

SPERRY RAND

UNIVAC

DCT 500
DATA
COMMUNICATIONS
TERMINAL

PROGRAMMERS
REFERENCE

This manual is published by the Univac Division of Sperry Rand Corporation in loose leaf format. This format provides a rapid and complete means of keeping recipients apprised of UNIVAC Systems developments. The information presented herein may not reflect the current status of the product. For the current status of the product, contact your local Univac Representative.

The Univac Division will issue updating packages, utilizing primarily a page-for-page or unit replacement technique. Such issuance will provide notification of hardware or software changes and refinements. The Univac Division reserves the right to make such additions, corrections, and/or deletions as, in the judgment of the Univac Division, are required by the development of its Systems.

UNIVAC is a registered trademark of Sperry Rand Corporation.

CONTENTS

CONTENTS	1 to 2
1. INTRODUCTION	1-1 to 1-2
1.1. SCOPE	1-1
1.2. PURPOSE	1-1
2. SUBSYSTEM DESCRIPTION	2-1 to 2-5
2.1. GENERAL	2-1
2.2. CONFIGURATIONS	2-2
2.2.1. Functional Operations	2-2
2.2.1.1. Type 8541-99 Standard Version	2-2
2.2.1.2. Type 8541-98 Automatic Operation Version	2-2
2.2.2. Optional Operating Functions	2-2
2.2.2.1. Type 8541-99 Standard Version and Type 8541-98 Automatic Operation Version	2-4
2.2.2.2. Type 8541-98 Automatic Operation Version	2-4
2.2.3. Additional Equipment Features	2-4
2.2.3.1. Type 8541-99 Standard Version	2-4
2.2.3.2. Type 8541-98 Automatic Operation Version	2-5
3. CODES AND FORMATS	3-1 to 3-5
3.1. GENERAL	3-1
3.2. CHARACTER CODES	3-1
3.3. MESSAGE FORMATS	3-5
4. SUBSYSTEM PROGRAMMING CONSIDERATIONS	4-1 to 4-10
4.1. GENERAL	4-1
4.2. ESTABLISHMENT	4-1
4.2.1. Private Line	4-1
4.2.2. Public Telephone Line	4-2
4.3. TYPE 8541-98 AUTOMATIC OPERATION VERSION	4-2
4.3.1. Establishment	4-2
4.3.2. Status Poll	4-2
4.3.3. Fast Select	4-2
4.3.4. Terminal and Device Addressability	4-3
4.3.5. Selection	4-3
4.3.6. Acknowledgment	4-3
4.3.7. Master Station	4-3
4.3.8. Motor Control	4-3
4.3.9. Form Control	4-3
4.3.10. Remote Control	4-4
4.3.11. Print Monitor	4-4

4.4. DATA EXCHANGE	4-4
4.5. TERMINATION	4-5
4.6. DISCONNECTION	4-5
4.7. TIMING	4-5
4.7.1. Communication Speeds	4-5
4.7.2. Establishment and Termination	4-9
4.7.3. Form Control Characters	4-10

FIGURES

1-1. UNIVAC Data Communications Terminal (DCT) 500	1-2
2-1. Block Diagram of UNIVAC DCT 500 with Optional Features	2-3
3-1. Message Format	3-5
4-1. Data Exchange - Dial Out, Teletypewriter Mode	4-6
4-2. Data Exchange - Dial In, Automatic Operation	4-6
4-3. Data Exchange - Multipoint, Private Lines, Automatic Operation, Fast Select	4-7
4-4. Data Exchange - Dial Out, Automation Operation, Status Poll	4-7
4-5. Data Exchange - Point-to-Point or Multipoint, Automatic Operation, Status Poll	4-8
4-6. Data Exchange - Point-to-Point or Multipoint, Automatic Operation, Fast Select	4-8

TABLES

3-1. Character Specifications	3-1
3-2. ASCII Characters	3-2
3-3. Character Set and Codes	3-3
3-4. Control Characters	3-4
4-1. Transfer Times	4-9
4-2. Transfer Rates	4-9
4-3. Timing Considerations for Control Characters	4-10

I. INTRODUCTION

1.1. SCOPE

This reference is presented in the four following sections:

- Introduction
- Subsystem Description
- Codes and Formats
- Subsystem Programming Considerations

Section 2, Subsystem Description, describes the overall operating characteristics and the available equipment configurations. Section 3, Codes and Formats, describes the character codes and message formats used for the UNIVAC Data Communications Terminal (DCT) 500. Section 4, Subsystem Programming Considerations, describes the procedures for controlling the various functions and the timing considerations during the control procedures.

1.2. PURPOSE

This reference provides a programmer-oriented description of the UNIVAC DCT 500 (Figure 1-1). The description includes all information pertinent to programming a central processor with which one or more DCTs are used as remote data processing terminals.

The text of this reference is based on the assumption that the reader is acquainted with the *UNIVAC DCT 500 Data Communications Terminal General Description*, UP-7804 (current version). It is not within the scope of this reference to provide information pertaining to the operating or servicing of the DCT.

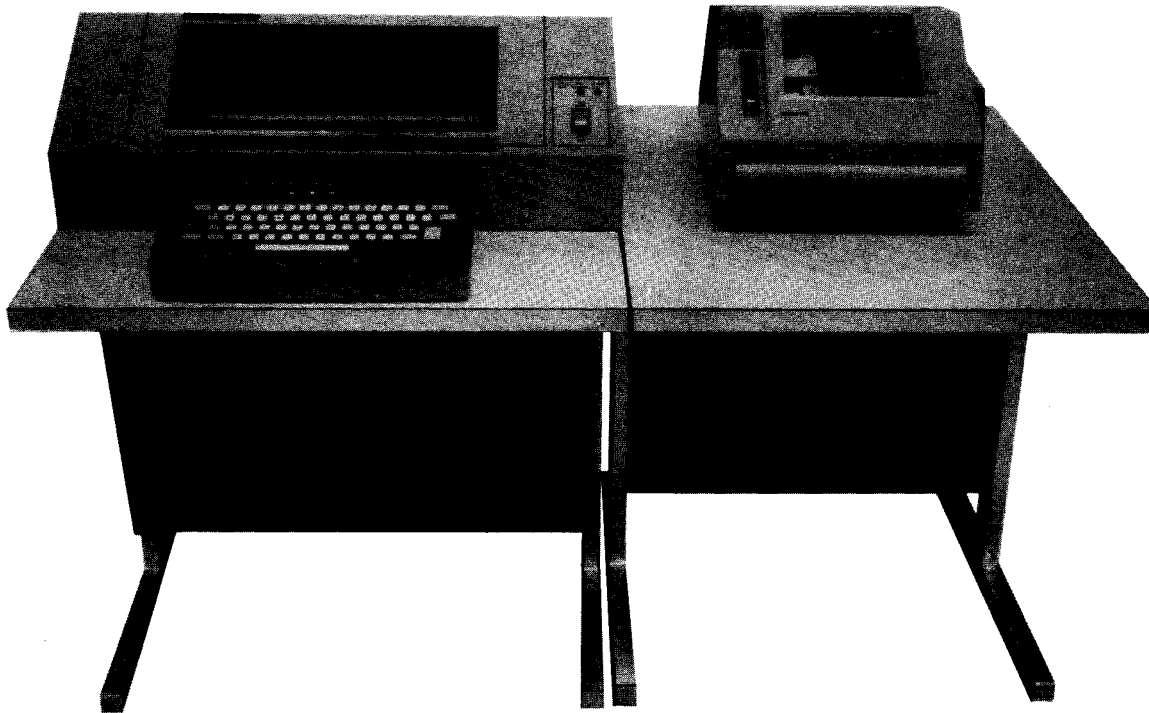


Figure 1-1. UNIVAC DCT 500 Data Communications Terminal

2. SUBSYSTEM DESCRIPTION

2.1. GENERAL

The UNIVAC Data Communications Terminal (DCT) 500 is a remote, unbuffered, input/output device which provides half-duplex or full-duplex low speed data communication. The DCT 500 provides this communication with another DCT 500, with TELETYPE* equipment, or with a central computer, by means of voice-grade facilities. The input/output methods include 132-position printing, paper tape reading and punching, and full 128 ASCII-character generation.

