (2)	80-Col. Card Code	Printable Characters	XS-3 Code (1)
12-1	A	01 0100	7	7	00 1010
12-2	B	01 0101	8	8	00 1011
12-3	C	01 0110	9	9	00 1100
12-4	D	01 0111	12	&	01 0000
12-5	E	01 1000	11	- (minus)	00 0010
12-6	F	01 1001	12-0	?	01 0011
12-7	G	01 1010	11-0	! (exclam.)	10 0011
12-8	H	01 1011	0-1	/	11 0100
12-9	I	01 1100	2-8	+	11 0011
11-1	J	10 0100	3-8	#	01 1101
11-2	K	10 0101	4-8	@	10 1110
11-3	L	10 0110	5-8	: (colon)	01 0001
11-4	M	10 0111	6-8	>	11 1110
11-5	N	10 1000	7-8	' (apos.)	10 0000
11-6	O	10 1001	12-3-8	. (period)	01 0010
11-7	P	10 1010	12-4-8	¤	11 1101
11-8	Q	10 1011	12-5-8	[	00 1111
11-9	R	10 1100	12-6-8	<	01 1110
0-2	S	11 0101	12-7-8	=	01 1111
0-3	T	11 0110	11-3-8	$	10 0010
0-4	U	11 0111	11-4-8	*	10 0001
0-5	V	11 1000	11-5-8	]	00 0001
0-6	W	11 1001	11-6-8	; (semi-col)	00 1110
0-7	X	11 1010	11-7-8	△	10 1111
0-8	Y	11 1011	0-2-8	≠	11 0000
0-9	Z	11 1100	0-3-8	, (comma)	11 0010
0	0	00 0011	0-4-8	%	11 0001
1	1	00 0100	0-5-8	(	10 1101
2	2	00 0101	0-6-8	\	00 1101
3	3	00 0110	0-7-8	)	11 1111
4	4	00 0111			
5	5	00 1000	Blank	Space N.P.	00 0000
6	6	00 1001			

Reproduced from UNIVAC 1004 Card Processor — 80 Column, Publication UT 2543 REV. 1A, page 4.

(1) See Table III for control codes.

(2) The seventh bit is an odd parity bit.

.6 CONDITION INDICATORS: . . . . . a wide range of visible switches and lamps are provided on the Operator Control Panel to display the operating status of the DCT 2000 Terminal. A total of 72 conditions can be displayed on 8 status indicators by means of a changeable overlay technique; the overlay is controlled by a knob on the side of the panel. Additional switches are provided under a flip-up panel to control diagnostic checking.

(Contd.)

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed: . . . . . 2,000 bits/sec (public telephone network); 2,400 bits/sec (leased voice-band line).

Transmission method: . . . . . serial by bit.

Transmission code: . . . . . 8-level USASCII (7 data bits plus parity) or 7-level UNIVAC XS-3 (6 data bits plus parity); see Tables I, II, and III.

Transmission mode: . . . . . half-duplex.

Order of bit transmission: . . . . . low-order bit first.

Synchronization: . . . . . synchronous; i.e., synchronization is maintained by interpretation of special Synch characters transmitted at the start of each data block and response.

TABLE III. UNIVAC DCT 2000 CONTROL CHARACTER CODES

USASCII		XS-3		Function
Character	Transmission Code	Character	Transmission Code	
SYN	001 0110	SYN	11 0101	Used to establish synchronization.
SOH	000 0001	SOM	00 0000	Indicates beginning of transmission.
SEL (1)		Message Control (2)		Indicates desired output device or format control:
Sp; 0			AX X000	Integral printer.
! ; 1	See		AX X000	Integral card punch.
¤ ; 2	Table I		AX X000	Peripheral device 1.
# ; 3			AX X000	Peripheral device 2.
$; 4			AX X000	Peripheral device 3.
% ; 5			AX X000	Peripheral device 4.
-			A1 0000	Initiate vertical tab.
-			A0 1000	Initiate form skip.
STX	000 0010	-		Indicates beginning of data.
VT	000 1011	(3)		Initiates vertical tab.
FF	000 1100	(3)		Initiates form skip.
EM	001 1001	-		Indicates end of short block (ASCII only).
ETX	000 0011	EOM	01 0101	Indicates end of data.
ACK	000 0110	ACK	00 0101	Positive acknowledge.
NAK	001 0101	NAK	00 0100	Negative acknowledge; request retransmission.
BEL	000 0111	BEL	10 0000	Causes an alarm to be sounded.
NO DATA/ XMIT START	001 0001	NO DATA/ XMIT START	10 0011	Response when a called terminal is not conditioned to transmit; used to start a remote unattended terminal.

(1) The first character shown is transmitted in the first transmission of a block and all retransmissions in response to a NAK acknowledgement; the second character is transmitted in a non-requested retransmission of that block.

(2) The bit indicated as A is transmitted as a "0" in the first transmission of a block and all retransmissions in response to a NAK acknowledgement; the bit is transmitted as a "1" in a non-requested retransmission of that block. The bits indicated as X can be either a "0" or a "1" but cannot both be a "0".

(3) With the DLT Control Unit (XS-3), these functions are initiated by a Message Control character.

.72 Connection to Communications Lines

Communications Line	Data Set*
Public telephone network (2000 bits/sec):	Bell System Data-Phone Data Set 201A.
Leased voice-band data channel operating at the following speeds —	
2000 bits/sec:	Bell System Data Set 201A.
2400 bits/sec:	Bell System Data Set 201B or Western Union 2400 Baud Data Modem.

.73 Transmission Control

Call initiation:	manual dialing or signaling.
Call reception:	unattended operation is an optional feature; otherwise operator must establish voice communication and then switch to data mode.
Functional operations:	form skip or vertical tab (optional) initiated by special character code; card feed or line advance occurs automatically at the end of a data block.

.74 Multistation Operation: . . . . . no provision announced to date.

.8 PHYSICAL SPECIFICATIONS

Components	High-Speed Printer and Control Unit*	Card Reader/Punch (1)	Paper Tape Subsystem
Width (inches)	65	40	25
Depth (inches	25	26	26.5
Height (inches)	45	41 (2)	50
Weight (pounds)	1,500		300
Power (KVA)	4.9		0.62(3), 0.27
Voltage	208/240		208/240
Frequency (Hz)	60		60
Phases	1		1
Temperature range (°F)	60 to 94		60 to 94
Humidity range (%)	20 to 85		20 to 85
Heat (BTU/hr)	17,000		2116(3), 935

(1) Combined unit forms an L-shaped cabinet, 65 inches along each of the two principal dimensions. The Operator Control Panel is located on the top of the reader/punch unit, or to the right of the print mechanism in a printer-only configuration.

(2) Height of work surface is 29 inches.

(3) Internal power supply.

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

(Contd.)

.9 PRICE DATA

Component or Feature (1)	Monthly Rental, $	Purchase Price, $	Monthly Maintenance, $	One-Time Charge, (2) $
Basic Data Communications Terminal				
USASCII Control Unit and Printer (80 print positions)	390	16,170	45	-
DLT 1/3 Control Unit, Printer (80 character positions), and error detection and retransmission capability	440	18,260	50	-
Card Reader/Punch				
Reader/Punch (read 200 cpm; punch 75 to 200 cpm)	175	7350	60	70
Punch Check and Alternate Stacker	37	1545	10	105
Control Unit Features				
Error Detection and Retransmission (included in DLT 1/3 Control Unit)	39	1620	3	25
Telephone Alert	12	470	2	25
Select Character Capability	12	470	2	25
Short Block Capability	12	470	2	25
Unattended Answering	23	140	2	25
Peripheral I/O Channel	46	1920	4	25
Transmit/Receive Monitor	26	1070	4	25
Off-Line Listing	16	640	2	25
Printer Features (3)				
Wide Print Carriage (provides a total of 128 Print Positions)	65	2695	17	120
Form Control	23	940	3	35
Paper Tape Subsystem				
Paper Tape Control Unit	115	5005	25	-
Reader	35	1525	15	30
Reader Spooler	35	1525	5	-
Punch	120	5220	20	30
Punch Takeup Spooler	15	655	5	-

(1) Refer to Paragraph .15, Description, for a detailed description of each feature.

(2) One-time charge for field installation of component or feature.

(3) Approximate field installation cost for translator and/or print bar is $100; approximate print bar cost is $300.

UNIVAC UNISCOPE 300
VISUAL COMMUNICATION TERMINALS

.1 GENERAL

.11 Identity: . . . . . Uniscope 300S and Uniscope 300M Visual Communication Terminals.

.12 Manufacturer: . . . . . UNIVAC Division of Sperry Rand Corporation
Post Office Box 500
Blue Bell, Pa.

.13 Basic Function: . . . . . displays, via cathode ray tube, data received from a remote computer or entered via keyboard; transmits data to remote computer over the public telephone network or leased voice-band lines.

.14 Basic Components

Name: . . . . . Uniscope 300S Visual Communication Terminal.
Function: . . . . . independent unit which contains control logic and buffering.

Name: . . . . . Uniscope 300M Visual Communication Terminal.
Function: . . . . . display unit and keyboard unit only.

Name: . . . . . Multi-Station Control Unit.
Function: . . . . . provides control logic and buffering for multiple 300M display units.

.15 Description

The UNIVAC Uniscope 300 is a visual communication terminal designed to facilitate rapid and efficient exchange of data between a computer and one or more remote stations under control of a stored program in the computer.

Basic Operation

The Uniscope 300M is designed to operate in a polling environment; all transmissions between the computer and the display stations are initiated by the computer. A total of 11 types of messages are used to coordinate data transmission between the remote computer and the display operators; see Paragraph .35.

The normal configuration of a Uniscope 300 terminal includes a controller and multiple display stations. A single display station with internal control logic is also available. Each controller operates in a half-duplex mode; full-duplex operation with simultaneous data transmission and reception is optional.

The Uniscope 300S is designed to operate in a full-duplex multi-station arrangement; i.e., several controllers and associated display stations are connected to a single full-duplex line. Provisions are included in the control logic of the terminals to allow the computer to interrupt transmission to one display controller to allow the computer to poll and initiate data transmission from another controller connected to the same communications line. Transmission to one controller and reception from a second controller can then proceed simultaneously.

Configuration

Two models of the Uniscope 300 are available: the 300S and the 300M. The Model 300S is intended for single-station operation and contains a cathode ray tube (CRT) display, a keyboard, a 1024-character core buffer, and character generation and control logic. Model 300M contains only the CRT and keyboard and is used with the Multi-Station Control Unit (MSCU).

The MSCU is modular and includes a basic 8,192-character core buffer and a basic character generator and control module. Separate versions of the basic controller are available for connecting up to 4 Uniscope 300M terminals capable of displaying up to 1024 characters each, or 8 Uniscope 300M terminals capable of displaying up to 512 characters each. When the MSCU includes all optional components, a maximum of 24 1024-character display terminals or 48 512-character display terminals can be connected. Each display station can be located up to 1500 cable feet from the MSCU.

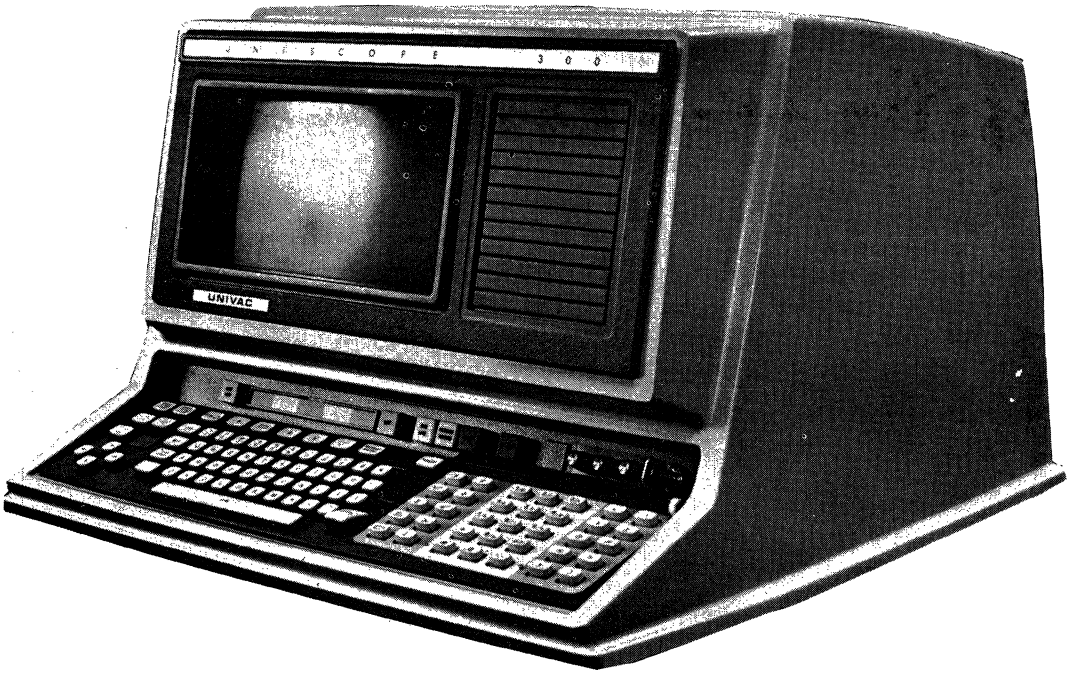


Figure 1. Uniscope 300 Visual Communication Terminal.

Data Transmission

The basic transmission rate of the Uniscope 300 is 2000 or 2400 bits per second; UNIVAC states that higher transmission rates are possible and are available on special request. The Uniscope 300 operates synchronously in the half-duplex mode; full-duplex operation is optional. A modified 7-level USASCII (formerly ASCII) transmission code is employed with an eighth bit added for character parity; see Table I.

TABLE I: UNIVAC UNISCOPE USASCII CODE

		2^3	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
		2^4	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
		2^5	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
		2^6	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
2^2	2^1	2^0																
0	0	0					CHAR ERASE	(	Ø	8	@	H	P	X	↓	◇	↳	::
0	0	1		DEL. IN DSPY		DEL. IN LINE	!	)	1	9	A	I	Q	Y	↧	Σ	↓	⊤
0	1	0		ERASE END DSPY		ERASE END LINE	"	*	2	:	B	J	R	Z	≤	↙	–	⋈
0	1	1		CR		HOME CURSOR	#	+	3	;	C	K	S	[	≥	≡	∧	÷
1	0	0	MSG WTG	SCAN UP			$	,	4	<	D	L	T	Δ	↑	↗	∨	∴
1	0	1		SCAN DOWN			%	–	5	=	E	M	U	]	↑	↑	⊢	⊣
1	1	0	TAB	SCAN LEFT			&	.	6	>	F	N	V	≠	≠	⊡	↓	¢
1	1	1	INSERT IN DSPY	SCAN RHT	INSERT IN LINE		'	/	7	?	G	O	W	□	⌐	↓	↖	⚡

(Contd.)

