

SYNCHRONOUS "DATASPEED*" 40/4 SYSTEM DESCRIPTION

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NOTICE

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1. GENERAL

1.01 This section covers the physical and functional characteristics of DATASPEED 40 station arrangements for systems using binary, synchronous line control procedures. This system will be referred to as the DATASPEED 40/4 system for DATA-PHONE® service.

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1.02 Whenever this section is reissued, the reasons for reissue will be listed in this paragraph.

1.03 A typical DATASPEED 40/4 system consists of a customer-provided processing unit (computer or CPU) under direct control of a customer-provided central line control unit (LCU), which in turn controls various station arrangements. The stations are arranged in 4-wire multipoint private line (PL) configurations using synchronous, 8-bit, odd parity ASCII code. Transmission rates are 2400 bps when using a data set (DS) 201-type or 4800 bps when using DS 208A-type. For the purposes of this document, the terms DS 201-type will be defined as DS 201B-type or 201C-type.

1.04 A selective calling format is used whereby the CPU can poll each remote DATASPEED 40/4 terminal. The DATASPEED 40/4 system is half-duplex with message transmission between

the CPU and the polled station only. Direct transmission between the remote stations is not possible.

1.05 In using binary synchronous communications (BSC), DATASPEED 40/4 terminals are compatible with a standard, software-supported communications procedure which conforms to ANSI (American National Standards Institute) Standard X3.28—1971 sub 2.4 and sub B2. Refer to Part 3 of this section for a detailed description of BSC.

2. SYSTEM DESCRIPTION

2.01 This text describes the physical and functional characteristics of DATASPEED 40/4 terminals when used in system configurations. The various operating states and features of the synchronous DATASPEED 40/4 system are explained using the exchange of signals or responses between the CPU and the DATASPEED 40/4 terminal.

A. Physical

2.02 Physical configuration of DATASPEED 40/4 terminals are available in a wide variety of clustered arrangements. A typical maximum cluster configuration, as shown in Fig. 1, consists of 24 keyboard displays (KD) and 12 printers (tractor or friction feed) coupled to 6 device cluster controllers (DCC) and controlled by 1 station cluster controller (SCC) and the associated data set. A typical minimum cluster configuration consists of a keyboard display and printer (tractor or friction) controlled by a minicluster controller (MCC) and the associated data set. Refer to the documents listed in Part 6 of this section for a more detailed description of individual components.

B. Functional

2.03 The functional block diagram of a typical synchronous DATASPEED 40/4 system is shown in Fig. 2. Binary synchronous line protocol is used to control communications over the 4-wire private line system. Transmission is in block format with the DATASPEED 40/4 terminal generating and checking odd vertical character parity (vertical redundancy check) and even longitudinal parity (longitudinal redundancy check). Blocks of data which are received incorrectly are automatically retransmitted upon receipt of a negative acknowledgment.