The DCT 500 transmits and receives the standard ASCII character set, with each character eight bits in length including parity. When transmitting and receiving, the DCT 500 operates at one of three speeds: 110, 150, or 300 baud asynchronous. With 11-bit characters (one start, eight data, and two stop bits), 110 baud operation provides an operating speed of 10 characters per second; and with 10-bit characters (one start, eight data, and one stop bits), 150 and 300 baud operation provides operating speeds of 15 and 30 characters per second, respectively. The desired operating speed of the DCT 500 is field or factory selected for the receive only configuration and switch selectable on the DCT 500 for the other configurations.

The DCT 500 can operate in either the half-duplex or full-duplex mode at all three operating speeds. When operating in the half-duplex mode, one function (either transmitting or receiving) can be accomplished at one time. In the full-duplex mode, transmitting and receiving can be accomplished simultaneously. When operating in the full-duplex mode, the operator is required to type blind unless a monitor is included. During operation in the full-duplex mode when a transmit monitor is used, data can be received on the punch while data transmitted simultaneously from the keyboard or paper tape reader is being printed. The operating mode of the DCT 500 is preselected within the DCT 500.

The DCT 500 may be connected to either a private voice-grade communications line or the public telephone system. Whether the DCT 500 is used on private or public lines, the DCT 500 presents an EIA-RS232C/CCITT interface to the communications modem.

*Trademark of AT&T Company

2.2. CONFIGURATIONS

There are two versions of the UNIVAC DCT 500: a standard version, designated Type 8541-99, and an automatic version, designated Type 8541-98.

The Type 8541-98 automatic operation version is available in three configurations:

- the basic configuration of the DCT 500 consisting of an incremental printer and a control unit;
- the expanded configuration, consisting of the printer, control unit, and keyboard;
- the maximum configuration, consisting of the printer, control unit, keyboard, and paper tape unit.

The Type 8541-99 standard version is available in two configurations:

- the basic configuration, consisting of an incremental printer and a control unit;
- the expanded configuration, consisting of the printer, control unit, and keyboard.

Figure 2-1 is a block diagram illustrating both versions of the UNIVAC DCT 500 and the various configurations.

2.2.1. Functional Operations

The DCT 500 provides three types of functional operations depending on the equipment configuration. In the basic configuration, consisting of a printer and control unit, the DCT provides receive only (RO) operation. In the expanded configuration that includes a keyboard the DCT provides keyboard send receive (KSR) operation. In the maximum configuration that includes a paper tape unit, the DCT provides automatic send receive (ASR) operation.

2.2.1.1. Type 8541-99 Standard Version

The basic configuration of the standard DCT 500 is designed to check parity, to operate in either half-duplex or full-duplex mode, and to recognize end of transmission (EOT).

2.2.1.2. Type 8541-98 Automatic Operation Version

The basic configuration of the automatic operation DCT 500 is designed to automatically answer and recognize a particular address transmitted by a central computer or another remote station in a multipoint network (automatic answering and terminal address). The central computer or remote station may select any of the DCT 500 input or output devices to process the message (automatic device selection). In addition, the central processor or remote station can determine whether the receiving station is ready to transmit or receive data (status poll). The automatic operation also provides the DCT 500 with the capability to permit the receiving station to interrupt and resume transmission.

2.2.2. Optional Operating Functions

Depending on the individual requirements for a DCT 500, certain capabilities may be selected to accommodate different applications. These options may be selected for inclusion into the DCT 500 or may be eliminated.

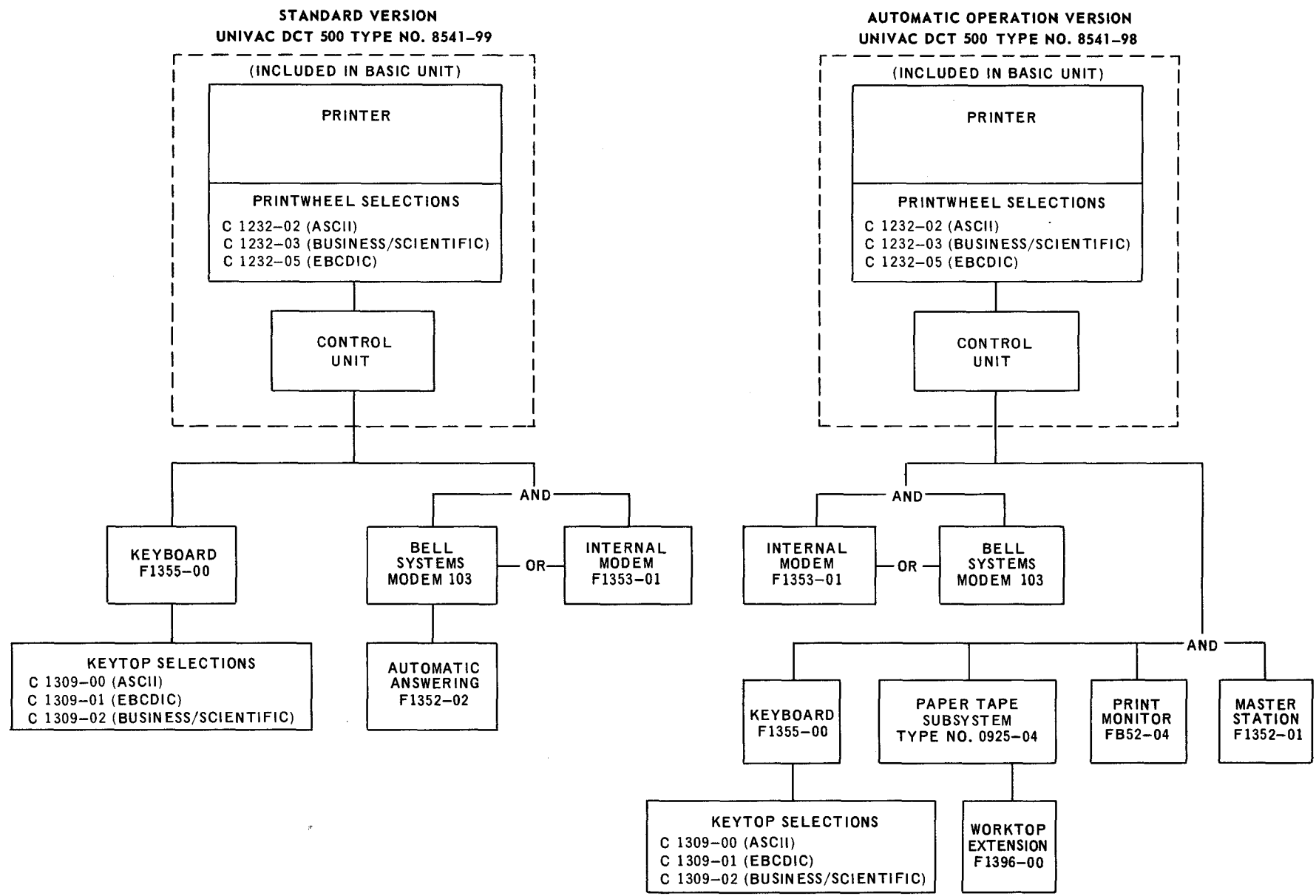


Figure 2-1. Block Diagram of UNIVAC DCT 500 with Optional Features

2.2.2.1. Type 8541-99 Standard Version and Type 8541-98 Automatic Operation Version

The following operating functions are available for selection with both the standard and automatic operation versions.

- Parity

The selection of parity provides the DCT 500 with the capability to generate and check either odd or even parity, or not check parity at all.

- Modes of Operation

The DCT 500 is capable of operating in one of two modes, either half duplex or full duplex.