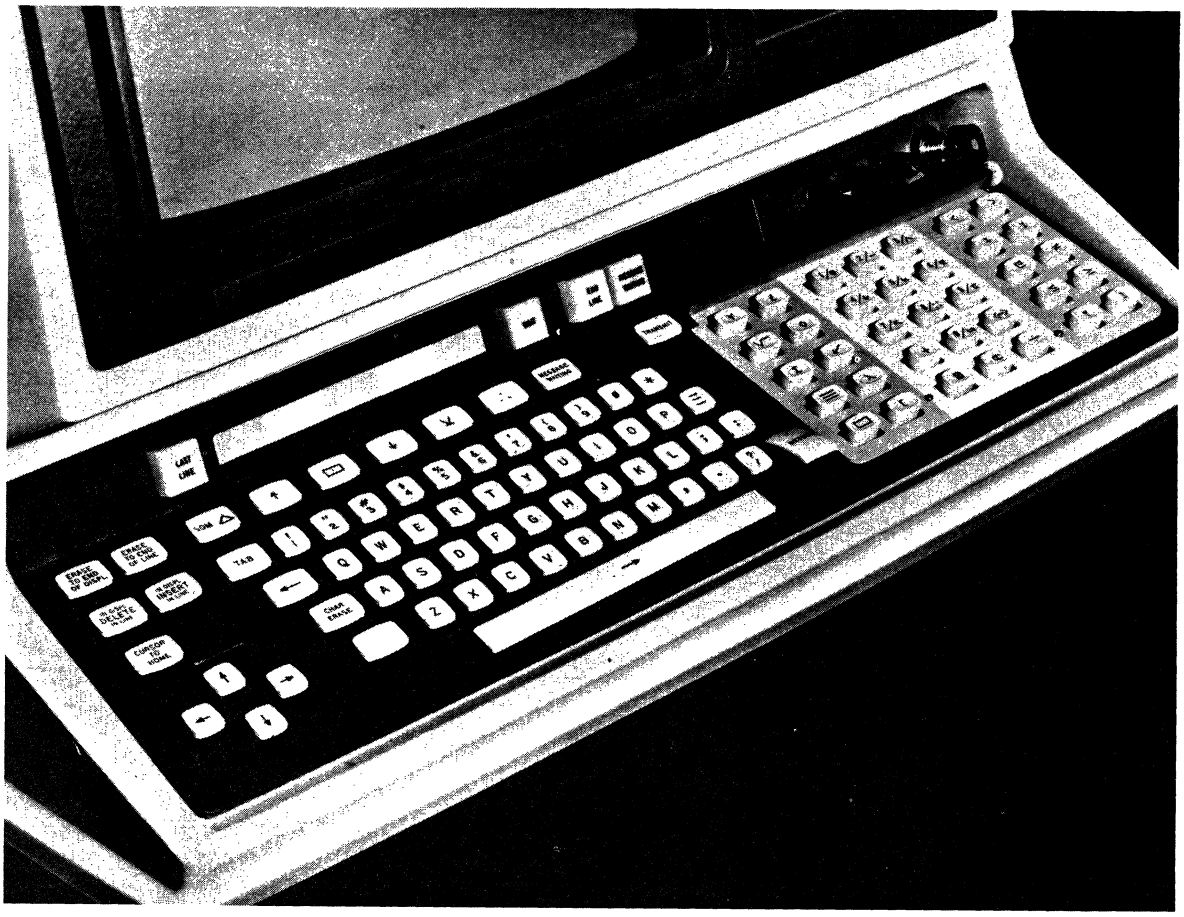


Figure 2. Uniscope 300 Keyboard, showing set of 5 optional special function keys at top of Keyboard and 35 optional special function keys to right of the typewriter keyboard; cursor control and edit keys are at left.

Display Unit

The Uniscope 300 provides a 10-inch by 5-inch image area, arranged in 8 or 16 lines of 64 characters each. The maximum data display is 512 or 1024 character positions. Few control and format characters occupy positions in the buffer to reduce the number of data characters that can be displayed. The transmission technique eliminates the need for storing Carriage Return (CR) and Line Feed (LF) symbols. The displayed data is transmitted beginning with the last data character, as defined by the cursor location, and ending with the Start of Field symbol. Each line is transmitted from right to left with CR and LF codes automatically inserted for each new line. Spaces to the right of data occupy positions in the buffer but are not transmitted.

The capability for specifying the starting and ending locations of a transmitted or received message allows several messages to be simultaneously displayed without the need for retransmission of any messages. This split-screen capability is particularly useful for displaying inquiries and the associated responses at the same time.

A stroke technique is employed to draw the displayed symbols. The characters are regenerated 60 times per second. The basic character set consists of 56 characters including numerals, alphabetics, and special symbols. The character set can be expanded to 96 characters, including 40 additional special symbols.

Each display station provides controls for focus and brightness.

Display Unit (Contd.)

The Uniscope 300 keyboard has 61 keys, including control and editing keys, arranged in conventional typewriter style; see Figure 2. An optional set of five keys located above the keyboard plus a 5-by-7 array of 35 keys located to the right of the keyboard expand the basic character set to provide additional special symbols. Other keys located to the left of the basic character keys provide cursor control and edit functions. Depressing a key causes the generation of a unique character or control code. Data entered via the keyboard is placed into the buffer and, except for control characters, displayed on the CRT.

A notched plastic overlay fits over the 35 special function keys and activates a unique combination of seven switches to produce an overlay identifier code. This code is transmitted as part of a message and is used to relate the 35 special symbols to specific applications. Up to 122 different overlays can be used, which provides representation for 4270 different function codes.

Editing Facilities

The Uniscope 300 incorporates a flexible set of edit functions. Any one of seven editing functions can be executed via a set of five keys. Two of the editing functions are performed by depressing the shift key in conjunction with an edit key.

Edit keys include:

- Character Erase — causes erasure of the character in the cursor position with a resulting space in that position.
- Erase to End of Line — causes space character (blanks) to be entered in each character position beginning at the cursor location and continuing to the end of the line.
- Erase to End of Display — causes space characters (blanks) to be inserted in all character positions beginning at the cursor and continuing to the end of the display.
- Insert — permits entry of data into an existing text by displacing all characters to the right of and including the cursor position, one space to the right; the last character on the line is discarded. When the Shift key is used in conjunction with the Insert key, all characters from the cursor position to the end of the display are displaced on position to the right and the last character of the display is discarded.
- Delete — permits data to be erased from the existing text while closing the text to maintain continuity. All characters to the right of the cursor are displaced one space to the left. When the Shift key is used in conjunction with the Delete key, all characters from the cursor to the end of the display (upper left corner) are displaced one space to the left.

Specific characters or portions of text can be made to blink (selective data blinking) by bracketing the desired character or characters with Start and End Blink Markers. The two special codes each occupy a buffer position but are not displayed and are included only in a computer message.

Two significant operations, each initiated by a computer message, allow a specific line of text to be added or deleted. Each such message may or may not contain a new line of text. When the computer message specifies a line insert function, all lines below and including the line containing the cursor are moved down one line; the bottom line is erased. The cursor-line is left blank or a new line of text is inserted. When the computer message specifies a line delete function, the line containing the cursor is erased and all lines below the cursor are moved up one line (filling in the erased line); the last line is left blank or a new line of text is inserted.

UNIVAC classifies the programming technique which employs multiple line insert or delete functions as the "Roll and Scroll" technique. This technique can be useful in a situation where the operator must scan through a larger amount of information than can be presented within the boundaries of the viewing screen. The operator can stop the rolling action by depressing a program-assigned function key and then select and/or edit the line item using the cursor control and edit keys.

Cursor

The cursor is a unique character that is constantly displayed in the CRT and marks the position to be occupied by the next character to be entered via the keyboard. It also marks the

(Contd.)

first character of text when data is transmitted to the computer. When the cursor is positioned over a displayable character, both blink at a preset rate of four to ten times per second. The cursor advances one position for each character entered from the keyboard and can be positioned by the cursor controls.

Nine control keys provide a large degree of cursor manipulation. When used with the edit keys, the cursor locates data to be inserted in text, deleted from text, and erased from text as described under Editing Facilities.

Cursor control keys include:

- Scan Forward — positions the cursor one position to the right; if this key is held down, the cursor moves at a rate of ten positions per second.
- Scan Up — positions the cursor up one line; if this key is held down, the cursor moves at a rate of ten lines per second.
- Cursor to Home — positions the cursor to the first character position on the display.
- Return — positions the cursor to the first character position of the next line.
- Space — positions the cursor one position to the right.
- Tab — positions the cursor to the right one position to the right of a tab stop character. The tab stop character is not displayed but remains stored in the buffer. The cursor stops at the end of the display if a tab stop character is not detected.
- Back Space — positions the cursor one position to the left.

Error Detection and Correction

Character and longitudinal parity are generated with each message transmitted and are checked for each message received. If no transmission errors are detected in a received message, a positive acknowledgement indication is transmitted in the next message to the computer from that control unit in response to a poll from the computer. The acknowledgement can be returned in a No Traffic message which indicates no more data to transmit. If an error is detected, the affected display station will not accept any more data and the partial message remains on the display screen until a retransmission is received. The control unit can also automatically respond to a retransmission request from the remote computer.

Options

Two optional features are available for a Uniscope 300M system to increase the efficiency and reliability of operation.

The Dual Modem Interface permits a second data set and communications line to be connected to a Multistation Control Unit. This feature can be used to provide full-duplex operation and to guard against failure of a communications line.

The Fall Back feature permits two adjacent control units to be connected to a group of display stations. The computer can transmit messages to the control units that instruct it to control either the left or right group of display stations or to disconnect. By including a spare control unit and with proper interconnections, a malfunctioning control unit can be disconnected from the system and the control of the display station groups be reassigned.

.16 First Delivery: . . . . . December 1967.

.17 Availability: . . . . . 4 to 6 months.

.2 CONFIGURATION

There are two UNIVAC Uniscope 300 display terminals:

- Uniscope 300S — a single display terminal which includes control logic and buffering; and
- Uniscope 300M — a keyboard/display unit which is used in conjunction with the Uniscope Multi-Station Control Unit. Two different 300M display units provide an 8-line, 512-character display or a 16-line, 1024-character display.

Both models of the Uniscope 300 display terminals are identical in appearance and contain a keyboard and CRT.
The Multi-Station Control Unit (MSCU) is modular, and includes a basic 8192-character core

.2 CONFIGURATION (Contd.)

buffer, character generator, and control module. Two MSCU types provide compatibility with the 8- or 16-line Uniscope 300M display unit; the two types of display units cannot be intermixed on the same MSCU. The basic MSCU provides connection for four 16-line or eight 8-line display units and can be expanded by adding up to five Multi-Station Control Expansion units. Each Expansion unit permits the connection of four additional 16-line or eight additional 8-line display units. The Expansion units include the buffering, character generation, and control logic required for the additional display units.

When the MSCU includes all optional components, a maximum of 24 16-line, 1024-character or 48 8-line, 512-character 300M display terminals can be connected.

The keyboard and character generator for each display unit can be expanded to accommodate 5 or 40 additional special function keys and symbols.

The basic MSCU contains a single communications interface and can communicate only in a half-duplex mode. When the Dual Modem Interface option is incorporated, the MSCU can be operated in a full-duplex mode by using two data sets and communications lines. Each buffer module requires a Dual Modem Interface option for connection to the second communication line.

With the Fall Back option a set of display terminals can be connected to two control units. Normally one control unit is operative and the other is inoperative. Messages from the remote computer can cause control of the set of display stations to be switched to the second or standby control unit.

See Paragraph .74 for the standard communications facilities that can be accommodated and the data sets required.

.3 INPUT

.32 Manual Input

Method of entry:. . . . . via 61-key keyboard, including control and editing keys; 5 keys (optional) located above the keyboard plus 35 keys (optional) arranged in a 5-by-7 matrix at the right of the keyboard are provided for special functions. See Figure 2.

Quantity of data:. . . . . up to 1024 characters when operating as a single display unit; up to 1024 or 512 characters when operating in a multistation arrangement; see .2, Configuration.

Character set:. . . . . 56 characters, including digits, upper-case letters and special symbols; 61 or 96 characters with an optional set of 5 or 40 special function keys.

Comments: . . . . . a set of seven switches is activated by a plastic overlay which fits over the 35 special function keys; up to 122 overlay key combinations can be used to relate the keys to specific applications.

.33 Fixed Input:. . . . . fixed data can be retained in the display buffer.

.34 Transaction Code Input:. . . . . the optional set of 5 or 40 special function keys could be used for this purpose.

.35 Message Configuration

A total of 11 different types of messages are transmitted between a Uniscope 300 Terminal and the remote computer; Table II summarizes these messages.

All messages are transmitted in one of two formats.

Messages transmitted from the Uniscope terminal begin with an eight-character message header followed by a one-character overlay identifier, data characters, a two-character starting location identifier, and a three-character message trailer. The message header consists of three sync codes followed by an SOM character, a three-character address code, and a one-character function code. One bit of the function code is reserved for positive or negative acknowledgement of the previous message. If transmission errors are detected, a

(Contd.)

TABLE II: UNIVAC UNISCOPE 300 MESSAGE TYPES

Message Type	Origin of Message	Purpose of Message
Poll	Computer	Requests a particular control unit to transmit data from any display station connected to that control that has data to transmit.
Query	Uniscope Terminal	Data message transmitted in response to a Poll.
No Traffic	Uniscope Terminal	Response to a Poll to indicate no data to transmit.
Retransmission	Computer	Requests retransmission from a particular control unit.
Reply	Computer	Normally used to reply to a Query. This message may or may not contain data; it can contain a control code to unlock the keyboard.
Break	Computer	This is not a message as such but a special provision to allow the computer to interrupt a long transmission to one control unit to transmit a Poll or other short message to a different control unit.
Fall Back	Computer	A set of three short messages to allow the computer to cause a particular control unit to go off-line and to switch the connected display stations to a standby control.
Memory Test	Computer	A set of three short messages to allow the remote computer to test the control unit memory.
Computer Message Waiting	Computer	To inform the operator that the computer has a message waiting for a particular display station.
Unconditional Computer Message	Computer	Displays an urgent message on a particular display station; this message overrides any operation the operator is performing.
Request Computer Message	Uniscope Terminal	To inform the computer that the operator is ready to receive an unsolicited message which causes a Computer Message Waiting transmission or to acknowledge the receipt of an urgent message received as an Unconditional Computer Message. This message is transmitted when the operator depresses the Computer Message Waiting button.

negative indication is returned. The remaining bits of the function code identify the message type. The location identifier specifies the location of the initial data character of the message. The message trailer consists of an EOM character followed by a parity check character and an EOT character. The data portion of the message also contains format control symbols such as Tab and Carriage Return. All message header, trailer and control characters are automatically inserted when composing and transmitting.