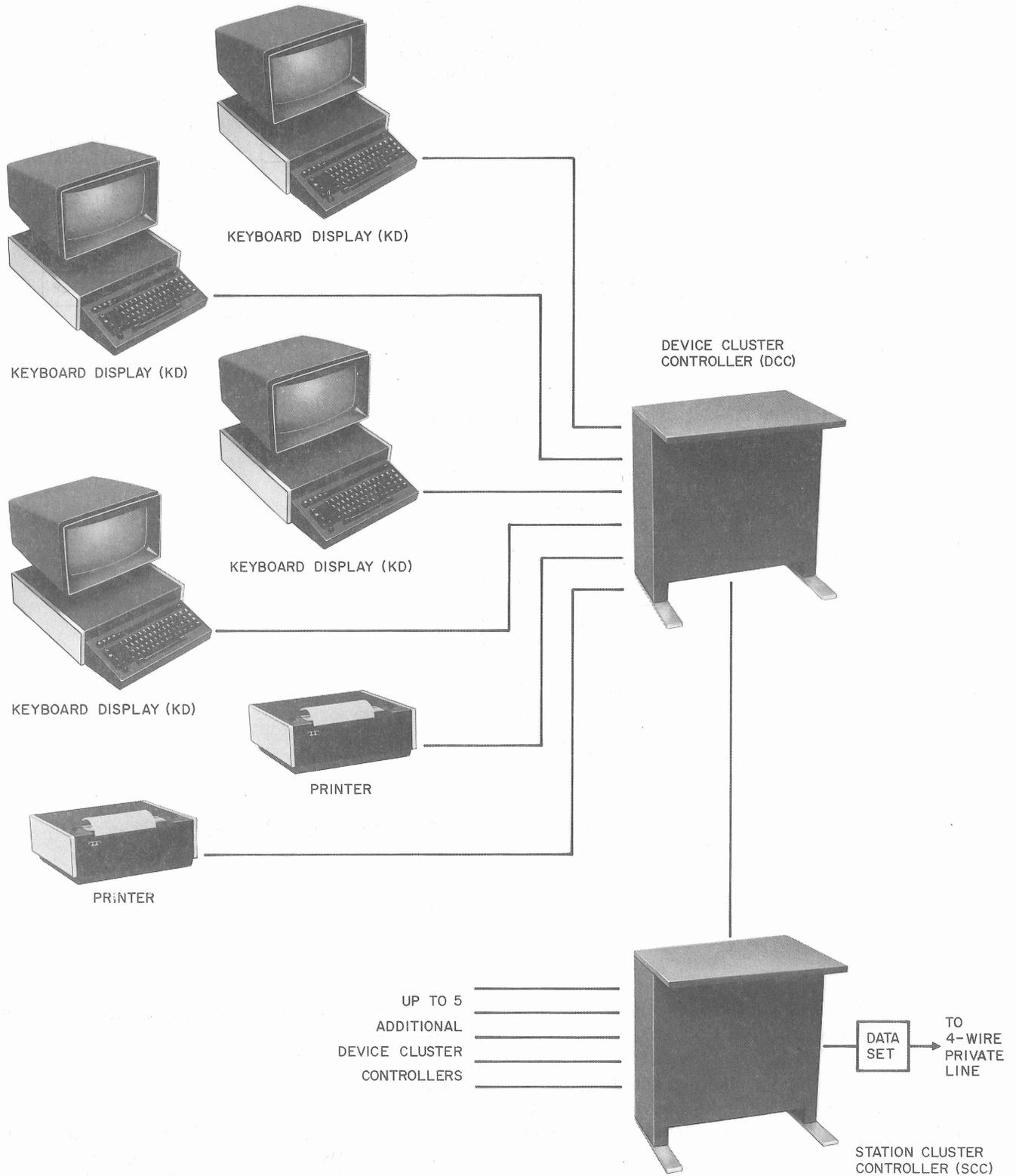


Fig. 1—Typical Maximum Cluster Configuration of DATASPEED 40/4 Station

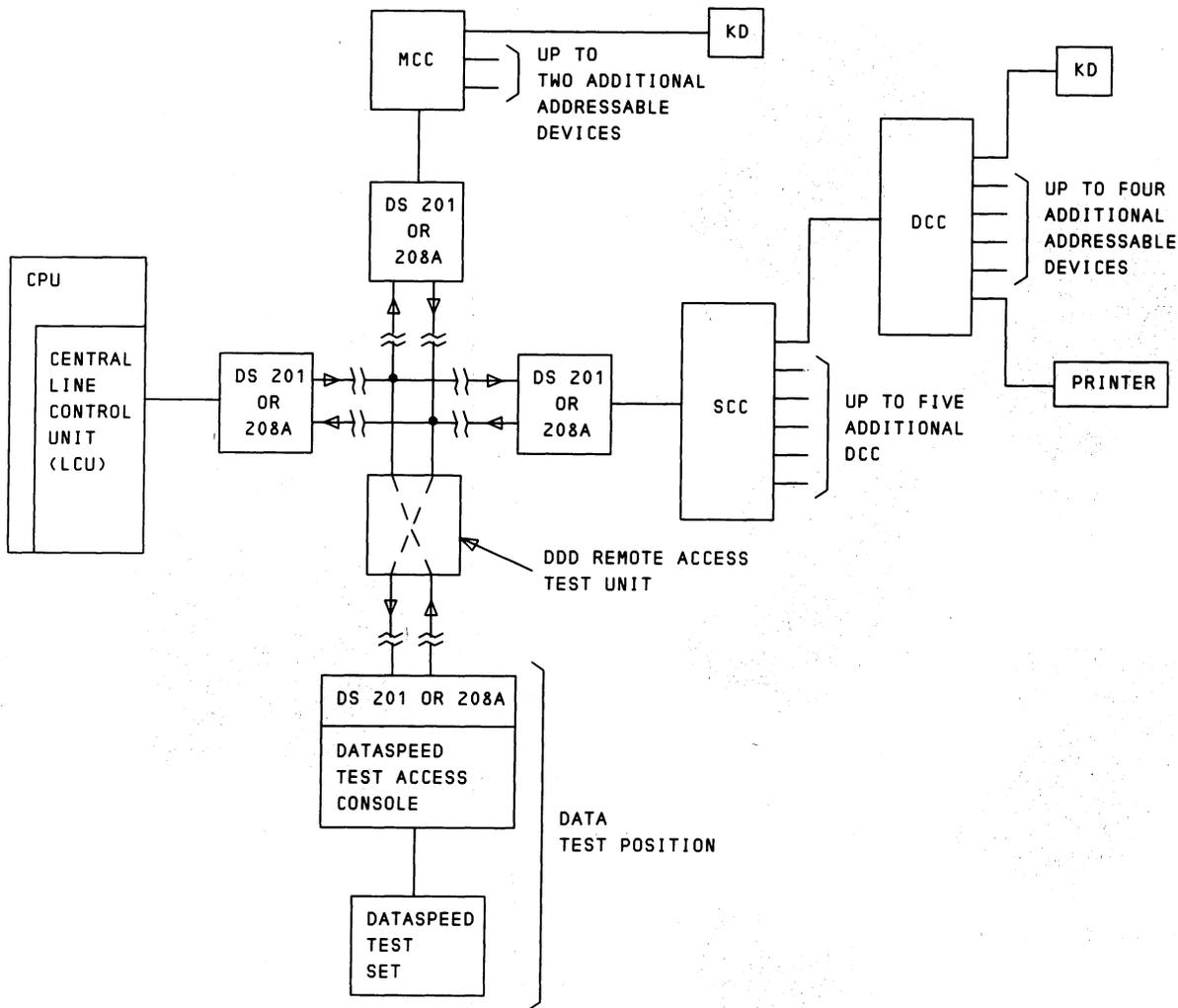


Fig. 2—Functional Block Diagram of a Typical DATASPEED 40/4 System

2.04 The CPU (data processing unit and line control unit) functions as the master controller for the DATASPEED 40/4 system. All transmissions are initiated by computer polling and selection of the individual DATASPEED 40/4 device. Customer software programming is considered to be beyond the scope of this section.

2.05 Data sets 201-type and 208A-type provide access to the basic 3002-type 4-wire private lines which comprise the multipoint DATASPEED 40/4 system. The 3002-type 4-wire PL channel

must meet the requirements given in Section 314-410-500.

DS 201-Type

2.06 DS 201-type is a synchronous, binary, serial, 2400-bps data set which operates on 4-wire PL or two direct distance dialing (DDD) lines as backup facility using DAS 829-type, or equivalent. DS 201-type uses differential phase shift keying to transmit data signals over the analog telephone (data) channel. Differential 4-phase modulation is

used as the method of encoding the serial stream of data into dibits and modulating an 1800-Hz carrier.

DS 208A-Type

2.07 DS 208A-type is a synchronous, binary, serial, 4800-bps data set which operates on 4-wire PL or two DDD lines as back-up facility using DAS 829-type, or equivalent. Like DS 201-type, DS 208A-type uses differential phase shift keying to transmit binary signals over the analog telephone (data) channel. In contrast to DS 201-type which uses 4-phase modulation, DS 208A-type uses 8-phase modulation as the method of encoding the serial stream of data into tribits and modulating the 1800-Hz carrier.

Station Cluster Controller (SCC)

2.08 The SCC receives polling and selection requests from the remote CPU and generates the appropriate responses. Formatting of data received from the device cluster controller (DCC) and error control functions are also performed by the SCC. Each SCC has the capability to interface with six DCCs but operation with less than six is permitted as required. The SCC provides an interface which meets the requirements of EIA Standard RS-232-C and is compatible with DSs 201-type and 208A-type. The SCC must be located within 50 cable feet of the associated data set.