- New Line

The selection of new line provides the DCT with the capability to cause carriage return and line feed automatically when a line feed character is received. If the new line capability is not selected, both carriage return and line feed characters are necessary.

2.2.2.2. Type 8541-98 Automatic Operation Version

The following operating functions are available for selection with the automatic operation version only.

- Status Poll

The selection of status poll provides the DCT 500 with the capability to determine whether the receiving station is ready to transmit or receive data.

- Terminal and Device Addressability

The selection of terminal and device addressability provides the DCT 500 with the capability to recognize a particular address and select any of the DCT 500 input or output devices to process the message (see 3.2 for codes). The address must be followed by ENQ or STX characters during transmission.

2.2.3. Additional Equipment Features

The operating capabilities of the DCT 500 configurations can be expanded by utilizing the available equipment features. These features include automatic answering, internal modem, master station, and print monitor. Figure 2-1 illustrates the additional features that can be used with each version of the DCT 500.

2.2.3.1. Type 8541-99 Standard Version

The following features are available with the standard version DCT 500.

- Automatic Answering

The automatic answering feature provides the DCT 500 with the capability of answering incoming calls, acting upon the call, and then terminating the call. When the incoming call is answered, the DCT 500 can be selected to send or receive data.

- Internal Modem

The internal modem feature is similar to the Bell System 103 Modem and provides the DCT 500 with direct access to a communications line. This feature requires the master station function to originate calls.

2.2.3.2. Type 8541-98 Automatic Operation Version

The following features are available with the automatic operation version of the DCT 500.

- Internal Modem

The internal modem feature is similar to the Bell System 103 Modem and provides the DCT 500 with direct access to a communications line. This feature requires the master station feature to originate calls.

- Master Station

The master station feature provides the DCT 500 with the capability of initiating transmission to a selected station or stations. In addition, the DCT 500 is capable of polling a designated station to initiate transmission of data from that station.

- Print Monitor

The print monitor feature provides the DCT 500 with the capability of monitoring data transmission or reception by use of the printer when the paper tape reader, paper tape punch, or keyboard is being used.



3. CODES AND FORMATS

3.1. GENERAL

This section describes the character codes and message formats used for the UNIVAC DCT 500.

3.2. CHARACTER CODES

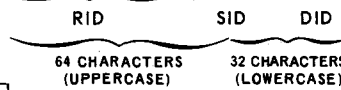
The UNIVAC DCT 500 transmits and receives the ASCII character set. The specifications for an individual character at the three transmission rates are specified in Table 3-1, and the ASCII code is defined in Table 3-2. The characters listed in columns 0 and 1 of Table 3-2 cannot be printed by the DCT 500; the characters listed in columns 6 and 7 of the table initiate printing of the corresponding characters listed in the same row under columns 4 and 5.

SPEED (BAUD)	SPEED (CPS)	DATA BITS/ CHAR	START BITS/ CHAR	STOP BITS/ CHAR	TOTAL BITS/ CHAR	TIME/ CHAR (MS)
110	10	8	1	2	11	100
150	15	8	1	1	10	67
300	30	8	1	1	10	33

Table 3-1. Character Specifications

Table 3-3 lists the DCT 500 text and control characters with their ASCII codes and equivalent EBCDIC, Fieldata, and XS3-H codes. In addition, the table lists each printed character and the corresponding keys to be printed for each control character. The information listed in the table is for a DCT 500 equipped with the ASCII type-wheel and keypad.

ROW	BITS	CONTROL CHARACTERS		GRAPHIC CHARACTERS						
		COL. 0	COL. 1	COL. 2	COL. 3	COL. 4	COL. 5	COL. 6	COL. 7	
0	0000	NUL	DLE	SP	0	@	P		p	
1	0001	SOH	DC1	!	1	A	Q	a	q	
2	0010	STX	DC2	"	2	B	R	b	r	
3	0011	ETX	DC3	#	3	C	S	c	s	
4	0100	EOT	DC4	\$	4	D	T	d	t	
5	0101	ENQ	NAK	%	5	E	U	e	u	
6	0110	ACK	SYN	&	6	F	V	f	v	
7	0111	BEL	ETB	'	7	G	W	g	w	
8	1000	BS	CAN	(	8	H	X	h	x
9	1001	HT	EM	)	9	I	Y	i	y
10	1010	LF	SUB	*	:	J	Z	j	z	
11	1011	VT	ESC	+	;	K	[	k	{
12	1100	FF	FS	,	<	L	\	l	|	
13	1101	CR	GS	-	=	M	]	m	}
14	1110	SO	RS	.	>	N	^	n	~	
15	1111	SI	US	/	?	O	_	o	DEL	




Example:  = A
b₇.....b₄

Table 3-2. ASCII Characters

Twelve control characters are used for the DCT 500. Any of these twelve control characters except EOT may appear in any text location of the transmitted or received messages. Table 3-4 lists and describes each of the control characters used for the DCT 500. The address characters for DCT 500 station and device identification are restricted to certain ASCII characters. The remote identifier (RID) and station identifier (SID) portions of the address are selected from columns 2 through 7 of Table 3-2. The device identifier (DID) portion of the address is as follows for the associated devices.

- 1011 0010 Keyboard
- 1011 0001 Printer
- 0011 0110 Paper Tape Reader
- 0011 0101 Paper Tape Punch

KEY CHARACTERS	CONTROL CHARACTER	PRINT CHARACTER		KEY CHARACTER				PRINT CHARACTER		KEY CHARACTER				PRINT CHARACTER		KEY CHARACTER			
		ASCII ₈	ASCII ₈	ASCII ₈	EBCDIC ₁₆	FIELDATA ₈	X53-H ₈	ASCII ₈	EBCDIC ₁₆	FIELDATA ₈	X53-H ₈	ASCII ₈	EBCDIC ₁₆	FIELDATA ₈	X53-H ₈	ASCII ₈	EBCDIC ₁₆		
CTL @	NUL	000		SP		240	40	05	00	@	@	300	7C	00	40	'	@	140	
CTL A	SOH	201		!	!	041	5A	55	43	A	A	101	C1	06	24	a	A	341	81
CTL B	STX	202		"	"	042	7F	76	60	B	B	102	C2	07	25	b	B	342	82
CTL C	ETX	003		#	#	243	7B	03	37	C	C	303	C3	10	26	c	C	143	83
CTL D	EOT	204		\$	\$	044	5B	47	42	D	D	104	C4	11	27	d	D	344	84
CTL E	ENQ	005		%	%	245	6C	52	55	E	E	305	C5	12	30	e	E	145	85
CTL F	ACK	006		&	&	246	50	46	63	F	F	306	C6	13	31	f	F	146	86
CTL G	BEL	207		'	'	047	7D	72	56	G	G	107	C7	14	32	g	G	347	87
CTL H	BS	210		(	(	050	4D	51	61	H	H	110	C8	15	33	h	H	350	88
CTL I	HT	011		)	)	251	5D	40	75	I	I	311	C9	16	34	i	I	151	89
NEW LINE	LF	012		*	*	252	5C	50	41	J	J	312	D1	17	44	j	J	152	91
CTL K	VT	213		+	+	053	4E	42	20	K	K	113	D2	20	45	k	K	353	92
CTL L	FF	014		,	,	254	6B	56	62	L	L	314	D3	21	46	l	L	154	93
RETURN	CR	215		-	-	055	60	41	02	M	M	115	D4	22	47	m	M	355	94
CTL N	SO	216		.	.	056	4B	75	22	N	N	116	D5	23	50	n	N	356	95
CTL O	SI	017		/	/	257	61	74	64	O	O	317	D6	24	51	o	O	157	96
CTL P	DLE	220		0	0	060	F0	60	03	P	P	120	D7	25	52	p	P	360	97
CTL Q	DC1	021		1	1	261	F1	61	04	Q	Q	321	D8	26	53	q	Q	161	98
CTL R	DC2	022		2	2	262	F2	62	05	R	R	322	D9	27	54	r	R	162	99
CTL S	DC3	223		3	3	063	F3	63	06	S	S	123	E2	30	65	s	S	363	A2
CTL T	DC4	024		4	4	264	F4	64	07	T	T	324	E3	31	66	t	T	164	A3
CTL U	NAK	225		5	5	065	F5	65	10	U	U	125	E4	32	67	u	U	365	A4
CTL V	SYN	226		6	6	066	F6	66	11	V	V	126	E5	33	70	v	V	366	A5
CTL W	ETB	027		7	7	267	F7	67	12	W	W	327	E6	34	71	w	W	167	A6
CTL X	CAN	030		8	8	270	F8	70	13	X	X	330	E7	35	72	x	X	170	A7
CTL Y	EM	231		9	9	071	F9	71	14	Y	Y	131	E8	36	73	y	Y	371	A8
CTL Z	SUB	232		:	:	072	7A	53	21	Z	Z	132	E9	37	74	z	Z	372	A9
CTL [	ESC	033		;	;	273	5E	73	16	[	[	333	4A	01	17	{	[	173	
CTL \	FS	234		<	<	074	4C	43	36	\	\	134		57	15	|	\	374	4F
CTL]	GS	035		=	=	275	7E	44	35	]	]	335	5F	02	01	}	]	175	
CTL ^	RS	036		>	>	276	6E	45	76	^	^	336		04	57	~	^	176	
CTL DEL	US	237		?	?	077	6F	54	23	-	-	137	6D	77	77	DEL	-	377	FF