Messages received from the remote computer are expected in a format similar to the transmit format except that there is no overlay identifier and the starting location identifier precedes the text.

.36 Operating Procedure

A message to be transmitted from a display terminal is composed by:

- Positioning the cursor; and
- Entering the desired data from the keyboard beginning with the start-of-field (SOF) character.

The operator then depresses the Transmit key and waits for a Poll message. The message is transmitted to the computer when the terminal is polled. The waiting time is a function of the programming and activity of the remote computer; normally there would be only a momentary wait.

If a computer message alert is sent to the terminal while the operator is composing a message, the operator is alerted but continues composing the message to be transmitted. After the message is transmitted, the operator depresses the Message Waiting key and accepts the computer message. The computer can override any actions by the operator and can cause an urgent message to be displayed immediately.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.46 Output to Visual Display Device

Uniscope 300 —

Output medium: . . . . . cathode ray tube; displays white characters against black background.

Character set: . . . . . 56 characters, including digits, upper-case letters, punctuation marks, and special symbols; the basic character set can be optionally expanded to 61 or 96 characters to provide additional special symbols.

Character size: . . . . . nominally 0.113 inch wide and 0.150 inch high.

Display size: . . . . . 10 inches wide and 5 inches high.

Characters per line: . . . . . 64 characters.

Lines per display: . . . . . 16 lines for single display unit; 16 or 8 lines when operating in a multistation arrangement with up to 24 or 48 display units, respectively.

Buffer capacity: . . . . . 1024 characters for single display unit; 8192, 16,384 or 24,576 characters when operating in a multistation arrangement.

Format control: . . . . . horizontal tab, character insert and delete, split-screen, and partial display transmission; very flexible cursor movement controls; see Paragraph .15 under Editing Facilities.

Rated output speed: . . . . . 250 or 300 char/sec over a voice-band line; higher speeds available.

Effective speed: . . . . . limited by message length and communications facility.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors: . . . . . no provision except visual verification of displayed data. Errors are corrected by repositioning the cursor and rekeying only the incorrect data.

.52 Data Transmission Errors

Type of checking: . . . . . character parity and longitudinal parity.

Error indication: . . . . . indicator lamp lights and audible alarm sounds; a negative acknowledge is included in the next message to the computer; the terminal can also respond to a retransmission request contained in a message to the terminal.

Correction procedure: . . . . . automatic retransmission in response to request in message from the computer. The number of retransmissions is under control of the computer.

(Contd.)

.53 Data Recording Errors:. . . . . no provisions other than visual verifications of displayed data.

.55 Line Malfunctions

Detection:. . . . . visual; operator monitors display unit for no-response condition.

Action:. . . . . manual; operator can test display unit to verify functioning.

.6 CONDITION INDICATORS

A number of indicators are provided on the Uniscope 300 Terminal. The indicators, when lighted, alert the operator to the following conditions:

- Last Line — indicates the cursor is positioned somewhere in the last line of the display.
- End Line — indicates the cursor is in any of the last eight character positions of a line.
- Message Waiting — indicates a computer message is waiting.
- Wait — indicates a message is being transmitted or received.
- Fault — indicates a parity error has been detected in a computer message.

A temperature indicator is also provided. An audible alarm is provided to alert the operator when the cursor moves to position 57 of any line or to the first character position of the last line, or when a computer message is waiting.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:. . . . . 2000 or 2400 bits/sec (240 or 300 char/sec).
Transmission method:. . . . . serial by bit.
Transmission code: . . . . . modified 7-level UNIVAC USASCII code plus character parity; see Table I.
Transmission mode:. . . . . half-duplex or full-duplex (optional). A full-duplex line is normally used; see Paragraph .15.
Order of bit transmission:. . . . . high-order bit of each character is transmitted first.
Synchronization:. . . . . synchronous; i.e., synchronization is established by sync characters transmitted at the beginning of each record.
Comments:. . . . . higher transmission rates can be obtained on special request.

.72 Connection to Communications Lines

Communications Line or Service**	Data Set*
Public telephone network (2000 bits/sec):	Bell System Data-Phone Data Set 201A.
Leased common-carrier voice-band line (2400 bits/sec):	Bell System Data Set 201B or Western Union 2400 Baud Data Modem.

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

** The Dual Modem Interface requires two data sets and two communications lines for full-duplex operation.

.73 Transmission Control

Call initiation:. . . . . only when polled by the remote computer.
Call reception:. . . . . capable of unattended operation.
Functional operations:. . . . . format of displayed message can be controlled by control characters in incoming data.

.74 Multistation Operation

All communications are initiated by the remote computer. A control unit responds to a Poll message by sequentially transmitting any waiting messages from connected display terminals. The computer can inform a particular display terminal that a message is waiting or can override all operations and display an urgent message. The computer can address all display terminals on the same line simultaneously.

.8 PHYSICAL SPECIFICATIONS

Component	Uniscope 300S or 300M Terminal	Multistation Control Unit*
Width (inches)	25	36
Depth (inches)	24	24
Height (inches)	17	64
Weight (pounds)	150	800
Power (KVA)	0.8	3.0
Voltage	120	120
Frequency (cps)	60	60
Phases	1	1
Temperature Range (°F)	40 to 105	40 to 105
Humidity Range (%)	5 to 95	5 to 95
Heat (BTU/hr)	2000	8000

* Includes all control logic and buffering for Uniscope 300M Terminals.

.9 PRICE DATA

Component or Feature	Monthly Rental		Purchase Price, $	Monthly Maintenance, $
	1-year lease, $	5-year lease, $		
Uniscope 300S Single-Station Display	410	360	15,140	60
Uniscope 300M Multi-Station Display (1)	135	120	4,130	40
Multi-Station Control Unit (2)	850	740	32,625	100
Options				
Multi-Station Control Expansion (3)	200	175	7,400	30
Special Function Keys:				
First 5 Keys —				
Symbol Generator Expansion	15	13	435	5
Keyboard Expansion	15	13	435	5
Subsequent 35 Keys —				
Symbol Generator Expansion	25	22	870	5
Keyboard Expansion	25	22	870	5
Dual Modem (300M only)	70	60	2,610	10
Fall Back (300M only)	35	30	1,305	5

(1) Uniscope 300M is available as a 16-line, 1024-character display unit or as an 8-line, 512-character display unit.

(2) Multi-Station Control Units are available for both types of Uniscope 300M display units; i.e., 16-line, 1024-character or 8-line, 512-character display unit. The basic control unit contains buffering, character generation, and control for one to four 16-line 300M display units or for one to eight 8-line 300M display units.

(3) Multi-Station Control Expansion units are incorporated in the Multi-Station Control Unit to expand the number of Uniscope 300M display unit positions in increments of four or eight positions. A maximum of five Expansion units per control unit is permitted, providing up to 24 16-line 300M display unit positions or up to 48 8-line 300M display unit positions.

ADVANCE REPORT
UNIVAC DCS-1 DATA COMMUNICATIONS SUBSYSTEM

.1 GENERAL

.11 Identity: . . . . . UNIVAC DCS-1 Data Communications Subsystem.

.12 Manufacturer: . . . . . UNIVAC Division of Sperry Rand Corporation
P. O. Box 8100
Philadelphia, Pa. 19101

.13 Basic Function: . . . . . provides connection between a UNIVAC 9200 or 9300 Computer System and a voice-band or broad-band line for transmission and reception of data at up to 50,000 bits per second.

.15 Description

The UNIVAC DCS-1 Data Communications Subsystem, announced on October 10, 1967, provides the small-scale UNIVAC 9200 and 9300 Computer Systems with single-line data communications capability.

The information presented in this Advance Report was obtained from a UNIVAC press release and from preliminary documentation. A complete report on the DCS-1 will be published in AUERBACH Data Communications Reports when detailed information becomes available.

The UNIVAC 9200 and 9300 Computer Systems were announced in June 1966 as the first two members of the 9000 Series computer family. They employ plated-wire main memories and monolithic integrated circuitry.

The UNIVAC 9200 is an internally-programmed, card-oriented computer that includes a 250-lpm printer, 400-cpm reader, and 75- to 200-cpm punch. The UNIVAC 9300 can be used as a punched card system with higher computing and input-output speeds than the 9200 or as a magnetic tape system.

Up to two DCS-1's can be incorporated in a UNIVAC 9200 or 9300 Computer System. The two DCS-1's are internally connected to the optional Multiplexor Channel. Each DCS-1 contains a communications interface for connection to a single voice-band or broad-band line. Data transmission via a DCS-1 is compatible with other UNIVAC computer systems, including the 418, 494, 1004, 1107, and 1108, and with UNIVAC's DCT 2000 Terminal (Report 6863). Processing and data communications can be fully overlapped.

The DCS-1 Data Communications Subsystem operates synchronously over a voice-band line at 2000 or 2400 bits per second or over a broad-band facility at up to 50,000 bits per second. Message length can be varied from a single character up to memory capacity.

A choice of 5-, 6-, 7-, or 8-level (plus parity) transmission codes is available, including user-selectable synchronizing, idling, start-of-message, and end-of-message characters. Odd or even parity is generated for transmitted characters and checked for received characters.

Incoming calls on the public telephone network can be automatically answered under program control.

Initial deliveries of the DCS-1 are expected in June 1968. The price of a typical DCS-1 will be $212 per month on a one-year rental basis or $184 per month on a five-year lease. It may be purchased for approximately $7900.

UNIVAC UNISCOPE 100 DISPLAY TERMINAL

.1 GENERAL

.11 Identity: . . . . . Uniscope 100 Display Terminal.

.12 Manufacturer: . . . . . UNIVAC Division
Sperry Rand Corporation
Post Office Box 8100
Philadelphia, Pennsylvania 19101

.13 Basic Function: . . . . . displays, via cathode-ray tube, alphanumeric data received from a remote computer or entered via keyboard; transmits data to a remote computer over the public telephone network or leased voice-band lines.

.15 Description

The UNIVAC Uniscope 100 Display is a visual communications terminal which facilitates rapid and efficient exchange of alphanumeric data between a computer and one or more remote stations under control of a stored computer program.

Basic Operation

The Uniscope 100 is a low-cost, alphanumeric display designed for a broad range of applications that require direct operator interaction with a centralized computer system. Due to its modular construction, this terminal can operate either as a data entry or as a display device. It can be located at the central computer site and connected via a direct channel interface or at a remote site where it is connected over telephone lines via a data set interface. Up to 31 terminals may use a single communications line or may be connected to a computer input/output channel by using a multiplexor.

The Uniscope 100 is designed to operate in a polling environment; all transmissions between the computer and the terminal are initiated by the computer. Messages (in either direction) must be acknowledged by the recipient.

Terminals can be configured singly or multiplexed in clusters, or these two methods can be combined on a single communication line (voice-grade, high-speed, or channel). Each terminal contains its own memory and control logic; the multiplexor serves only to direct messages to the proper terminal in its cluster.

Every singly configured terminal or multiplexed cluster operates in half-duplex mode, but the effect of sharing of a line by several units or clusters results in full-duplex use of the line. Provisions are included in the control logic of the terminals to allow the computer to interrupt transmission to one display controller in order to permit the computer to poll and initiate data transmission from another terminal (or cluster) connected to the same communication line.

A keyboard unit provides all of the operator controls and keys required to operate the CRT and initiate data transmission. The keyboard may be removed from the display and connected with an optional cable up to 20 feet in length. There are three keyboard divisions:

- Editing and cursor control keys
- Basic typewriter keyboard
- Numeric entry keyboard

All keyboard options include the editing and cursor control keys and may include either or both of the other keyboards.

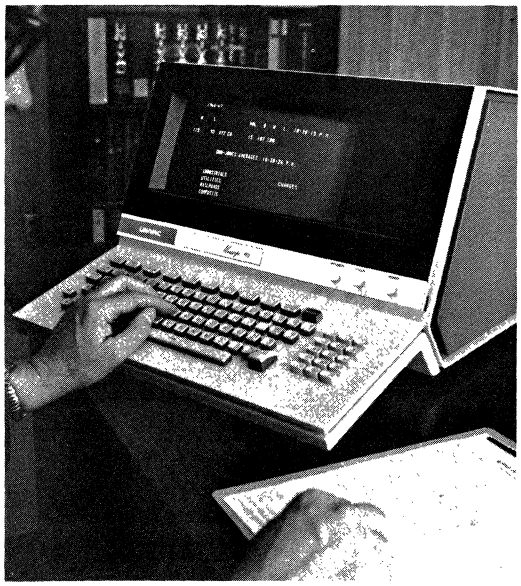


Figure 1. UNIVAC Uniscope 100 Display Terminal Including Alphanumeric and Numeric Entry Keyboards

.15 Description (Contd.)

Visual output is strictly alphanumeric in a viewing area 10 inches wide by 5 inches high. Data is arranged into one of four optional formats:

- 6 lines of 80 characters each
- 12 lines of 80 characters each
- 16 lines of 32 characters each
- 16 lines of 64 characters each

Character generators are available for either 64 or 96 distinct characters. The latter permits display of the full USASCII character set, including upper- and lower-case alphabetics.

A selective data blink feature enables blinking of any combination of characters. This feature uses two control characters, one to activate and one to deactivate blinking of each character or set of contiguous characters to be blinked. Hard copy from the display is available via an optional interface to an incremental printer.

Split screen operation enables operator designation and rapid changing of an active screen area without affecting the remainder of the display. During split screen operation, only the active screen area is used for message exchange between the display and computer.

Controlled text scrolling is available on a full-screen basis and within split screen operation. It is implemented by program use of the line insert and line delete edit functions.