Device Cluster Controller (DCC)

2.09 The DCC provides the logic circuitry to drive the standard DATASPEED 40 13-inch diagonal CRT keyboard display (KD) or printer. A 1920-character storage buffer is provided for each device (KD or printer). The DCC has the capability to interface with up to four KDs and two printers but operation with less than the maximum number of devices is permitted as required. However, at least one KD must always be provided for maintenance. The DCC must be located within 2000 cable feet of the SCC.

Keyboard Display (KD)

2.10 The KD consists of the standard DATASPEED 40 13-inch CRT monitor and the operator console (keyboard). Keyboard-or computer-generated data is displayed on the high resolution CRT monitor. A maximum of 1920 characters (24 lines

of 80 characters) can be displayed in the 5-1/4 by 11-1/4 inch viewing area. The characters are formed using a 7-by 9-dot matrix and refreshed 60 times/second. Alphanumeric data can be entered and edited with the operator console, which consists of an electronic keyboard and editing function keys. The keyboard is similar in appearance and touch to a standard electric office typewriter and provides the following functions:

- ASCII keyboard
- Six cursor positioning keys
- Generate upper and lower case
- Alarm bell
- Operational controls
- Internal diagnostic (test keys).

The KD must be located within 100 cable feet of the associated DCC.

Printer

2.11 The printer is a standard DATASPEED 40 printer and is available in 80-column friction or tractor feed models. Printing speed is 220 lines per minute using an upper/lower case character set (96 characters) and 312 lines per minute using a monospace character set (64 characters). Information is printed at 10 characters per inch, 80 characters per line, and 6 lines per inch. In addition, a 132-column tractor feed printer using an upper/lower case or monospace character set with a print speed of 220 lines/minute is available. All DATASPEED 40 printers contain self-generated printing test patterns to completely test the printer electronics and the electromechanical print mechanisms. The printer can be located up to 2000 cable feet from the associated DCC.