Table 3-3. Character Set and Codes

161
1010

DCT 500 CHAR	TTY 33/35 CHAR	OCTAL ASCII	DEFINITION	REMARKS
ENQ	WRU	005 <i>X'05'</i>	Enquiry. Sent from computer as status poll or data poll. Preceded by 3-character identification prefix (see 3.3). In point-to-point without paper tape, identification prefix is unnecessary.	ACK or NAK response expected in response to status poll. Data or EOT expected in response to data poll. Identification prefix is field installable selection.
ACK	RU	006 <i>X'06'</i>	Acknowledge. Indicates selected receiving terminal and device ready.	Single character in response to ENQ.
LF	LF	012 <i>X'0A'</i>	New line. Returns carriage and feeds line. (Optionally feeds line only.)	In any text location, but at 300 baud, must be followed by DEL characters (see 4.7).
FF	FF	014 <i>X'0E'</i>	Form feed. Returns carriage and advances to top of next page. (Applicable only for 11-inch forms.)	In any text location, but must be followed by DEL characters (see 4.7).
DC1	XON	021	Device control 1. When received, permits resumption of transmission that was interrupted by receipt of DC3.	Pressing of PROCEED key also performs this function. DC1 sent by simultaneous pressing of CTL and Q keys.
STX	EOA	202	Start of text. Immediately follows identification prefixes and is followed by text characters.	Optional operating function required when using RID, SID, and DID.
EOT	EOT	204 <i>X'0C'</i>	End of transmission. Cancels previous selection. Follows last transmitted character. Turns off motor of paper tape punch.	Sent manually or punched in paper tape.
CR	CR	215	Carriage return. Returns carriage without feeding line.	In any text location, but must be followed by DEL characters (see 4.7).
DLE		220	Data link escape. Precedes EOT in DEOT sequence (see 3.3). Same function as EOT, but causes disconnection from switched telephone network.	Sent by simultaneous pressing of CTL and P keys.
DC3	XOFF	223	Device control 3. When received, interrupts transmission until receipt of DC1 or pressing of PROCEED key.	Sent by simultaneous pressing of CTL and S keys.
NAK	ERR	225	Negative acknowledge. Indicates selected receiving terminal or device not ready.	Single character in response to ENQ.
DEL	RO	377	Delete. Paper-tape character of all punches used to cover spurious characters. Transmitting of DEL characters read from tape is optional.	For time fill during line feeds, carriage returns, form feeds, perforation skips, and motor turnon (see 4.7).

Table 3-4. Control Characters

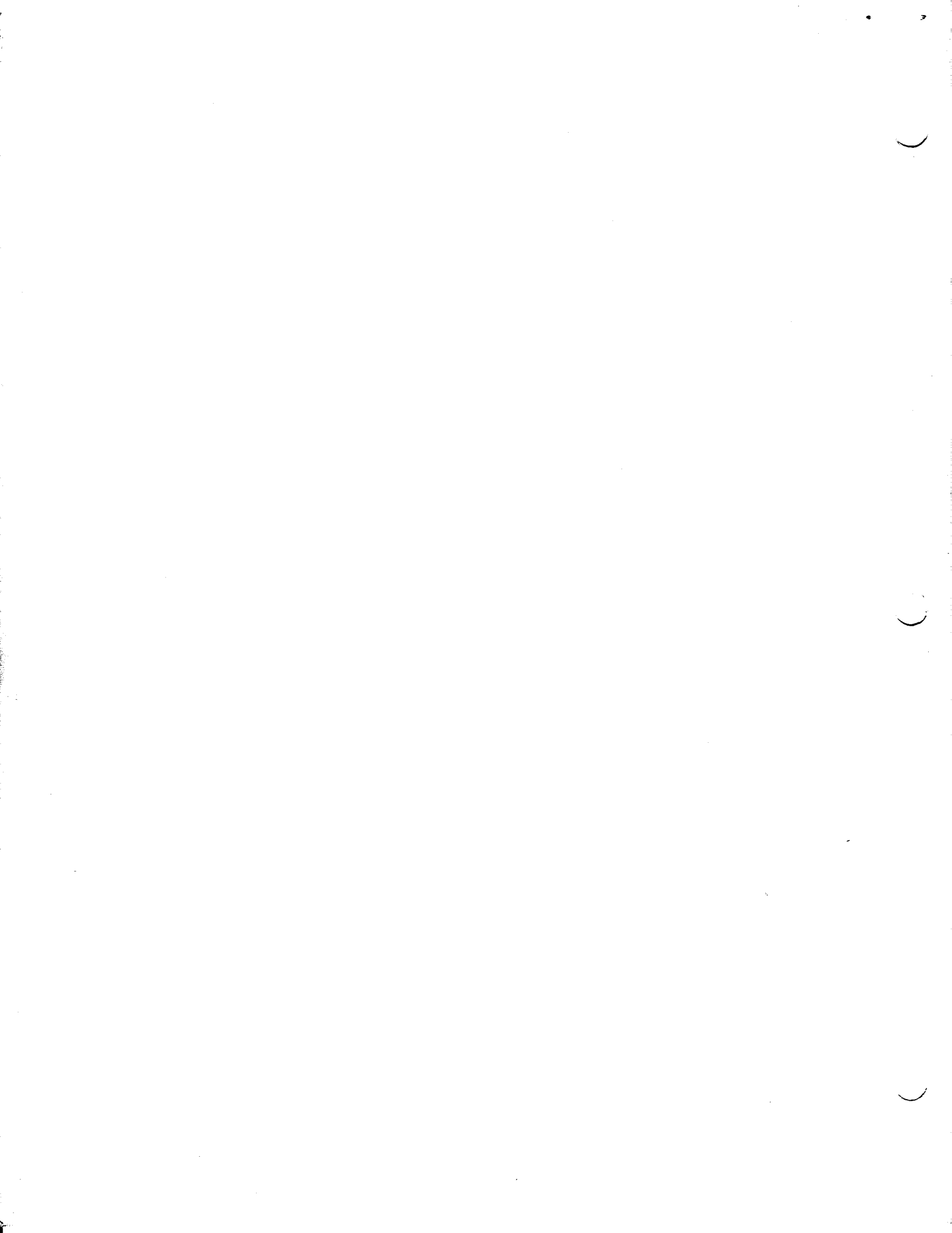
3.3. MESSAGE FORMATS

The UNIVAC DCT 500 transmits and receives individual characters. In the receive only (RO) and keyboard send receive (KSR) configurations, the DCT 500 transmits and receives all characters. In the automatic send receive (ASR) configuration with the terminal and device addressability option included, characters can be arranged in message form. To accomplish the forming of a message, all characters received are ignored by the DCT 500 until an STX character is received. Each address, or series of addresses, must be followed by either ENQ or STX for the DCT to accept text characters.