Display Unit

The Uniscope 100 incorporates the same display tube as the Uniscope 300. It is a 13-inch diagonal cathode-ray tube mounted with the long dimension horizontal. Screen viewing area is 10 inches by 5 inches arranged in a variety of formats permitting a maximum of 1,024 characters to be displayed. The tube phosphor is type P31 with both color elements green and a flicker-free refresh rate of 60 times per second. Tube brightness is manually variable.

.15 Description (Contd.)

Visual output is provided in the form of alphanumeric characters on the cathode-ray tube. Characters appear white against a dark background, normally 0.113 inch wide by 0.150 inch high in lines of up to 64 characters or 0.091 inch wide by 0.135 inch high in lines of 80 characters. Options provide for a 64-character or 96-character set. The latter character set includes the full USASCII code set including lower-case alphabetics.

Each display is freestanding and contains all the components required for its own operation. The addition of a basic multiplexor permits up to eight terminals to interface with a single communications line. Multiplexor options permit additional terminals (in increments of eight) to be added; up to three such expansions may be added for a total of 31 terminals on a single communications line. Every Uniscope 100 contains a computer core memory with a sufficient number of 7-bit characters to meet the requirements of the particular format option selected.

Operator input is accomplished through a keyboard (shown in Figure 2), which includes keys for editing and cursor control and optionally alphanumeric and/or numeric entry of data. Keyboard labeling for the typewriter keyboard may be obtained to agree with the character set selected (64 or 96 characters). When the numeric keyboard is included, a redundant space key is provided so that the controls normally used with a numeric keyboard (space, tab, and carriage return) are available immediately adjacent to it. The feel of the keyboard is comparable to that of an electric typewriter and permits input at a rate of at least 80 words per minute without loss of data. The keyboard may be removed from the display and connected with an optional cable of up to 20 feet in length.

The Uniscope 100 includes a blinking capability that enables blinking of selected characters or character strings. Blinking is accomplished by bracketing the character or characters to be blinked with two unique nondisplayable characters (blink on and blink off). Selective data blinking can be activated as part of a computer message only, not by direct keyboard input. When the cursor is associated with a displayable character, both will automatically be blinked.

A split screen capability is included and allows use of portions of the screen for active message interchange without disturbing the remainder of the display. During split screen operation, the active area of the screen is that area between the cursor position and the previous start-of-field symbol. The operator can freely position the cursor to dynamically change the active screen area and can split the screen into as many different areas as is necessary and useful. This split screen feature allows the computer and the operator to exchange messages without requiring transmission of the entire contents of the display each time.

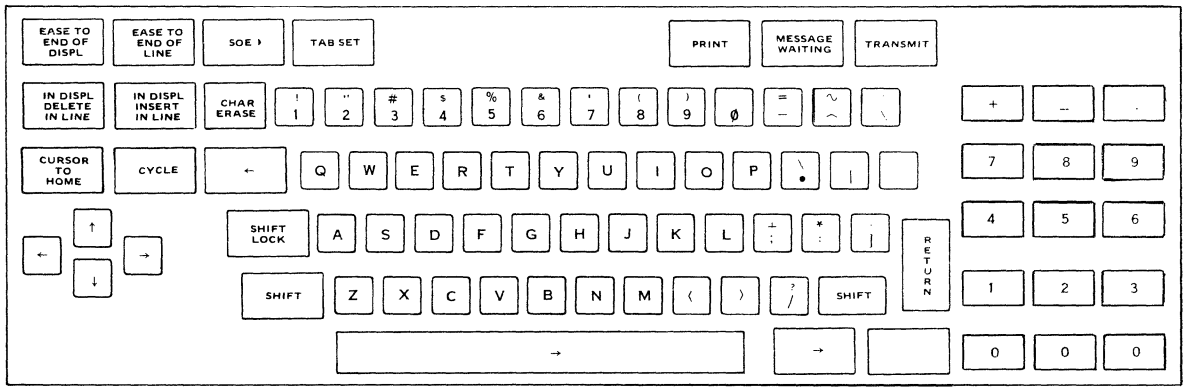


Figure 2. Uniscope 100 Keyboard

.15 Description (Contd.)

Data Transmission

Data can be transmitted over the public telephone network, leased common carrier voice-band lines, or directly over a channel. The standard transmission mode for each terminal is half-duplex; but when two or more terminals share a communications line, full-duplex communication is realized. Transmission is serial by bit (except for the parallel interfaces) with the high-order bit of each character transmitted first. The transmission code is standard 7-level USASCII code plus character parity as shown in Table I.

TABLE I. UNIVAC UNISCOPE 100 USASCII CODE

					96-Character Set							
					64-Character Set							
Bit Positions b7 → b6 → b5 →					0_0	0_1	1_0	1_1	0_0	0_1	1_0	1_1
b4 ↓	b3 ↓	b2 ↓	b1 ↓	col → / row ↓	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	ø	@	P	`	P
0	0	0	1	1	SOH	DCI	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK		5	E	U	e	u
0	1	!	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	¦
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	//

.15 Description (Contd.)

These data transmission features are standard on all communication interfaces:

- Interleaved Message Transmission — during the time the computer is transmitting a long output message to one display, the display logic enables the computer to insert polling messages to other displays. This permits improved system performance in systems involving substantial computer output volume.

- Segmented Message — allows the computer to address any point on the screen and send a message of any length up to the end of the screen. This permits changing individual characters, words, or blocks of data without disturbing the rest of the screen.

- Parity — character and message parity are used in all communications interface options in transmission and reception. The Uniscope 100 checks parity on received data and provides an appropriate acknowledgment that conforms to USASCII standards. Parity is also generated by the Uniscope 100 for transmitted data.

- Status Poll — the computer can issue a status poll to a display and receive its condition indicating whether or not data is available for a normal poll. This allows the computer to continue to poll at times when it is not ready to accept data.

Editing Facilities

A flexible set of edit functions is incorporated. Any one of seven editing functions can be executed via a set of five keys. Two of the editing functions are performed by depressing the shift key in conjunction with an edit key.

Edit keys include the shift key plus the following keys:

- Character Erase — causes erasure of the character in the cursor position with a space resulting.

- Erase to End of Line — causes space character (blanks) to be entered in each character position beginning at the cursor location and continuing to the end of the line.

- Erase to End of Display — replaces all characters from the cursor position to the end of the display with spaces.

- Insert — permits entry of data into an existing text by displacing all characters one space to the right of and including the cursor position; the last character on the line is discarded. When the Shift key is used in conjunction with the Insert key, all characters from the cursor position to the end of the display are displaced one position to the right and the last character of the display is discarded.

- Delete — allows data to be erased from the existing text while closing the text to maintain continuity. All characters to the right of the cursor are displaced one space to the left. When the Shift key is used in conjunction with the Delete key, all characters from the cursor to the end of the display (upper left corner) are displaced one space to the left.

Two significant operations, each initiated by a computer message, allow a specific line of text to be added or deleted. Each such message may or may not contain a new line of text. When the computer message specifies a line insert function, all lines below and including that containing the cursor are moved down one line; the bottom line is erased. The cursor line is left blank or a new line of text is inserted. A line may be deleted by a computer message that positions the cursor to the start of the line and then specifies an Erase to End of Line function. A special Cycle key operates with all others except the Erase, Delete, Insert, Shift Lock, Print, Message Waiting, Transmit, and Cursor to Home keys. When simultaneously depressed with another key, the Cycle key causes the second key function to be repeated at a rate of approximately 10 hertz.

.15 Description (Contd.)

Cursor

The cursor is a unique character that is constantly displayed on the CRT and marks the position that will be occupied by the next character entered via the keyboard. It also marks the last character of text when data is transmitted to the computer. When the cursor is positioned over a displayable character, both blink at a preset rate between 4 and 10 times per second. The cursor advances one position for each character entered from the keyboard and can be moved by the cursor controls.

Eight control keys provide a large degree of cursor manipulation. When used with the edit keys, the cursor locates data to be inserted in text, deleted from text, and erased from text as described under Editing Facilities. Cursor control keys include:

- Scan Forward — moves the cursor one position to the right; if this key is held down, the cursor moves at a rate of 10 positions per second.
- Scan Back — positions the cursor one position to the left; if this key is held down, the cursor moves at a rate of 10 positions per second.
- Scan Up — positions the cursor up one line; if this key is held down, the cursor moves at a rate of 10 lines per second.
- Scan Down — positions the cursor down one line; if this key is held down, the cursor moves at a rate of 10 positions per second.
- Cursor to Home — moves the cursor to the first character position on the display.
- Return — moves the cursor to the first character position of the next line.
- Space — moves the cursor one position to the right.
- Tab — moves the cursor one position to the right of a tab stop character. The tab stop character is not displayed but remains stored in the buffers; the cursor stops at the end of the display if a tab stop character is not detected. Tab stops may be inserted by the central computer or directly from the keyboard.

The following key, provided on the typewriter keyboard only, may also be used for editing functions:

- Back Space — moves the cursor one position to the left.

Line insert and line delete editing functions provide a rapid, simple method of obtaining scrolling for an operator scanning through large amounts of data. Line insert and line delete functions are computer designated, causing the last or first lines of the active display area to be deleted from the screen, automatically moving the remaining lines down or up on the screen, and allowing a new line to be placed at the top or bottom of the displayed text. These functions can be used in conjunction with split screen operation so that the active screen area is from the line in which the cursor appears to the previous Start-of-Field symbol or the top of the screen. Use of the keyboard with appropriate programming can allow the operator to roll up or down one line for each operation of a predefined key or to activate an automatic scrolling up or down at a preselected roll rate.

Error Detection and Correction

Character and longitudinal parity are generated with each message transmitted and are checked for every message received. If no transmission errors are detected in a received message, a positive acknowledgment indication is included in the next message to the computer from that control unit response to the computer's poll. The acknowledgment can be returned in a No Traffic message, which indicates there is no more data to transmit. If an

.15 Description (Contd.)

error is detected, the affected display station will not accept any more data and the partial message remains on the display screen until a retransmission is received (sent automatically in reply to a computer request).

Options

UNIVAC Uniscope 100 Display Terminals are designed to satisfy a wide variety of interface requirements. Terminals can be operated singly or can be multiplexed over the public telephone networks or leased common carrier lines, or operated via a channel interface directly to a computer. Optionally, the modem may be incorporated into the terminal itself.

The following interface options are available with the Uniscope 100:

- RS232B Asynchronous — this interface permits operation with asynchronous modems that conform to EIA Standard RS232B and provides asynchronous timing. It normally would be used with acoustical couplers as well as directly connected modems, such as the 103A, 103F, 202C and 202D.

- RS232B Synchronous — permits operation with synchronous modems that conform to EIA Standard RS232B. Maximum distance between the Uniscope 100 and the modem when using either of the RS232B interfaces is 50 feet. The RS232B interface will operate with the following:

- MIL 188B Asynchronous — an asynchronous interface with electrical characteristics compatible with MIL Spec 188B. These electrical characteristics allow operation over much greater distances than are available with the RS232B interface used with most of the Bell modems. Operation is possible over distances in the order of two miles, with the maximum permissible distance being a function of the data rate. This interface can operate up to 4,800 bits per second. However, the ability to achieve this rate in a multipoint system involves careful consideration of the synchronizing and settling characteristics of the modems and the rest of the communications facility.

- MIL 188B With Clock — a synchronous interface compatible with MIL Spec 188B that provides an optional data clock to permit operation without modems, for example, direct connection of the Uniscope 100 or Terminal Multiplexor to a CTMC or similar phone line adapter.

- Multiplexor Synchronous 200 Feet — provides a synchronous interface compatible with the Terminal Multiplexor and permits operation of the Uniscope 100 up to 200 feet from the Multiplexor.

- Multiplexor Asynchronous 200 Feet — provides an asynchronous interface compatible with the Terminal Multiplexor and permits operation of the Uniscope 100 up to 200 feet from the Multiplexor.

- Multiplexor Synchronous 5000 Feet — permits operation of the Uniscope 100 up to 5000 feet from the Multiplexor.

- Multiplexor Asynchronous 5000 Feet — permits operation of the Uniscope 100 up to 5000 feet from the Multiplexor.

- CPU Interface 400/1100 Series — allows the direct connection of a Uniscope 100 to one I/O channel of the UNIVAC 400/1100 series computers. One 8-bit ASCII character per word is transferred to and from the display via this connection.

- CPU Interface 9000/360 Series — this interface will allow the direct connection of a Uniscope 100 to the multiplexor channel of the 9000 series or IBM System/360 computers. One 8-bit byte will be transferred to and from the display in this case.

.15 Description (Contd.)

- IBM Remote Interface — provides communications interface compatible with the IBM S/360 series.

- CCITT — meets CCITT interface specification standard. Speeds for operation with CCITT modems are 200/600/1,200 bits per second. Synchronous and asynchronous models are available.

- Parallel Interfaces — offers a general-purpose Input/Output channel using the request/acknowledge control to provide characters from the Uniscope 100 memory or to load characters into the memory. During the use of this channel, the keyboard is locked out. The input channel incorporates the control characters used by the keyboard to permit the connected device to operate such features as carriage return, tab, start of message, transmit, and so on. The UNIVAC Communications Output printer will be connected to this channel and can be activated from the Print key on the Uniscope 100 keyboard or from the computer.

- Teletype Interface — can be included in the display to permit the connection of a receiver-only teleprinter compatible with the Teletype Model 33 or 35. Data to the teleprinter is taken from the refresh memory of the Uniscope 100. The keyboard is locked out during printing.

.16 First Delivery: . . . . . first quarter, 1970.

.17 Availability: . . . . . three months.

.2 CONFIGURATION

A wide variety of Uniscope 100 screen, format, character set, keyboard, and interface options exist to permit a terminal to be adapted for a particular application. Figure 3 summarizes available single terminal options.

In an operating environment, there are three basic types of configurations (shown in Figure 4):

- Single station operation over a direct channel or communications lines to the computer.

- Multistation operation, with up to 31 terminals multiplexed over a direct channel or communications lines to the computer.

- Mixed single station and multistation clusters sharing the same communication lines to the computer.

The basic multiplexor permits connection of up to eight Uniscope 100 terminals to one data channel. An expansion feature permits up to eight more terminals on the same channel. A maximum of three expansion features may be added to provide a total of 31 terminals on one channel. Standard cable lengths of up to 200 feet between multiplexor and terminal are provided, with up to 5000 feet available as an option.

Each Uniscope 100 terminal operates in half-duplex mode. However, operation over any of the multistation communication configurations is effectively full-duplex. The polling logic insures that only one terminal at a time will transmit over a single communication line.