The text characters following the address are completely free form. DC1, DC3, and form control characters may be imbedded messages or transmitted individually. The form control characters must be followed by DEL characters as specified in 4.7, and EOT characters must be the last character transmitted. ACK and NAK, which are responses to ENQ sequences, are transmitted individually. The ENQ character is transmitted individually except where remote identifier (RID), station identifier (SID), and device identifier (DID) precede it (see 3.2) either in multipoint networks or during use of the DCT 500 automatic operation version. The end of transmission (EOT) character is transmitted individually or at the end of a message. DEOT, which is the mandatory disconnect sequence for use on the switched telephone network, consists of a DLE character followed by an EOT character. Figure 3-1 illustrates the basic message formats for the DCT 500.

CHARACTER TRANSMISSION SEQUENCE						
1	2		3	4	5	6
ENQUIRY	READY OR NOT READY		TEXT		END OF TRANSMISSION	MANDATORY DISCONNECT
RSDE IIIN DDDQ	A C K	N A K	S T X	TEXT	E O T	DE LO ET

Figure 3-1. Message Format



4. SUBSYSTEM PROGRAMMING CONSIDERATIONS

4.1. GENERAL

This section describes the operating functions of the UNIVAC DCT 500. The description includes the pertinent operating characteristics that are required for consideration in developing a program for a central processor. The description of the operations are divided into the following categories:

- Establishment
- Type 8541-98, Automatic Operation Version
- Data Exchange
- Termination
- Disconnection
- Timing

4.2. ESTABLISHMENT

The UNIVAC DCT 500 may be connected to either a private voice-grade communications line or the public telephone system.

4.2.1. Private Line

Establishment on a private line can be originated either by the remote DCT 500 or a central processor. When the DCT 500 originates establishment, the DCT 500 is operating in the KSR or ASR operation (the MASTER/SLAVE switch on the control panel is set to the MASTER position or the machine permanently strapped for master mode), and the associated modem establishes an originate mode carrier. When the processor originates establishment, the DCT 500 is performing either in the RO operation and is automatically a slave terminal or in the KSR or ASR operation (with the MASTER/SLAVE switch in the SLAVE position or the machine permanently strapped for slave mode) and the associated modem in the answer mode. The processor establishes an originate mode carrier. The receiving DCT 500 receives the carrier and generates a return answer mode carrier at a different frequency. When the originating processor receives the answer mode carrier, data exchange may commence.

Since no more than one station on the line can be in the originate mode and no more than one station can be in the answer mode, full-duplex operation and operation with status polls and acknowledgments are prohibited for broadcast applications. The elapsed time required for private line establishment is approximately 265 milliseconds.

4.2.2. Public Telephone Line

Establishment on a public telephone line can be initiated either by the central computer or a remote DCT 500. To initiate establishment, a call is placed on the dial facility. When the call is answered the DATA-PHONE* Data Auxiliary Set pushbuttons are switched from the TALK pushbutton to the DATA pushbutton. The originating station then assumes the originate mode at one carrier frequency, and the called station assumes the answer mode at a different carrier frequency.

When the called station answers, the modem automatically transmits the carrier to the originating station. When the answer carrier is received by the originating station, the originating modem transmits its carrier. When both carriers are established, data exchange may commence.

The elapsed time for establishment on the public telephone line is approximately 3.6 seconds. In addition the dialing time is 5 to 25 seconds, and the answering time is 4.6 seconds. Dialing can be performed either manually or automatically from the processor and manually only from the DCT. Answering can be performed either manually or automatically at the processor, manually or automatically (if the automatic answering feature is included) at the DCT in the RO and KSR operations, and automatically in the ASR operation.

4.3. TYPE 8541-98 AUTOMATIC OPERATION VERSION

The following operating characteristics are applicable to the automatic operation version of the DCT 500.

4.3.1. Establishment

Initially, the processor or DCT establishes a connection, and either the processor selects the terminal and device or the DCT transmits to the computer. If the DCT 500 is to receive data, either receiver status poll recognition or fast select must be employed; or fast selection may be employed with status poll.

4.3.2. Status Poll

For status poll the processor sends RID, SID, DID, followed by an ENQ character. Receipt of this character at the DCT causes transmission of the ACK character if the terminal and device are ready to receive data; the NAK character is transmitted if the terminal and device are not ready to receive data; the EOT character is transmitted if the terminal and device are not ready to transmit data; or data is transmitted if the terminal and device are ready to transmit data.

4.3.3. Fast Select

For fast select the DCT accepts data, starting with an STX immediately after the terminal and device addresses (see 2.2.2.2). Some delay is necessary for ASR operation with motor control. The fast select operation is required for broadcast (more than one receiver of transmission) applications and is preferable over status polls for conversational applications.

*AT&T trademark

4.3.4. Terminal and Device Addressability

Terminal and device addressability is required for multipoint networks and can be employed when more than one receiving device is available; that is, printer and paper tape punch. Terminal and device addressability is also required to enable the processor to poll for input data. The addresses consist of three characters: RID, SID, and DID, in that order (see 3.2). Each address, or series of addresses, must be followed by either ENQ or STX. The processor selects by sending the appropriate addresses before each input and each output. On the switched telephone network the originator of a call transmits DEOT following the last transmission for disconnection.

4.3.5. Selection

Selection occurs when the processor sends the terminal and device address characters RID, SID, and DID before transmitting data and preceding the ENQ character in status polls and input data polls. After the processor polls the DCT to transmit data, it may do so immediately, or after establishing a connection. Receiving or transmitting is determined by the specific device selected. If the DCT 500 has no data to transmit, the DCT answers the poll with EOT. An EOT is transmitted before each change in direction of traffic.

4.3.6. Acknowledgment

Acknowledgment is the act of answering an ENQ character with either an ACK or NAK character. An ACK character is sent if the terminal and output devices are ready; a NAK character is sent if the terminal and output devices are not ready. In the ASR operation, the ACK is not returned until the paper tape motor, if selected, is up to speed, with the result that there is a 3/4 to 2-1/4 second delay.

4.3.7. Master Station

Two methods of operation are available with the DCT 500: slave operation and master operation (see 2.2.3.2). With the MASTER/SLAVE switch in the MASTER position, the DCT 500 initiates transmissions. With the switch in the SLAVE position, the computer initiates transmissions.

4.3.8. Motor Control

When the DCT recognizes the paper tape punch DID, the paper tape punch motor is turned on. The paper tape motor remains on until the DCT 500 receives an EOT character, at which time the paper tape punch motor is turned off. A minimum of five DEL characters must be sent to allow for motor turnon (see Table 4-3). The ACK acknowledgment character for answering a status poll is not returned until the motor is up to speed, which takes 3/4 to 2-1/4 seconds.

4.3.9. Form Control

Three form control characters are acted upon by the DCT 500 form feed (FF), line feed (LF) or new line (see 2.2.2.2.), and carriage return (CR). Form feed is for 11-inch forms only and cannot be adjusted. No vertical or horizontal tabs are available with the DCT 500. The form control characters received by the DCT 500 are acted upon when received and must be followed by a minimum of DEL characters (see Table 4-3). The form control characters that are received by the DCT 500 with an invalid parity are ineffective and cause the printing of an asterisk. In addition, the DCT 500 has an automatic perforation skip function (see 4.7). Form control characters are transmitted in the same manner as data characters and may be imbedded in data messages, provided that the timing requirements are properly considered.

4.3.10. Remote Control

Remote control permits the receiving DCT 500 or computer to halt transmission. There are two methods of remote control.