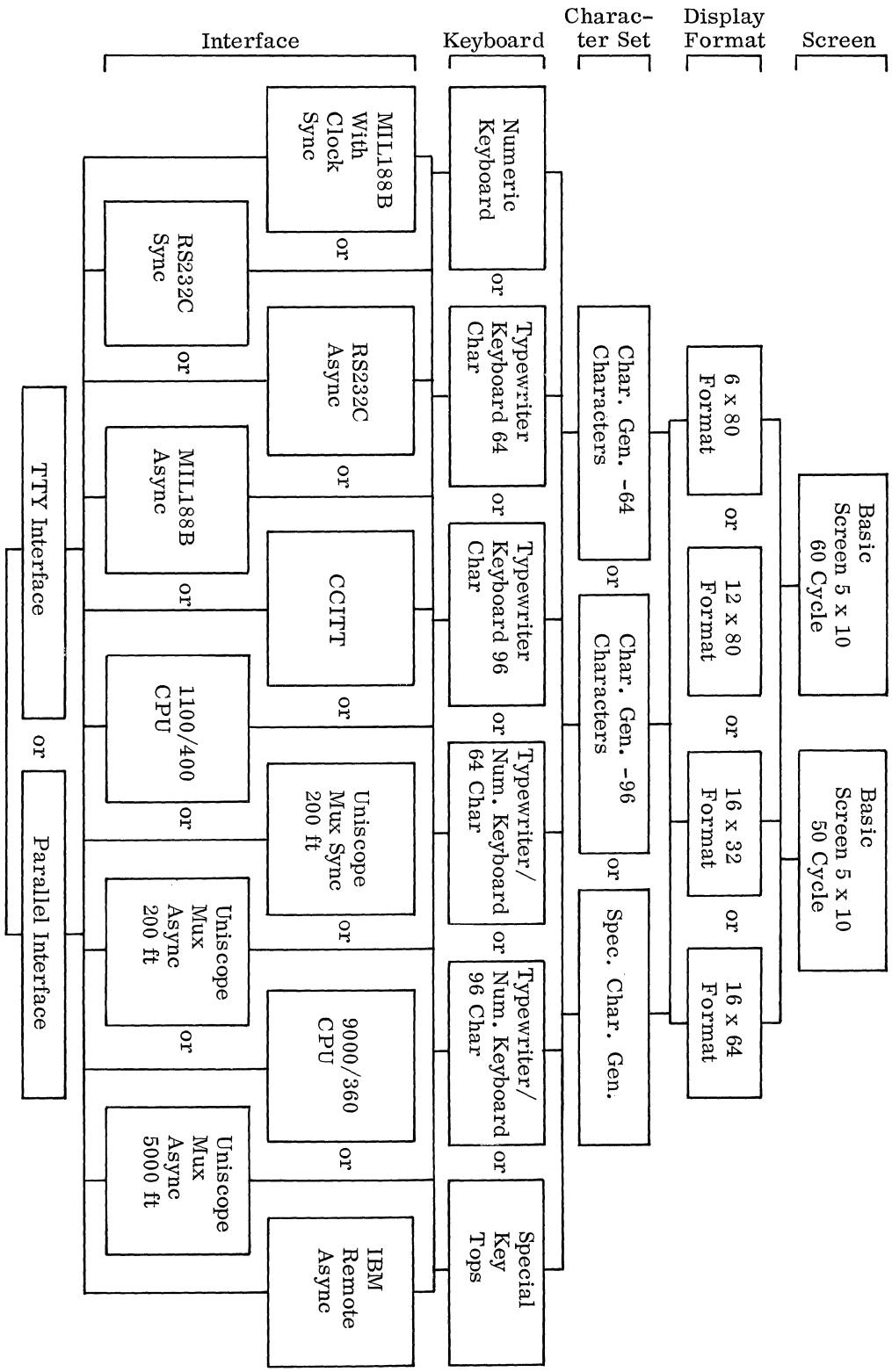


Figure 3. Uniscope 100 Options

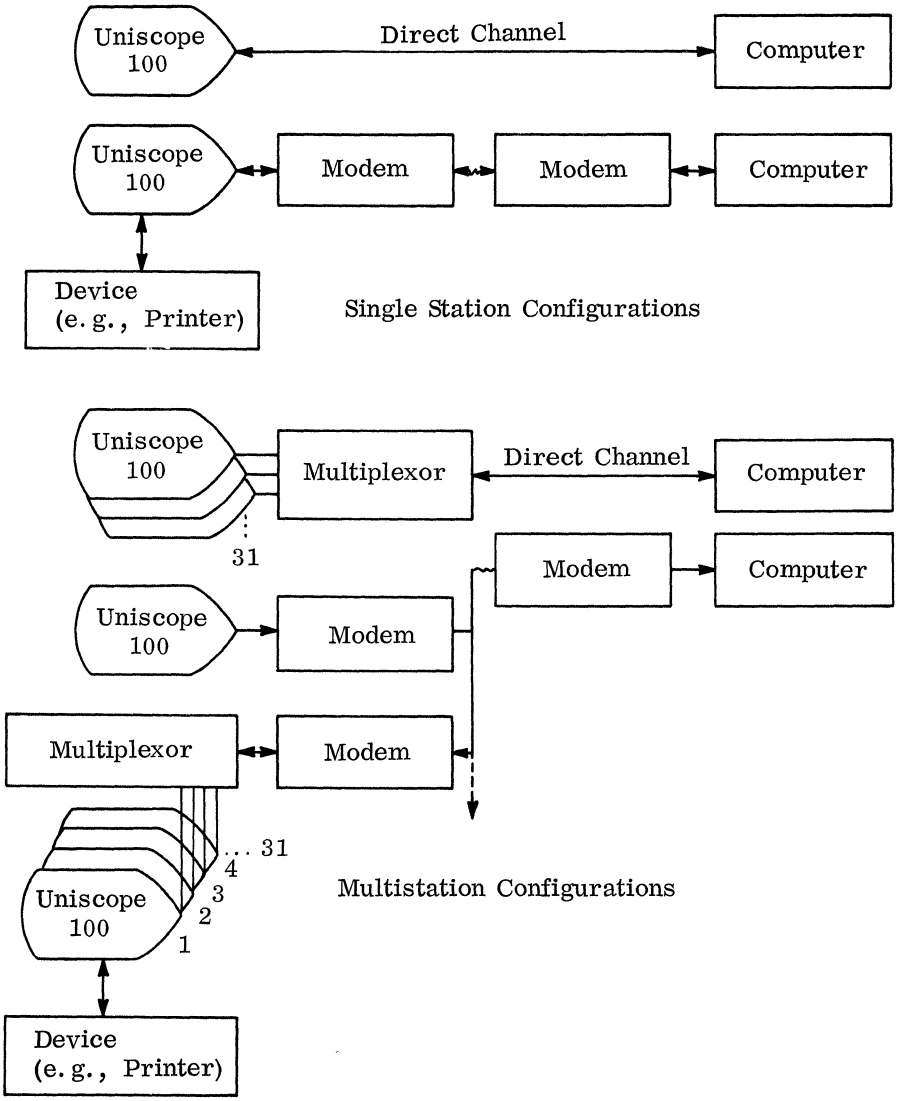


Figure 4. Uniscope 100 Configurations

.3 INPUT

.32 Manual Input

Method of entry:	via 80-key keyboard, including eight cursor control keys and five edit function keys; alphanumeric and/or numeric data keyboards are optionally available; set of numeric data keys is located to the right of the alphanumeric keyboard; see Figure 2.
Quantity of data:	up to 1,024 characters.

.32 Manual Input (Contd.)

Character set:	64 characters, including digits, upper-case alphabetics, and special symbols; or 96 characters (includes lower-case alphabetics).
Comments:	no special function keys or switches are provided; keyboard may be connected to display by 20-foot cable; keyboard incorporates conventional typewriter key configuration.

.33 Fixed Input: . . . . . fixed data can be retained in the display buffer.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration

A total of 11 different types of messages are transmitted between a Uniscope 100 Terminal and the central computer; Tables IIA and IIB summarize these messages.

All messages (except No Traffic without acknowledgment) begin with a 4-character message header, followed by a variable length message or control sequence, and terminated by a 2-character message trailer. The message header consists of a Start of Header (SOH) code and a 3-character address (preceded by four sync characters in synchronous systems). Message content is variable depending on the message type and may be arbitrarily long if it contains text. Test messages may contain format control characters such as Tab and Carriage Return. The message trailer consists of an End of Text (ETX) character followed by a Block Count (BCC) character (checksum). All message header, trailer, and control characters are automatically inserted by the terminal when composing and transmitting a message.

The No Traffic message without acknowledgment is an exception to the proceding format. This is a message that is expected to be sent frequently and is as brief as possible. It consists of two End of Transmission (EOT) characters (preceded by four sync characters in synchronous systems).

TABLE IIA. TERMINAL TO COMPUTER COMMUNICATION

Message	Purpose
Text	Data message transmitted in response to a traffic poll; may include an acknowledgment.
Traffic	Sent in response to a Status Poll, the message indicates that the terminal has text to send; may include an acknowledgment.
No Traffic	The No Traffic response by a terminal indicates that the terminal has no text to send and is not missing an acknowledgment for text transmitted; an acknowledgment may be sent.
Request Message Waiting	Informs the computer that the operator is ready to receive an unsolicited message for which a Computer Message Waiting message was sent. This message is transmitted when the operator depresses the COMPUTER MESSAGE WAITING button.
Busy	The Busy response indicates that the terminal is in an extended sequence, such as printing, and is not immediately available.

.35 Message Configuration (Contd.)

TABLE IIB. COMPUTER TO TERMINAL COMMUNICATION

Message	Purpose
Traffic Poll	Solicits traffic from the remote terminal and may include an acknowledgment. It may have either a specific or general address (any station on a specific multiplexor).
Status Poll	Solicits status information from the remote terminal and may include an acknowledgment. It may have either a specific or a general address.
Retransmission Request	Causes the terminal to transmit its last text.
Break	This is not a message as such, but a special provision to allow the computer to interrupt a long transmission to one terminal and transmit a poll or other short message to a different terminal.
Text	A message to the terminal containing text and control characters. It may lock the keyboard (otherwise, it is unlocked), display text unconditionally, display edited text, and be used to test the terminal memory.
Computer Message Waiting	To inform the operator that the computer has an unsolicited message waiting for his terminal.

.36 Operating Procedure

A message to be transmitted from a display terminal is composed by:

- Positioning the cursor, and
- Entering the desired data from the keyboard beginning with the Start of Entry (SOE) character.

The operator then depresses the Transmit key and waits for a Poll message, which is transmitted to the computer when the terminal is polled. Waiting time is a function of the programming and activity of the remote computer; normally there would be only a momentary delay.

If a computer message alert is sent to the terminal while the operator is composing a message, the operator is alerted but continues forming the message to be transmitted. After the message is sent, the operator depresses the Message Waiting key and accepts the computer message. The computer can override any actions by the operator and can cause an urgent message to be displayed immediately.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.46 Output to Visual Display Device

Output medium:	cathode ray tube; displays light green characters against dark green background.
Character set:	64 characters, including digits, upper-case alphabetics, and special symbols; basic alphanumeric character set can be expanded to 96 characters including lower-case alphabetics.
Character size:	0.135 inch high by 0.191 inch wide, or 0.150 inch high by 0.113 inch wide.
Display size:	10 inches wide by 5 inches high.
Character generation:	stroke (up to 8 strokes per character).
Characters per line:	32, 64, or 80.
Lines per display:	6, 12, or 16.
Characters per display:	480, 512, 960, or 1024.
Buffer capacity:	up to 1024 characters for single display unit; 8192, 16,384, 24,576, or 31,744 total characters in a multistation arrangement (up to 31 units) via expansion features.
Format control:	horizontal tab; character insert and delete; split screen; partial display transmission; flexible cursor movement controls; see Paragraph .15 under Editing Facilities.
Rated output speed:	up to 1200 char/sec over a voice-band line; up to 50,000 char/sec over direct connection to the computer.
Effective speed:	less than rated speed, limited by message length and communications facility.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors:	no provision except visual verification of displayed data. Errors are corrected by repositioning the cursor and re-keying only the incorrect data.

.52 Data Transmission Errors

Type of checking:	character and longitudinal parity.
Error indication:	indicator lamp lights and audible alarm sounds; an acknowledge is not included in the next message to the computer; the terminal can respond to a retransmission request contained in a message to it.
Correction procedure:	automatic retransmission in response to a request in a message from the computer.

.53 Data Recording Errors:	no provisions other than visual verifications of displayed data.

.55 Line Malfunctions

Detection:	visual; operator monitors display unit for no response condition.
Action:	manual; operator can test display unit to verify functioning.

.6 CONDITION INDICATORS

There are three data control keys located in the upper right-hand corner of the keyboard. One is the Message Waiting switch, which is used in conjunction with unsolicited messages. The other is the Transmit key. The Transmit key causes data to be transferred to the computer, starting from the Start of Entry symbol closest to the cursor and continuing to the cursor. If no Start of Entry symbol appears, data transmission starts from the upper left-hand corner of the screen. The keyboard will be locked to prevent further data entry until the message being transmitted is accepted by the computer.

Functions of the three indicators, which are located to the right of the screen, are as follows:

- MESSAGE INCOMPLETE — lights whenever a parity error is detected in the message that is being received from the computer.
- MESSAGE WAITING — lights whenever an unsolicited message is to be received from the computer.
- WAIT — lights during the time that a message is being transmitted or received.

An audible alarm sounds to alert the operator to three possible conditions: a single beep is sounded when the cursor moves into the 57th character position of any line and also when the cursor moves into the first character position of the last line. In addition, the alarm sounds intermittently during the time that an unsolicited computer message is waiting. The alarm is terminated when the Message Waiting switch is pressed.

There are three display controls, which are described as follows:

- On-Off — in the "on" condition, the terminal is in an operating state. When "off", the keyboard is disabled, and the screen is blanked; but the terminal remains on-line to the central computer system.
- Louder — varies the volume of the audible alarm.
- Brighter — changes the intensity of the characters being displayed.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	2000, 2400, 4800, or 9600 bits/sec (depending on data set used).
Transmission method:	serial by bit.
Transmission code:	modified 7-level USASCII plus character parity; see Table I.
Transmission mode:	half-duplex (single station) or full-duplex (multi-station); see Paragraph .15, under Data Transmission.
Order of bit transmission:	high-order bit of each character is transmitted first.
Synchronization:	synchronous; i.e. synchronization is established by sync characters transmitted at the beginning of each record.