In one method the DCT 500 halts transmission upon receipt of a DC3 character and resumes transmission upon receipt of a DC1 character. To send these characters from the DCT, DC3 and DC1 must be keyed in or must have been punched on the paper tape. When transmission has been halted, the operator is alerted by the INTRPT indicator being lit. This indicator lights when either a DC3 character is received from a processor or the INTRPT key is pressed at another DCT 500. The modem carrier is not dropped in this situation; therefore, an EOT or DEOT must be sent if data is to be exchanged with another station during the interrupt interval. The spacing signal is sent from the DCT 500 when the INTRPT key is pressed. Remote control characters are transmitted to the DCT 500 in the same manner as data characters and may be imbedded in data messages, provided that timing requirements are properly considered.

4.3.11. Print Monitor

The print monitor permits the printing of data being read from or punched in paper tape. The print monitor requires no software considerations but is useful in testing paper tape handling. If the printer runs out of paper during print monitor operation, only the print monitor function is affected. Without the print-monitor function, offline printing of paper tape can be performed at the DCT.

4.4. DATA EXCHANGE

Simplex, half-duplex, or full-duplex operation is possible over two wire lines. No special control procedures exist for data exchange with the standard version. With the automatic operation version, an STX character is required before data characters. Without the receipt of STX in the automatic operation version, all received data is ignored. To send STX from the DCT 500, the character must be keyed in or must have been punched in the paper tape.

Transmitted characters have odd or even parity, and received characters are checked for parity with both versions of the DCT 500.

When a character is received with an invalid parity, an asterisk is printed or punched in place of the invalid character, and the ~~PARITY CHECK~~ indicator lights for the ~~KSR and ASR operations~~. The indicator remains lit until any new message after the EOT character is received. When a character is received with an invalid parity for the RO operation, an asterisk is printed in place of the invalid character. Form control characters received with invalid parity are ineffective for all operations. In addition, remote control and form control characters can be sent separately or can be imbedded in text messages with the automatic operation version.

If the printer runs out of paper or the paper tape punch runs out of paper tape, the received messages will be lost. However, in the automatic operation version the next ENQ is answered with an NAK character.

The standard version DCT 500 can be used in a teletypewriter type mode during KSR operation. In this type operation, data exchange is in free form and is used for point-to-point and switched telephone networks. The operation employs no polling, no acknowledgments, no special header characters, and no special trailer characters. The devices used are manually selected by the DCT 500 operator.

Data exchanged between a processor and a DCT 500 generally fall in one of six categories:

- Dial Out, Teletypewriter Mode
- Dial In, Automatic Operation
- Multipoint, Private, Automatic Operation
- Dial Out, Automatic Operation, Status Poll
- Point-to-Point or Multipoint, Automatic Operation, Status Poll
- Point-to-Point or Multipoint, Automatic Operation, Fast Select

Figures 4-1 through 4-6 illustrate the six typical data exchanges between a computer and a DCT 500. These figures show the automatic operation DCT or the automatic answering feature if the Bell System modem is used with the standard version. The DCT 500 is equipped with a keyboard and includes the various functions and equipment as required for the specific procedures illustrated. In the figures, the symbol α represents the address sequence RID, SID, and DID.

4.5. TERMINATION

Termination occurs with the transmission of an EOT character or DEOT (DLE-EOT) character sequence by the transmitting station and cancellation of any previous selection. On the switched telephone network, termination automatically accompanies disconnection. To send EOT or DEOT from the DCT 500, the characters must be keyed in or must have been punched in the paper tape. When EOT or DEOT is received by a selected DCT 500 on a private line, the DCT 500 modem carrier is turned off. Termination requires approximately 70 milliseconds.

4.6. DISCONNECTION

Disconnection applies only to the switched telephone network using a Bell System 103A Modem. When a DEOT (DLE immediately followed by EOT) is received, the DCT goes "on hook" and any previous selection is cancelled. On a private line, DEOT has the same effect as EOT. To send DEOT from the DCT, the DLE and EOT characters must be keyed in or must have been punched in the paper tape. Disconnection requires approximately 3.8 seconds.

4.7. TIMING

The following paragraphs describe the timing considerations for the operation of the DCT 500.

4.7.1. Communication Speeds

The DCT 500 has three communication speeds: 110 baud, 150 baud, and 300 baud. Table 4-1 lists the transfer times for each speed, and Table 4-2 lists the transfer rates for each speed. The information contained in Table 4-2 is presented with the assumption that STX is not used, motor control is not employed, the DCT 500 is operating in a teletypewriter mode, and each line of data contains a carriage return character, a line feed character, and the required DEL characters.

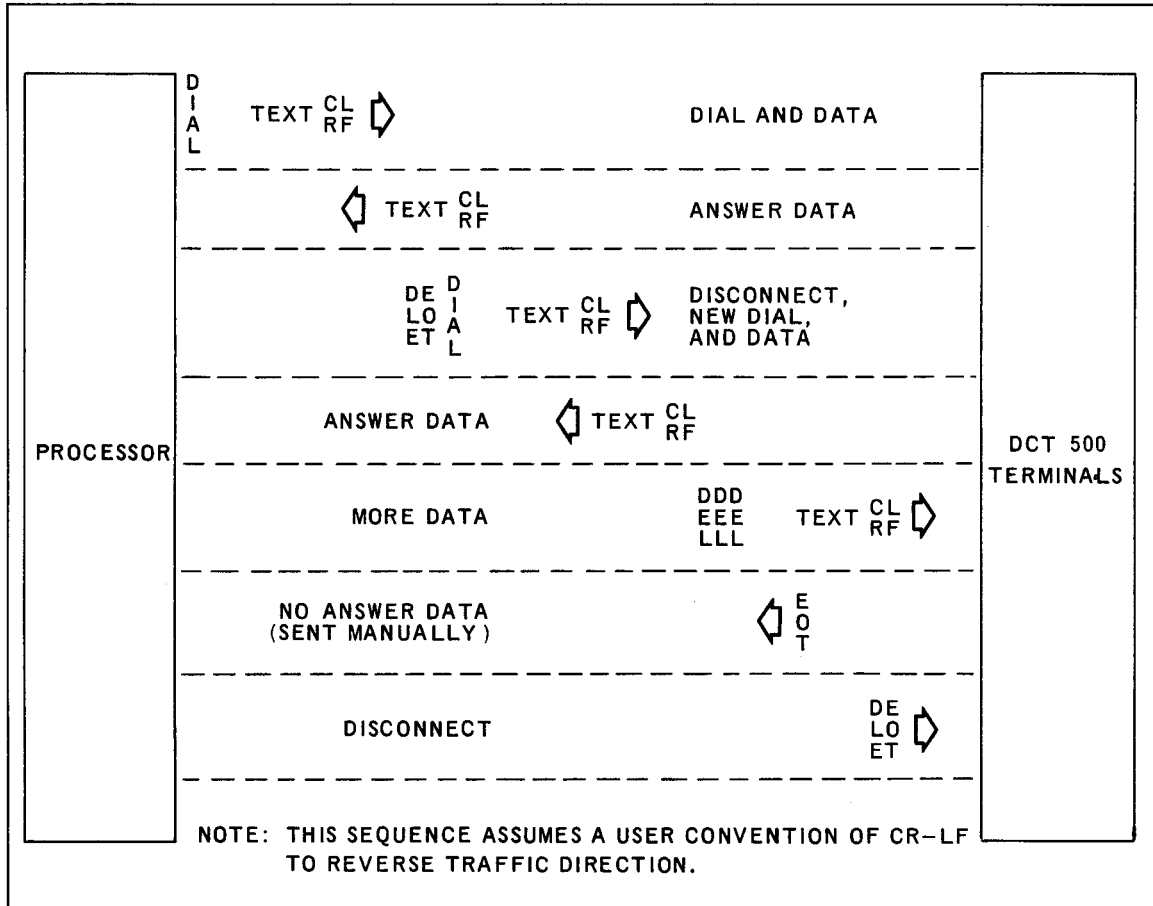


Figure 4-1. Data Exchange - Dial Out, Teletypewriter Mode

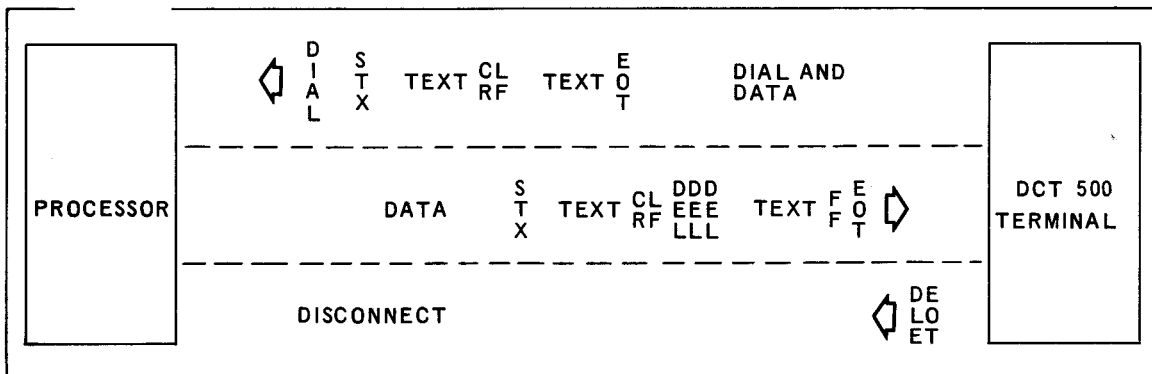


Figure 4-2. Data Exchange - Dial In, Automatic Operation

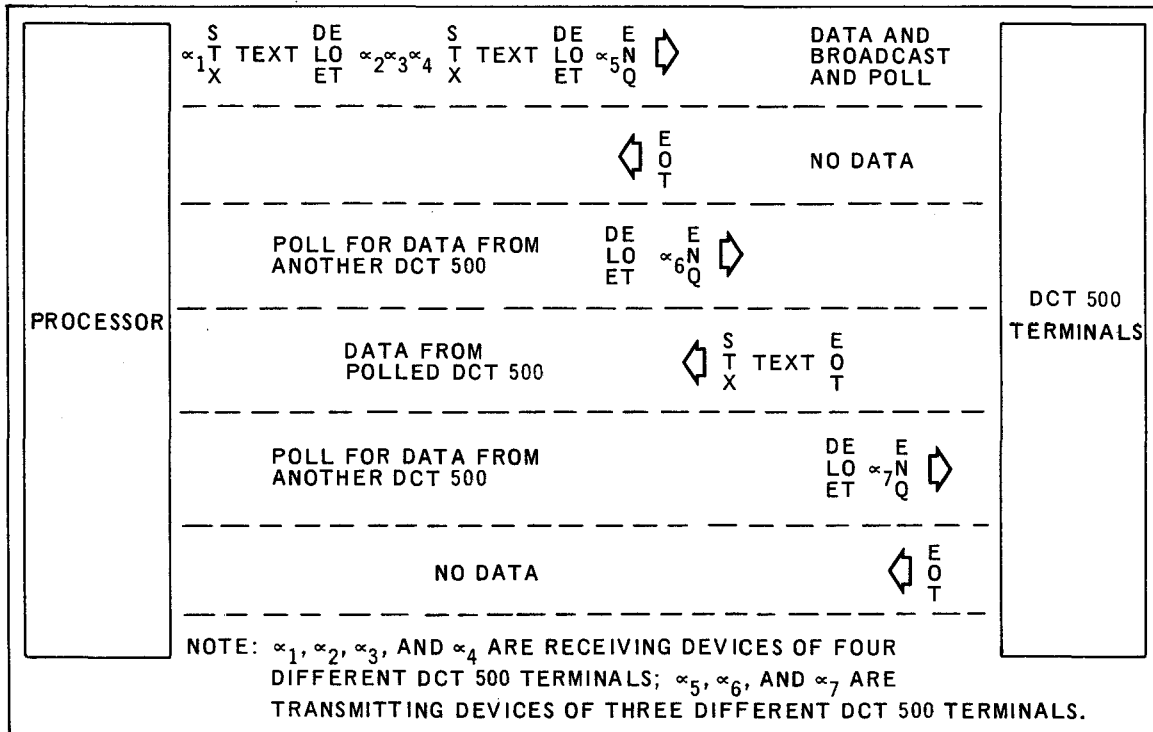


Figure 4-3. Data Exchange - Multipoint, Private Lines, Automatic Operation, Fast Select