.72 Connection to Communications Lines

Communications Line or Service**	Data Set*
Public telephone network (2000 bits/sec):	Bell System Data-Phone Data Set 201A.
Leased common-carrier voice-band line (2400 bits/sec):	Bell System Data Set 201B or Western Union 2400 Baud Data Modem.

.73 Transmission Control

Call initiation:	only when polled by the remote computer.
Call reception:	capable of unattended operation.
Functional operations:	format of displayed messages can be controlled by control characters contained in the incoming data.

.74 Multistation Operation

All communications are initiated by the remote computer. A terminal responds to its poll messages by transmitting status information or a waiting message, depending on the type of poll. The computer can inform a particular display terminal that it has a message waiting or can override all operations and display an urgent message; keyboard locking is also under computer control. All display terminals on a single multiplexor can be polled simultaneously by the computer.

.8 PHYSICAL SPECIFICATIONS

Component	Uniscope 100 Display Terminal
Width (inches)	18
Depth (inches)	26
Height (inches)	12
Weight (pounds)	80
Power (KVA)	0.1
Voltage	120
Frequency (Hz)	60
Phases	1
Temperature Range (°F)	40 to 105
Humidity Range (%)	5 to 95
Heat (BTU/hr)	341

*In some cases, equivalent data sets and telephone couplers can be used; see Sections 4620 and 4640 for a current list of modems available from independent manufacturers of telephone equipment.

**The dual modem interface requires two data sets and two communications lines for full-duplex operation.

.9 PRICE DATA

Component or Feature	Monthly Rental $	Purchase Price $	Monthly Maintenance $
Uniscope 100, 5 x 10 inch screen with 64-character generator and format selections: 6 lines, 80 characters per line 16 lines, 32 characters per line	60	2950	25
Uniscope 100, 5 x 10 inch screen with 64-character generator and format selections: 12 lines, 80 characters per line 16 lines, 64 characters per line	70	3450	25
Options			
Interfaces (select one):			
Interface MIL 188B With Clock	10	320	-
Interface RS232 Sync	10	320	-
Interface RS232 Async	10	320	-
Interface MIL 188B Async	10	320	-
Interface CCITT	10	320	-
Interface - CPU (400/1100 or 9000/360)	40	1280	-
Interface Multiplexor Sync 200 feet	10	320	-
Interface Multiplexor Async 200 feet	10	320	-
Interface Multiplexor Sync 5,000 feet	20	640	-
Interface Multiplexor Async 5,000 feet	20	640	-
Interface — Parallel	10	320	-
Character Generator Expansion 64 - 96 characters	15	720	-
Keyboard, Numeric	5	200	-
Keyboard, Alphanumeric	10	225	-
Keyboard, Alphanumeric/Numeric	15	425	-
Terminal, Multiplexor	30	1600	5
Channel Expansion:			
8-position expansion unit (expands 8 to 16 scopes, or 16 to 24 scopes, or 24 to 31 scopes)	20	880	-
Multiplexor Interfaces:			
Interface — Long Distance	320	10	-
RS232B Sync	320	10	-
RS232B Async	320	10	-
MIL 188B Sync	320	10	-
MIL 188B With Clock	320	10	-
CPU Adapter	1280	40	-
Unshielded Cable (maximum 200 feet long each)	-	0.20/ft	-
Shielded Cable (maximum 5000 feet long each)	-	0.30/ft	-

VERNITRON DATAPORT PORTABLE TERMINAL

.1 GENERAL

.11 Identity: . . . . . Dataport Portable Terminal Type VDT-2.

.12 Manufacturer: . . . . . Vernitron Corporation
Data Devices Division
176 Central Avenue
Farmingdale, New York 11735

.13 Basic Functions: . . . . . portable two-way typed message data communication at up to 10 char/sec over the public telephone network.

.15 Description

The Dataport Portable Terminal, which is composed of a modified Teletype Model 33 KSR teleprinter, control circuitry, and an acoustic telephone coupler, is contained in two luggage-type units. The Dataport Terminal was formerly marketed by Mauchly-Honig Time Sharing Associates Inc.

The Dataport Terminal, intended as a portable teleprinter terminal for a computer system, operates serially by bit in either the half- or full-duplex modes at transmission rates up to 10 characters per second (110 bits per sec). The terminal acoustically connects to the public telephone network via a conventional Bell System Series 500 telephone set, or equivalent, and is compatible with the Bell System Data-Phone Data Set 103A2.

The terminal employs a 96-character USASCII-coded character set consisting of upper-case alphabetics, numerics, and special characters for control functions; see Table I.

Two control keys are provided in addition to the 53-key teleprinter keyboard to initiate the special functions of local/remote operation and break-reset. When the terminal is placed in local operation, data entered from the keyboard is printed but is not transmitted; received data is printed. The break-reset key permits the operator to reset an indicator lamp that lights when a unique break code (a $\frac{1}{4}$-second space signal) is received. The Dataport operator can also signal the remote site in the same manner via a break key located on the keyboard.

The printer utilizes friction-fed or pin-fed roll or fanfold forms up to 8.5 inches wide. Vertical spacing is 6 lines per inch; horizontal spacing is 10 characters per inch. Horizontal tabulation is available as an optional feature.

The basic Dataport Terminal does not generate or check parity; parity generation is available as an option.

.16 First Delivery: . . . . . February 1966.

.17 Availability: . . . . . 10 days.

.2 CONFIGURATION

The Dataport Portable Terminal contains a modified Teletype Model 33 KSR teleprinter, control circuitry, and an acoustic telephone coupler that provides compatibility with a Bell System Data-Phone Data Set 103A located at the remote site.

The teleprinter is housed in one luggage-type case. The control circuitry and acoustic coupler are housed in a second luggage-type case.

.3 INPUT

.31 Prepared Input: . . . . . no provision.

.32 Manual Input

Method of entry: . . . . . via 4-row, 53-key keyboard.
Quantity of data: . . . . . variable.
Character set: . . . . . 96 characters including upper-case alphabetics, numerics, special characters and control codes; see Table I.

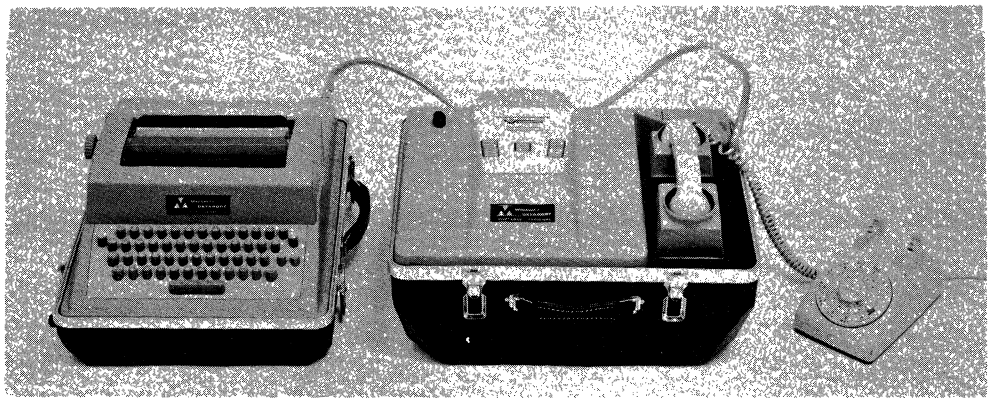


Figure 1. The Dataport Portable Terminal includes the Teletype Model 33 KSR teleprinter (left) and electronics and telephone coupler (right)

.32 Manual Input (Contd.)

Comments: . . . . . the keyboard is a modified Teletype Model 33 KSR teleprinter keyboard.

.33 Fixed Input: . . . . . No provision except for a 20-character reply to a received WRU (control-E) character or whenever the HERE IS key, on the keyboard, is depressed.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration: . . . . . 1 to N data characters with control characters interspersed.

.36 Operating Procedure:

(1) Establish connection by dialing.

(2) Place telephone handset in telephone-coupler cradle.

(3) Key in message when data indicator is lighted.

(4) Press Disconnect (DSCN) key to terminate call.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.44 Output to Printer

Output medium: . . . . . friction-fed forms, up to 74 char/line; or pin-fed forms, up to 72 char/line.

Character set: . . . . . 64 printable characters: upper-case alphabetics, numerics, specials, and control codes; see Table I.

Rated printing speed: . . . . . 10 char/sec.

Effective speed: . . . . . somewhat less than rated speed due to operations such as carriage return, line feed, etc.

Format control: . . . . . carriage return, line feed, and optional horizontal tab.

.5 ERROR DETECTION AND CORRECTION: . . . . . no detection facilities except for visual verification of manual input or received data; parity generation is available as an option.

TABLE I: ASCII (AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE)

Bits 4, 3, 2, 1	Bits 7, 6, 5							
	000	001	010	011	100	101	110	111
0000	NULL	DC_0 ①	b	0	@	P		
0001	SOM	DC_1	!	1	A	Q		
0010	EOA	DC_2	"	2	B	R		
0011	EOM	DC_3	#	3	C	S		
0100	EOT	DC_4 (STOP)	$	4	D	T		
0101	WRU	ERR	%	5	E	U		
0110	RU	SYNC	&	6	F	V		
0111	BELL	LEM	'	7	G	W		
1000	FE_0	S_0	(	8	H	X	UNASSIGNED	
1001	HT/SK	S_1	)	9	I	Y		
1010	LF	S_2	*	:	J	Z		
1011	V_{TAB}	S_3	+	;	K	[		
1100	FF	S_4	,	<	L	\		ACK
1101	CR	S_5	-	=	M	]		②
1110	SO	S_6	.	>	N	↑		ESC
1111	SI	S_7	/	?	O	←		DEL

ACK	Acknowledge	*
CR	Carriage Return	*
DC_0	Device Control Reserved	
DC_1-DC_3	Device Control	*
DC_4 (STOP)	Device Control (Stop)	*
DEL	Delete/Idle	*
EOA	End of Address	
EOM	End of Message	
EOT	End of Transmissions	*
ERR	Error	
ESC	Escape	
FE_0	Format Effector	
FF	Form Feed	*
HT	Horizontal Tab	*
LEM	Logical End Media	
LF	Line Feed	*
RU	"Are You ...? "	*
S_0-S_7	Separator (Information)	
SI	Shift In	
SK	Skip (Punch Card)	
SO	Shift Out	
SOM	Start Of Message	
SYNC	Synchronous Idle	
VTAB	Vertical Tab	*
WRU	"Who Are You ?"	*
①	Unassigned Control	

* These control codes are presently generated and interpreted by Model 33 and 35 Teletype equipment.

Note: The eighth bit (bit 0) is always transmitted as a 1 in Model 33 and 35 Teletype equipment.

.6 CONDITION INDICATORS: . . . . . various status indicators are supplied and include power On-Off, Local Operation, Break, and Half- or Full-Duplex. A special arrangement allows operator to audibly monitor line.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed: . . . . . 10 char/sec (110 bits/sec).
Transmission method: . . . . . serial by bit.
Transmission code: . . . . . 8-level USASCII plus start and stop bits for each character; other codes can be specified.
Transmission mode: . . . . . half-duplex or full duplex
Order of bit transmission: . . . . . start bit followed by character bits (high-order bit first), and stop bits.
Synchronization: . . . . . start and stop bits are transmitted with each character. Start pulse is one bit-time in length; stop pulse is two bit-times in length.

.72 Connection to Communications Lines

Communications Line	Data Set
Public telephone network:	a data set is not required; the terminal includes a coupler that acoustically connects to a Bell System 500 Series telephone set or equivalent.

.73 Transmission Control

Call initiation:	manual dialing.
Call reception:	manual operation.
Functional operations:	carriage return, line-feed bell, horizontal tab (optional) and answer-back are initiated by special control codes.

.74 Multistation Operation: . . . . . no provision.

.8 PHYSICAL SPECIFICATIONS

Component	Control Module	Teleprinter Module
Width (inches)	15.75	15.75
Depth (inches)	20	20
Height (inches)	10.25	9.5
Weight (pounds)	30	34
Power (KVA)	0.69	power derived
Voltage	120	from Control
Frequency (cps)	60	Module
Phases	1	
Temperature Range (°F)	-20 to + 120	-20 to + 120
Humidity Range (%)	0 to 95	0 to 95
Heat (BTU/hr)	1125	1230

.9 PRICE DATA

Component or Feature	Monthly Rental,* $	Purchase Price,* $
Dataport Portable Terminal Type VDT-2	99.50	2450

*Monthly rental includes maintenance. Maintenance costs for purchased units are negotiated individually; multi-terminal purchases receive lower maintenance charges.

ADVANCE REPORT
VIATRON SYSTEM 21

.1 GENERAL

.11 Identity: . . . . . VIATRON System 21.

.12 Manufacturer: . . . . . VIATRON Systems Computer Corporation
105 Terrace Hall Avenue
Burlington, Massachusetts 01803.

.13 Basic Function: . . . . . transmission of magnetic tape data and/or displayed data, entered via keyboard, over a voice-band line; reception of data from a voice-band line to be displayed and/or recorded on magnetic tape. Source tape can be recorded and verified via the keyboard.

.14 Basic Components: . . . . . see Paragraph .2.

.15 Description

This advance report is based on specifications furnished at the time of publication by the VIATRON Company in published documentation and in verbal communication and information gathered at a demonstration of the system at the Warwick Hotel, Philadelphia, Pennsylvania, on February 13, 1969 and at the 1969 Spring Joint Computer Conference. The VIATRON Company has stated that design changes are still in progress, and that the delivered system may deviate from the description presented herein. As soon as complete information on the final production model becomes available, a full report on the VIATRON System 21 will be published.

The VIATRON System 21 records data entered via a typewriter-style keyboard onto magnetic tape, contained in a "Philips-type" cassette, called a Viatape cartridge. Data recorded on Viatape can be optionally transcribed to the IBM 729 Series or IBM 2400 Series magnetic tape format on standard-size magnetic tape reels, or to 80-column punched cards via a customer-provided IBM Model 029 Keypunch. Printed copy can be obtained when the optional VIATRON electromechanical typewriter attachment (Printing Robot) is attached to a customer-provided IBM Selectric typewriter. Data entered on or read from magnetic tape can also be displayed on a conventional monochrome CRT (basic unit) or an optional multi-color CRT.