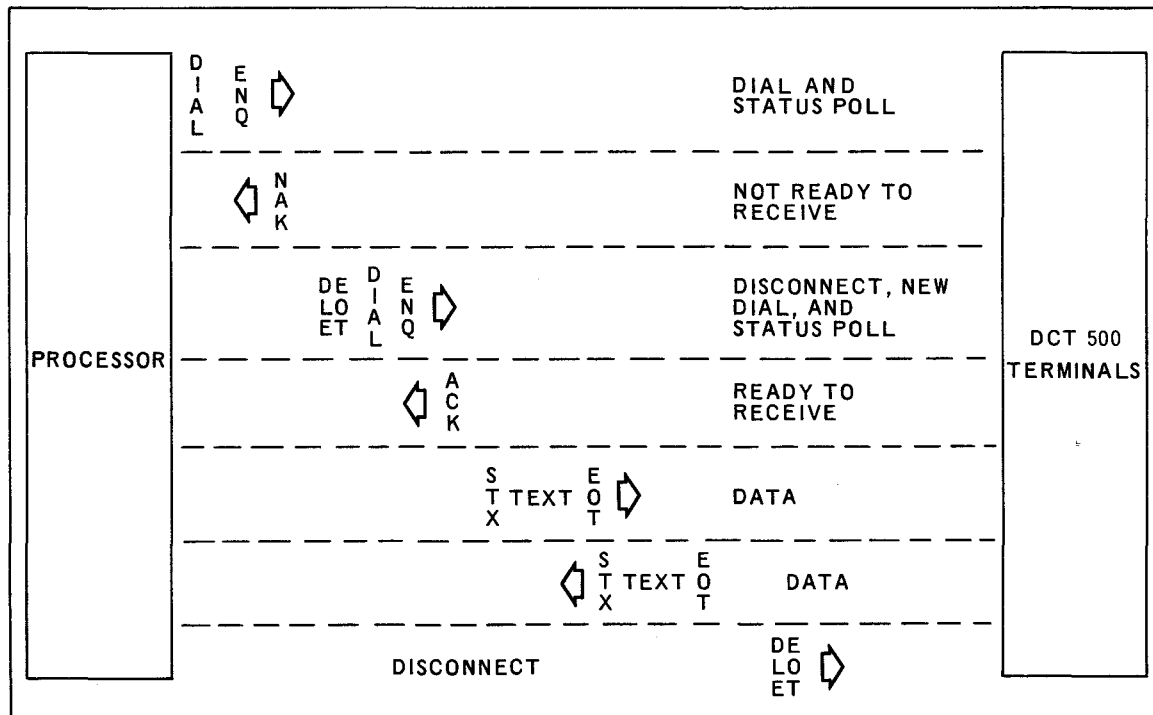


Figure 4-4. Data Exchange - Dial Out, Automatic Operation, Status Poll

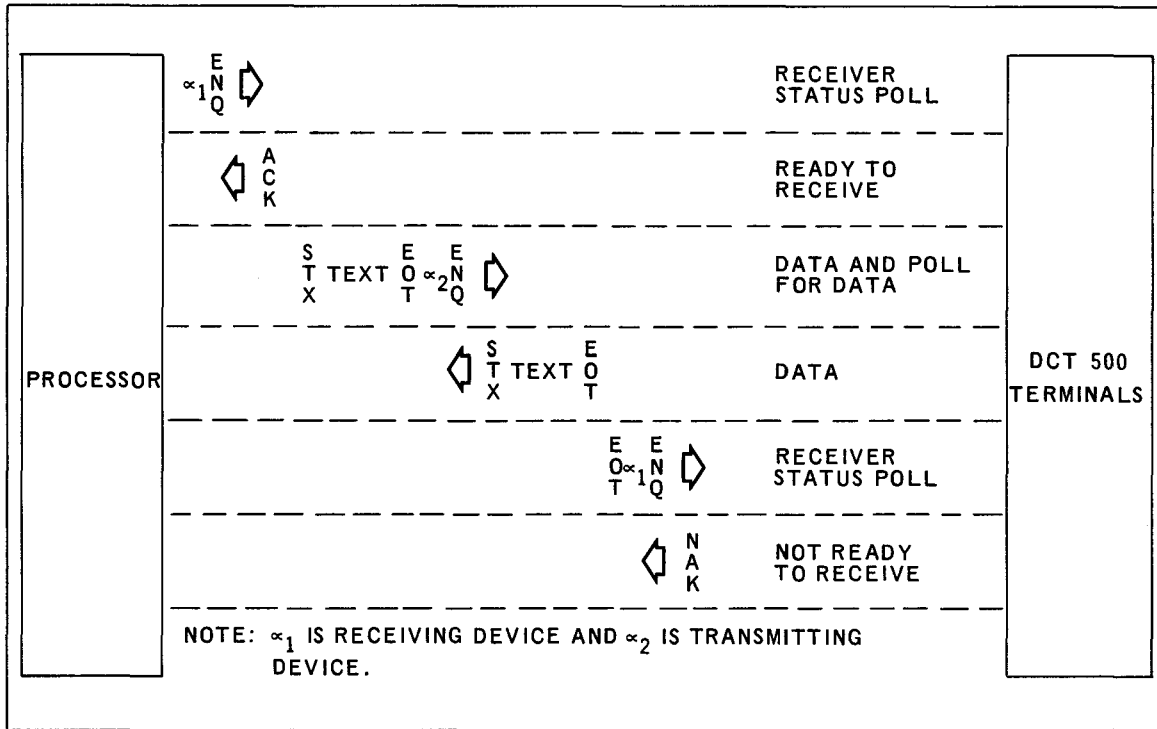


Figure 4-5. Data Exchange - Point-to-Point or Multipoint, Automatic Operation, Status Poll

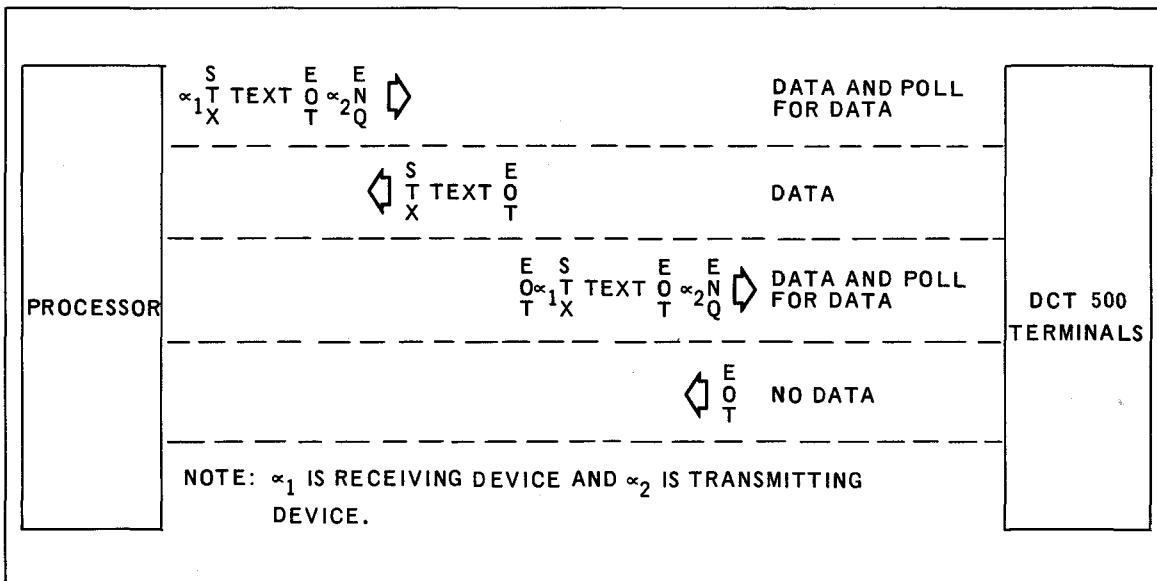


Figure 4-6. Data Exchange - Point-to-Point or Multipoint, Automatic Operation, Fast Select

4.7.2. Establishment and Termination

With the DCT 500 automatic operation version transmitting on private lines, the time for one message in each direction, during conversational (interactive) data exchange, includes two establishment times and two termination times. Following are the establishment and termination times for private lines, and the establishment and disconnect times for the switched telephone network:

- Private lines
 - Establishment: 265 milliseconds
 - Termination: 70 milliseconds
- Switched telephone network
 - Dial: 5 to 25 seconds
 - Answer (automatic): 4.6 seconds
 - Establishment: 3.6 seconds

EXPLANATION	TELETYPEWRITER MODE			AUTOMATIC OPERATION WITH FAST SELECT			AUTOMATIC OPERATION WITH STATUS POLLS		
	110 BAUD	150 BAUD	300 BAUD	110 BAUD	150 BAUD	300 BAUD	110 BAUD	150 BAUD	300 BAUD
Characters per second	10	15	30	10	15	30	10	15	30
Character transfer time (milliseconds)	100	66.7	33.3	100	66.7	33.3	100	66.7	33.3
132-character text transfer time (seconds)	13.3	8.8	4.4	13.6	9.1	4.5	13.9	9.2	4.6

Table 4-1. Transfer Times

SPEED	CHARACTERS PER SECOND	10-CHARACTER LINES* PER MINUTE	72-CHARACTER LINES* PER MINUTE	80-CHARACTER LINES* PER MINUTE	120-CHARACTER LINES* PER MINUTE	132-CHARACTER LINES* PER MINUTE
110 Baud	10	46.1	8.0	7.2	4.9	4.4
150 Baud	15	64.2	11.8	10.7	7.2	6.6
300 Baud	30	66.7	20.2	18.6	13.1	12.1

*Each line includes a CR, LF, and required DEL characters.

Table 4-2. Transfer Rates

4.7.3. Form Control Characters

The DCT 500 requires DEL characters between received form control characters and subsequent text characters. DEL characters must also be included at the beginning of an initial message to allow for motor turnon. Motor turnon is a function of motor control. When print monitoring messages are being received by the paper tape reader, carriage returns and line feeds are automatically provided; however, DEL characters or delays may be needed to compensate for carriage return and line feed times.

The minimum numbers of DEL characters required for form control and motor turnon are listed for each speed in Table 4-3. The DEL characters must follow the LF or FF character. Also included in the table are the numbers of DEL characters required to accommodate automatic perforation skipping.

The standard form for the DCT contains 66 print lines (11 inches). When the form is between the 63rd and 64th lines, it automatically advances to the fourth line of the next form. Therefore, only 60 of the 66 lines are usable.

The automatic perforation skip is executed within the time of a carriage return or new line function; however, text is lost at 300 baud if only a line feed and its required DEL character are received when the 63rd line (60th printable line) is being printed. Line feeding and perforation skipping are executed at the rate of 30 lines per second. Form feeding is executed at 12 lines per second but must also include the time for perforation skipping (7/30 second).

EXPLANATION	MINIMUM NUMBER OF REQUIRED DEL CHARACTERS		
	TRANSMISSION SPEED		
	110 BAUD	150 BAUD	300 BAUD
Carriage return/line feed (CR/LF) from right of page	1	2	14
New line (LF) from right of page	1	2	15
Line feed (LF)	0	0	1
Form feed (FF) from line:			
4 (full page)	13	19	37
33 (half page)	8	12	23
Automatic perforation skip	0	0	7
Motor turnon	5	8	15

Table 4-3. Timing Considerations for Control Characters