The VIATRON Microprocessor is the central component of the VIATRON System 21, a proposed, though not at present, totally integrated circuit package that provides the storage and control logic function for the System 21. Two models are presently offered. They differ only in Read-Only Storage (ROS) size. Model 1102 provides twice the storage provided by Model 1101; i.e., 1024 12-bit words. The ROS serves as the residence for a hard-wired microprogram, which is composed of a sequence or string of microinstructions required to execute one "macroinstruction." Each macroinstruction occupies one word of ROS storage. Access to a particular ROS subroutine is initiated via the alphanumeric and control characters that result during a data entry operation. The ROS is fixed and is inaccessible to the programmer; additional microprograms are planned.

Both microprocessors provide 400 bytes of storage equally divided into five storage areas: Read Record, Write Record, Master Record, Control Record 1, and Control Record 2. Any four of these areas can be manually selected for independent input and output operations. Any combination of these four areas can also be displayed. Although these five areas can be

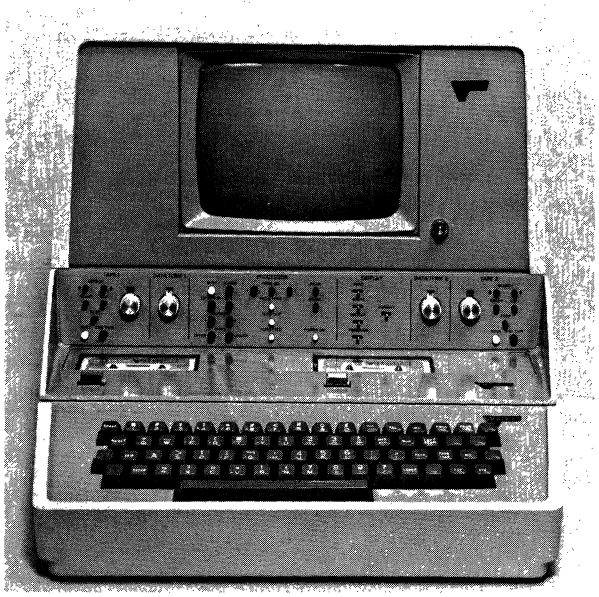


Figure 1. The VIATRON System 21 Basic Configuration.

.15 Description (Contd.)

manipulated according to the discretion of the user, the intended use of these storage areas is as follows:

- Read Record — provides automatic storage of data that had been previously entered in the Write Record and transferred to an output device or communications line. Data stored in the Read Record area is usually used for duplication.
- Write Record — provides storage for a data entry operation. Data stored in the Write Record is automatically transferred to the Read Record when the Write Record is transferred to an output device or communication line.
- Master Record — provides storage for master duplication or format information required for record composition.
- Control Records 1 and 2 — provides storage for two discrete programs, either can be selected to delimit fields within a record and to define operations such as automatic duplication or master duplication of common information, automatic skipping, and lower or upper shift.

Display Units

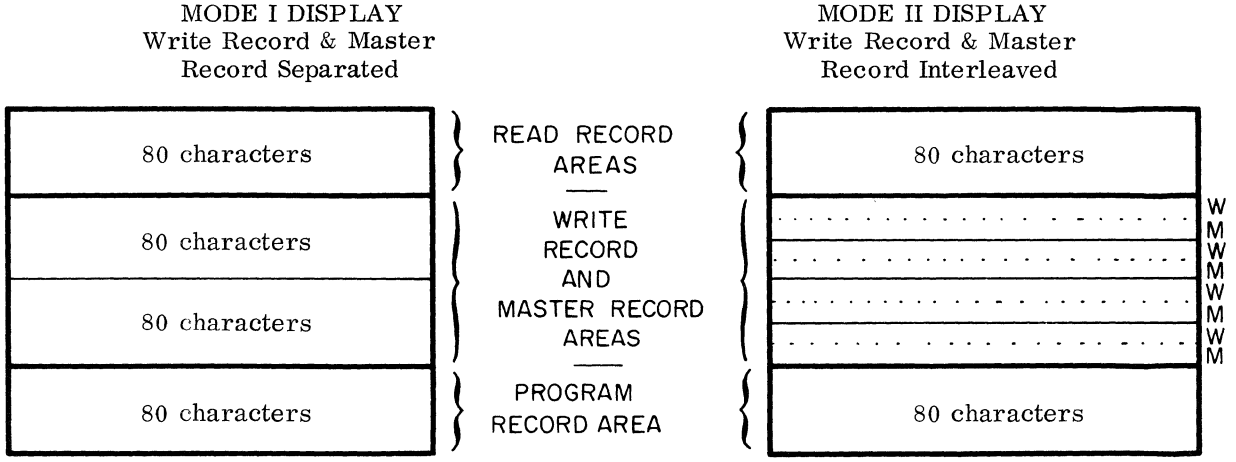
VIATRON offers two 9-inch (measured diagonally) rectangular monochrome, CRT display units, Models 3001 and 3002, and a 12-inch (measured diagonally) rectangular multi-color display unit, Model 3050, to be used with the VIATRON System 21. Both monochrome units are identical in characteristics; the Model 3002 Video Display can be used with the VIATRON RF Modulator (Model 1150 or 1151) in place of a conventional television set (TV). The Model 1150 RF Modulator provides connection for one Model 3002 Video Display or one TV; the Model 1151 provides connection for up to 12 3002 Video Display units or 12 TV's. The Model 3050 Color Video Display can be used only with the Model 1102 Microprocessor.

(Contd.)

.15 Description (Contd.)

Display Format

The display provides 320 display positions arranged in 16 lines of 20 characters per line. Characters are formed by a 5-by-7 dot matrix. The screen is functionally divided into four sections: each consists of four lines of 20 characters, which is equivalent to an 80-character record. Each of the four sections correspond to one of four storage areas: Read Record, Write Record, Master Record, and Control Record 1 or 2. Write and Master Records can be interleaved when the Master Record contains format information, which is used to identify variable data-entry positions. Both screen formats are illustrated below.



Any combination of record areas can be displayed; i.e., manual blanking of display areas is provided.

The Model 3050 Color Video Display can operate in one of two manually-selectable modes. Any one of eight colors (including black and white) can be specified via keyboard for background or foreground; i.e., data fields, when operating in the color-selection mode. The fixed-color mode assigns one of four specific colors to each of four character sub-sets:

(1) Upper-case: . . . . . aqua
(2) Lower-case: . . . . . green
(3) Numeric/punctuation: . . . . . yellow
(4) Communications characters: . . red

Editing Facilities

The basic editing facilities are limited; they include the capability to replace a character with another character or space and to erase a record area. The cursor, an underline symbol, appears under the character position to be entered into next. A beginning-of-field marker appears under the first character in each field. Both cursor and field marker appear only in the record that is in the process of composition.

Operating Modes

Three operating modes are provided by the Model 1101 Microprocessor: Entry, Send, and Receive. Two additional modes are provided by the Model 1102 Microprocessor: Search and Verify.

.15 Description (Contd.)

When in the Entry mode, data can be entered into one of five record storage areas from the keyboard, either Viatape, or card reader via the optional Card Punch/Reader Adaptor. The entered data can be transferred to either Viatape, Selectric Typewriter via the optional Printing Robot, card punch via the optional Card Punch/Reader Adaptor or any combination of three devices that includes a Viatape Recorder.

Send and Receive modes are available only with the optional Communications Adaptors. Received records can also be entered into any one of the five record storage areas. A record can be transmitted from any one of the five record storage areas concurrent with a printing or punching operation and a Viatape recording operation. The Communications Adaptor replaces one of the two optional output devices (typewriter or card read/punch).

The Verify and Search modes are presently under development; operation in these modes has not been disclosed at this time.

Communications Interface

In addition to local functions, the VIATRON System 21 features a communications option. Asynchronous communication in the half-duplex mode with another VIATRON System 21, remote computer, or compatible device is provided by the Model 1350 Manual Communications Adaptor and the Model 1351 Automatic Communications Adaptor. Both feature low or medium speed interfaces equipped to provide manual selection of either of two transmission speeds: up to 110 or 247.5 bits per second (low speed) and up to 600 or 1200 bits per second (medium speed). VIATRON states that other transmission speeds will be offered. The Model 1351 interface is equipped with an automatic answering capability.

Terminal portability is provided by a Model 1352 telephone coupler data set, which connects to a conventional desk telephone set and operates at speeds up to 300 bits per second.

The 7-level, 11-unit USASCII transmission code is employed. Even parity can be transmitted with each character or manually disabled.

The reverse-channel technique is used to enable the receiving VIATRON System 21 to request the next record after having recorded the previous one. This is not a positive/negative acknowledgement to the received record, but is incorporated for Viatape timing considerations.

This keyboard-to-magnetic tape system possesses a number of noteworthy characteristics. The announced monthly leasing fee for each of the various system components is significantly lower than competitive prices. The compactness of the operator's main console should enable it to be installed at almost any location where source-data recording is needed. The cathode-ray display is clear and stable, and therefore useful as a verifying device. The entire current record, the previous record, the current format and the current program can be displayed simultaneously, in contrast with the usual restriction of a single record at a time. The quantity of data stored by the miniaturized control and storage unit ("microprocessor") before being recorded on tape compares favorably with that of many other systems despite the price disparity. Limitations that would normally be imposed by the modest buffer size of the microprocessor can be circumvented by simple operational techniques for storing and recording longer records. Through additional console features and various options, the adaptability of the system to a range of applications is considerable.

It follows that when the VIATRON company delivers the System 21 at the quoted price schedule, it will have achieved a major advance in the state of the art. The company has announced that the circuitry of delivered systems will be composed of large-scale integrated (LSI) semiconductors, specifically, those of metal-oxide semiconductor (MOS) construction. According to the company, the low quoted prices are to be realized by means of the MOS components and by economies accruing from large-scale purchasing. The compactness of the system is also attributable to the MOS elements. At the time of publication the company had

(Contd.)

.15 Description (Contd.)

not yet identified its supplier of these elements, but on the other hand numerous first-line manufacturers have publicly expressed their readiness to supply these parts in factory quantities. All demonstration models to date have been constructed to conventional third-generation components, namely, transistors and standard integrated circuits.

.2 CONFIGURATION

The basic VIATRON System 21 with a data-communications capability consists of the following devices:

- A Model 1101 Microprocessor,
- A Model 1050 Data Channel,
- A Model 1051 Parallel Data Channel,
- A Model 3001 Video Display,
- A Model 4001 Keyboard,
- Two Model 5001 Viatape Recorders, and
- A Model 1350 Manual Communications Adaptor, or a Model 1351 Automatic Communications Adaptor.

The Model 1352 Acoustic Coupler option can be used in place of a data set.

The expanded VIATRON System 21 on-line configuration is presented in Figure 2.

The Viatape can be transcribed to various other media, including computer-compatible tape or punched cards, via one of the following optional auxiliary devices:

- Model 5201 Viatape-to-Viatape Duplicator — provides multiple duplication of Viatape cartridges on a one-for-one basis using two Model 5001 Viatape Recorders.
- Model 7001 Bi-directional Viatape-to-Punched Cards Translator — provides buffered interface with the IBM Model 029 Keypunch to punch cards from Viatape or to write on Viatape from punched cards.
- Model 7201 Bi-directional High Speed Computer Tape Converter (including four Viatape drives) — provides transcription of Viatape data to 7- or 9- track IBM computer-compatible tape.
- Model 7202 Bi-directional Low Speed Computer Tape Converter (including two Viatape drives) — provides the same capability as the Model 7201 at low speeds.
- Models 8001, 8002, and 8003 Printing Robots — provides a printed copy of the microprocessor's contents when interfaced with a Model 1050 Data Channel and an IBM Selectric typewriter; the Model 8003 is a stand-alone unit with an integrated Viatape recorder eliminating the need for a direct microprocessor interface to access printer data from its tape recorders.

Auxiliary devices compatible with the basic System 21 configuration are presented in Figure 3.

When operating in a communications environment, the initial Model 1050 Data Channel can be connected to a data set or the Model 1352 Acoustic Coupler data set using the Model 1350 (attended operation) or Model 1351 (unattended operation) Communications Adaptor to provide

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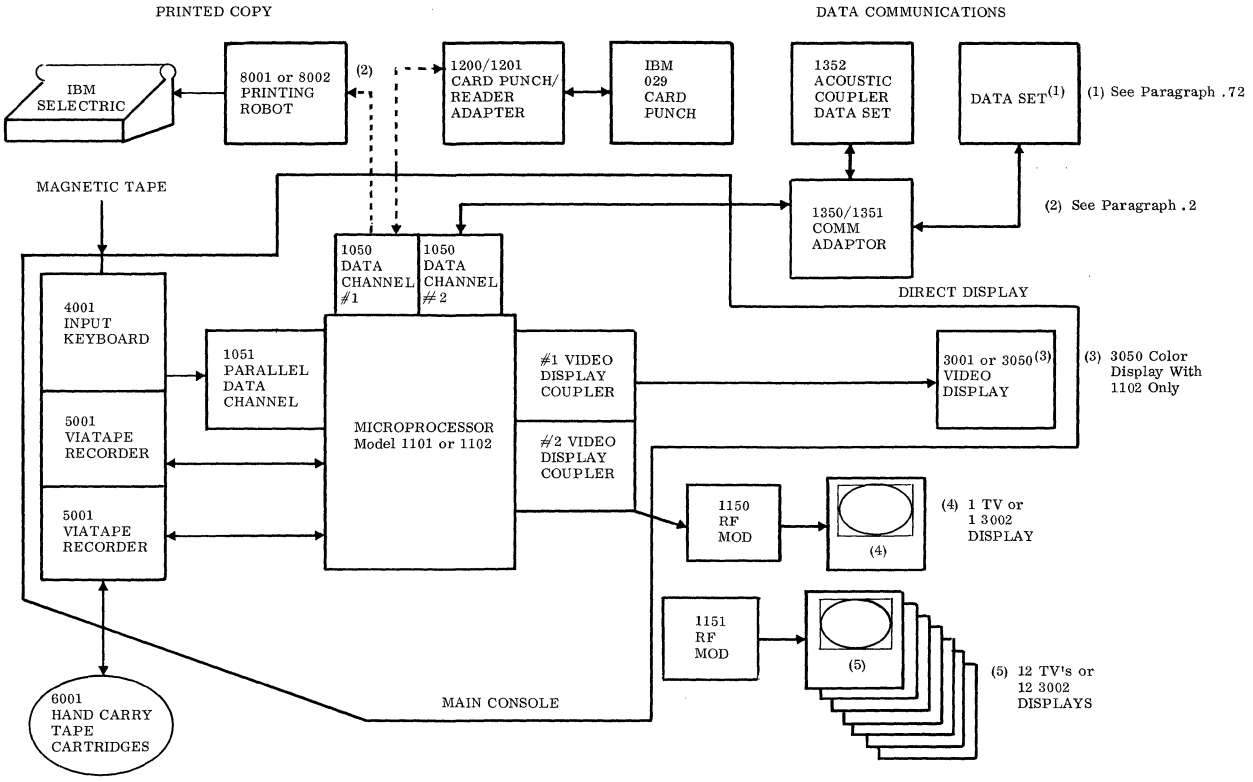

Figure 2. System 21 On-Line Configuration

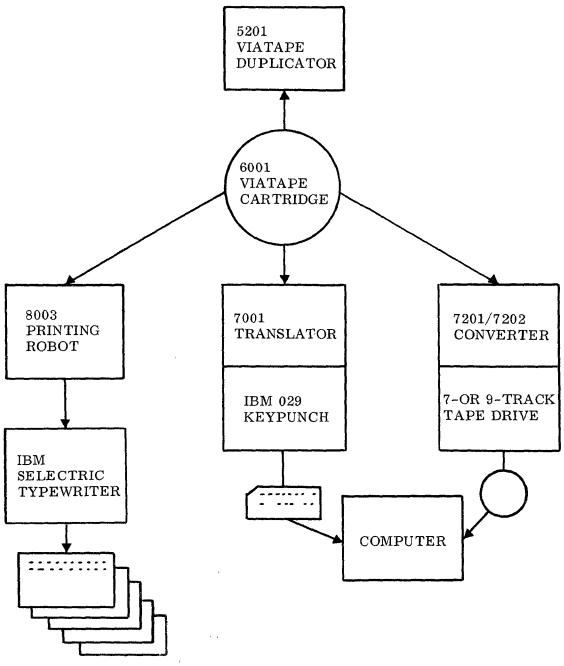

Figure 3. Auxiliary Devices for Viatape Transcription

.2 CONFIGURATION (Contd.)

a communications interface, while a Second Data Channel can be incorporated to interface with an IBM Selectric typewriter via a Model 8001 or 8002 Printing Robot, or with an IBM Model 029 Keypunch via a Model 1200 or Model 1201 Card Punch/Reader Adaptor. The Model 3001 monochrome Video Display can be replaced by a color Model 3050 when a Model 1102 Microprocessor is used. One TV or Model 3002 Video Display can be incorporated into the system interfaced with a Model 1150 RF Modulator, or up to twelve TV's or Model 3002 Video Displays can be employed when using a Model 1151 RF Modulator.

.3 INPUT

.31 Prepared Input

IBM 029 Keypunch (via the Model 1200 or 1201 Card Punch/Reader Adaptor) —

Input medium:	standard IBM 80-column punch cards.
Input code:	standard Hollerith card code.
Quantity of data:	80 characters per card.
Character set:	standard Hollerith characters; upper-case letters, numerics, and special characters.
Rated input speed:	20 characters (columns) per second.
Effective speed:	limited by the number of characters read and the number of columns automatically skipped.
Comments:	the keypunch can be operated independent of the adaptor. VIATRON does not supply the keypunch.

Magnetic tape drive (Viatape Recorder) —

Input medium:	0.15-inch magnetic tape recorded at 400 bits/inch; 300-foot tape is contained in a "Philips-type" cassette.
Input code:	7-level USASCII plus parity.
Quantity of data:	80-character records.
Character set:	64 characters; alphanumerics plus special, and record format characters.
Rated input speed:	109 char/sec.
Effective speed:	limited by block length and recording method; see Comments.
Comments:	free-standing Viatape-to-Card or Viatape-to-Computer Tape Converters can be used to transcribe punched cards or computer-compatible tape to Viatape for transmission. Card reader/punches can also be coupled to the Microprocessor via the 1200 or 1201 (unbuffered and buffered, respectively) adaptors. Data on the magnetic tape cassette is recorded redundantly with added check bits to form a total of 23 bits per character recorded on a single track.

.32 Manual Input

Keyboard —

Method of entry:	via a 73-key keyboard.
Quantity of data:	80 characters.
Character set:	64 characters; 26 alpha, 10 numeric, and 28 special.
Comments:	the basic keyboard is keypunch styled; but several extra control keys are added for initiating the editing functions of the 1102 Microprocessor or for entering color codes for the 3050 Video Display.

(Contd.)

.33 Fixed Input: . . . . . a data field can be entered into the buffer and automatically or manually duplicated in all subsequent records.

.34 Transaction Code Input: . . . . . no provision.

.35 Message Configuration: . . . . . messages are transmitted in 80-character fixed-length records that can include eight non-print characters to compensate for a 72-character teleprinter line, or in 72-character fixed-length records if the optional Short-Record Adaptor is used. Each character transmitted includes a start bit, seven data bits, a parity bit, and two stop bits. A receiving VIATRON unit will send a return-pulse to a sending unit to request transmission of the next record (this reverse-channel technique does not imply acknowledgement of a correctly- or incorrectly-received message).

.36 Operating Procedure

Before a message is transmitted, predetermined programs and time of transmission should be established between the communicating terminals. Programs should be on program tapes and ready for immediate use. Typical operating procedure is as follows:

(1) Load tape cassettes.
(2) Load program into memory.
(3) Set controls and keyboard switches.
(4) Establish connection by dialing or manually signaling.
(5) Depress Data key on data set.

.37 Entry of Time and Date: . . . . . no provision.

.4 OUTPUT

.42 Output to Punched Cards (via the Model 1200 or 1201 Card Punch/Reader Adaptor)

IBM 029 Keypunch —

Card type and size:	standard IBM 80-column cards.
Card code:	standard Hollerith code.
Rated punching speed:	20 characters (columns) per second (non-printing models); or 18 characters (columns) per second (printing models).
Effective speed:	limited by the number of columns automatically skipped and transmission speed.
Format control:	program card.
Comments:	the 1200 Card Punch/Reader Adaptor is unbuffered; the 1201 is buffered and permits both tape and card punch to operate simultaneously; the keypunch can be operated independent of the adaptor. VIATRON does not supply the Keypunch.

(Contd.)

.43 Output to Magnetic Tape

Magnetic tape drive (Viatape Recorder) —

Tape size:	0.15-inch magnetic tape recorded at 400 bits/inch; 300-foot tape is contained in a "Philips-type" cassette.
Tape code:	7-level USASCII plus parity.
Rated output speed:	6.25 inches/sec.
Effective speed:	limited by block length and transmission speed.
Format control:	extensive tape format control is provided by a stored program; see Paragraph .15 for description.
Comments:	80-character records are recorded in fixed-length format. The free-standing Viatape-to-Card or Viatape-to-Computer Tape converters can be used to translate the Viatape to punched cards or computer-compatible magnetic tape. Card reader/punches can also be coupled to the Microprocessor via the Model 1200 or 1201 (unbuffered and buffered, respectively) adaptors. Characters are recorded redundantly at 23 bits per character on a single track.

.44 Output to Printer

IBM Selectric typewriter —

Output medium:	friction-fed or pin-fed (optional) roll paper or fanfold forms up to 15.5 inches wide (13-inch writing width).
Character set:	88 printable characters; see Paragraph .2.
Rated printing speed:	14.8 char/sec.
Effective speed:	less than rated speed due to carriage return, line feed, or other format operations.
Format control:	controlled by function codes in incoming data or manually by operator. Controls include line feed, carriage return, case shift, backspace, and horizontal tab.
Comments:	horizontal spacing is 10 char/inch (12 char/inch, optional) vertical spacing is 6 lines/inch (8 lines/inch, optional). The 8001 Printing Robot is unbuffered; the 8002 is buffered to allow simultaneous keyboard entry and printout. Both models list tape data under control of a tabbing plugboard. The addition of Feature 1000 to either model adds an Execute mode that enables format control via control characters in the data stream as well as the Print (listing) mode. Data is transcribed from magnetic tape via the buffer in all models, except the free-standing 8003 printer. The Selectric typewriter can be operated independent of the VIATRON Printing Robot; VIATRON does not supply the IBM Selectric typewriter.

.46 Output to Visual Display Device

Model 3001 and 3002 Video Displays —

Output medium:	cathode ray tube; displays white characters against black background.
Character set:	64 characters; upper-case alphabetics, digits, punctuation marks, and special symbols.

(Contd.)

.46 Output to Visual Display Device (Contd.)

Character size:	?
Display size:	7.5 inches wide by 5.5 inches high on 9-inch-diagonal rectangular CRT.
Characters per line:	20 characters.
Lines per display:	16 lines.
Buffer capacity:	400 characters.
Format control:	horizontal tab, right justify numeric field, automatic duplication and skipping standard. Character insert and delete, and duplication into specified location with the Model 1102 Microprocessor only.
Rated output speed:	300 char/sec.
Effective speed:	limited by message length and communications facility.
Comments:	the Model 3002 is a television display and can be substituted for a commercial TV set used with the VIATRON Model 1150 or 1151 RF Modulator.

Model 3050 Color Display —

Output medium:	cathode ray tube; displays 8 possible letter-colors on 8 possible background-colors.
Character set:	64 characters, including digits, upper-case letters, punctuation marks and special symbols.
Character size:	?
Display size:	10 inches wide by 7.5 inches high or 12-inch-diagonal rectangular CRT.
Characters per line:	20 characters.
Lines per display:	16 lines.
Buffer capacity:	400 characters.
Format control:	horizontal tab, character insert and delete, duplication into specified location, automatic lower-case indication by color, and right justify numeric field.
Rated output speed:	300 char/sec.
Effective speed:	limited by message length and communications facility.
Comments:	the Model 3050 provides up to eight manually selectable background colors (including black and white) and foreground colors; see Paragraph .15; can only be used with the Model 1102 Microprocessor.

.5 ERROR DETECTION AND CORRECTION

.51 Data Entry Errors

Type of checking:	characters are recorded redundantly and error detection bits are added but are checked only during translation. The Model 1102 Microprocessor includes a verify mode.
Error indication:	indicator lamp is lighted on the 1102.
Correction procedure:	operator intervention.

.52 Data Transmission Errors

Type of checking:	character validity and character parity.
Error indication:	indicator lamp is lighted; a question mark (?) is substituted for the character in error.
Correction procedure:	operator intervention; operator searches tape for question-marked characters and informs transmitting operator of errors.

(Contd.)

.53 Data Recording Errors

Type of checking —	
Model 1101:	no provision.
Model 1102:	each record is reread and checked bit for bit with the buffer contents. Error detection bits on Viatape are checked during translation.
Error indication:	keyboard is locked, tape halts, and lamp is lighted
Correction procedure:	operator intervention is required.

.55 Line Malfunctions

Detection:	absence of signal on reverse channel for a 15-second period.
Action:	transmission terminated.

.6 CONDITION INDICATORS

A comprehensive array of indicator lamps provides error status, transmission status, verification status, and indicates the program and mode currently in control of keyboard operation.

.7 DATA TRANSMISSION

.71 Basic Characteristics

Rated transmission speed:	up to 110 bps or 247.5 bps; or up to 600 bps or 1200 bps; see Comments.
Transmission method:	serial by bit.
Transmission code:	7-level, 11-unit USASCII; includes even parity bit.
Transmission mode:	half-duplex.
Order of bit transmission:	low-order data bit first.
Synchronization:	asynchronous; one start and two stop bits append each character transmitted.
Comments:	VIATRON provides a low or medium speed communications interface; both provide two manually-selected speeds.

.72 Connection to Communications Lines

Communications Line or Service	Data Set*
Public telephone network operating at the following speeds:	
up to 110 bps or 247.5 bps	Bell System Data-Phone Data Set 103A.
up to 600 bps or 1200 bps	Bell System Data-Phone Data Set 202C.
Common-carrier leased voice-band line operating at the following speeds:	
up to 110 bps or 247.5 bps	Bell System Data-Phone Data Set 103F.
up to 600 bps or 1200 bps	Bell System Data Set 202D.

.73 Transmission Control

Call initiation:	manual dialing or automatic signaling.
Call reception:	manual (attended) or automatic (unattended).
Functional operations:	under control of stored program or keyboard control keys; see Paragraph .15 for description.

.74 Multistation Operation: . . . . . no provision.

* In some cases, equivalent data sets can be used; check with your local common-carrier communications consultant.

.8 PHYSICAL SPECIFICATIONS

Component	Keyboard	Microprocessor	CRT Display
Width (inches)	16.5	16.5	16.5
Depth (inches)	5.5	15.0	8.75
Height (inches)	3.0	6.5	10.0
Weight (pounds)	25 (or less) total		

.9 PRICE DATA

Component or Feature	Monthly Rental $
Model 1101 Microprocessor	20
Model 1102 Microprocessor	36
Model 3001 Video Display	5
Model 3002 Video Display	8
Model 3050 Color Video Display	35
Model 4001 Keyboard	5
Model 5001 Viatape Recorder	4
Model 5201 Viatape Duplicator	30
Model 7001 Viatape-to-Card Converter	100
Model 7201 Viatape-to-Computer Tape Converter (includes four Viatape Recorders)	220
Model 7202 Viatape-to-Computer Tape Converter (includes four Viatape Recorders)	125
Model 8001 Unbuffered Printing Robot	20
Model 8002 Buffered Printing Robot	45
Model 8003 Stand-Alone Printing Robot	48
Optional Features	
Model 1000 Four Tape Extender (for Models 5201 and 7201)	30
Model 1000 Data Stream Control Adaptor (for Models 8001, 8002 and 8003)	10
Model 1050 Data Channel	1
Model 1051 Parallel Data Channel	1
Model 1100 Short Record Adaptor	15
Model 1150 RF Modulator (for one TV or Model 3002 Video Display)	7.50
Model 1151 RF Modulator (for twelve TV's or Model 3002 Video Displays)	23
Model 1200 Card Punch/Reader Adaptor	36
Model 1201 Buffered Card Punch/Reader Adaptor	70
Model 1300 Control Keyboard	N/C
Model 1350 Manual Communications Adaptor	10
Model 1351 Automatic Communications Adaptor	25
Model 1352 Acoustic Coupler	35

(1) VIATRON Systems are not for sale. Only short term (3 months) leases are available.

(2) A machine replacement service instead of the usual maintenance is provided. Replacements are shipped within four hours of notification, at no charge to the customer. Two standby machines are stocked free of charge for installations of 50 or more. Additional standby machines are charged 75% rental.

(3) Maximum of two.

(4) Does not include IBM 029 Keypunch.

(5) Does not include Selectric typewriter.

N/C - no charge.