Mini Cluster Controller (MCC)

2.12 The MCC configuration is an economical method of providing a DATASPEED 40/4 station where the versatility of the SCC-DCC configuration is not required. Functionally, the MCC combines the features of the SCC and DCC into one controller. Three addressable devices are the maximum that an MCC can control, one of which must be a KD. The KD can be located up

to 100 cable feet from the MCC, while the printer can be located up to 2000 feet from the MCC.

DATASPEED Test Position

2.13 The DATASPEED test position consists of a DS 201- or 208A-type, a DATASPEED test set, and a DATASPEED test access console. Located in a data test center (DTC), the DATASPEED test position, in conjunction with the DDD remote access test unit, provides test capability for the synchronous DATASPEED 40/4 system. Pre-programmed test messages of 256 characters in length can be transmitted by the DATASPEED test set. The test message will check the station and device logic circuitry and verify the following:

- Ability to transmit and receive
- Ability of station device to respond to selected attribute characters
- Monitor of device, station, and line protocol.

The DATASPEED test set must be equipped with a SYNC 40 key in order to test the synchronous DATASPEED 40/4 system.

DDD Remote Access Test Unit

2.14 The DDD remote access test unit allows testing and monitoring of services routed through distant offices by extending the circuits to the DATASPEED test position. The remote access test unit provides switched network access to dedicated 4-wire private lines. Transmission levels are adjusted to make the 4-wire PL and DDD data signal levels compatible. A voice coordination channel is also provided by the remote access test unit.

3. COMMUNICATIONS FORMAT

3.01 This text describes the various operating states of the synchronous DATASPEED 40/4 system and explains the exchange of signals between the CPU and DATASPEED 40/4 stations.

BINARY SYNCHRONOUS COMMUNICATIONS

3.02 The binary synchronous communications (BSC) procedure provides the method of channel protocol for synchronous transmission of binary-coded data. All data in BSC is transmitted

as a serial stream of binary digits (0 and 1 bits). Synchronous communications is defined as the active receiving station on a communications channel functioning in time with the transmitting station through the recognition of a specific bit pattern at the start of each transmission.

3.03 In contrast to asynchronous transmission where start and stop bits are transmitted with each character, synchronous transmission provides increased throughput by eliminating these bits. Instead, synchronizing characters (at least two consecutive sync characters for DATASPEED 40/4) are transmitted at the beginning of each message block to establish synchronization for the entire block. Thus, fewer bits are required to transmit the same number of characters.

A. Multipoint Data System

3.04 In a multipoint data system such as DATASPEED 40/4, one station is designated as the control station (LCU) of the multiple remote stations connected by nonswitched 4-wire lines. The remote stations function only as a means of updating, or requesting information stored in the CPU. The LCU controls all transmissions within the DATASPEED 40/4 system by selecting or polling a remote station. All transmissions over the system are between the LCU and *one* of the remote stations while the other stations are in passive monitoring mode.

B. Polling and Selection

3.05 Polling is an "invitation to send" transmitted from the CPU to a specific remote station. Two types of polling are used in the DATASPEED 40/4 system: general and specific. In response to a general poll, each device at a station having a bid up can transmit to the CPU. If more than one device at a station has a bid up, the CPU must repeat transmission of the general poll until each device in turn has transmitted to the CPU. In response to a specific poll, only the specific device that is addressed can transmit to the CPU. Selection is a "request to receive" notification transmitted from the CPU to a specific remote station, instructing the station to receive the forthcoming message.

3.06 Each remote station and device is assigned a unique address at the time of installation, which is used to alert the station or device for

polling and selection. The station and device addresses are transmitted two times for increased reliability where the first two characters will address the station and the second two characters will address the specific device.

C. Message Blocks

3.07 A typical message consists of one or more blocks of text data transmitted in block format to provide more accurate and efficient error control. The length of a transmission block when transmitting from the remote station to the CPU is an average of 254 characters or a maximum of 256 characters, unless the transmitted block is either the first and only block containing less than 254 characters or the last block of a message. When the CPU is transmitting to a remote station, block size is determined by the message length.

3.08 The text data is the body of the message and is identified by a start of text (STX) character immediately preceding each message. In addition, each block of text except the last is immediately followed by an end-of-transmission block (ETB) character or a block check character (BCC). The last block of text in a message is immediately followed by an end of text (ETX) character and BCC.

3.09 The text of a message to the CPU can be preceded by a heading that contains auxiliary information pertaining to the next data. The heading is identified by a start of heading (SOH) character immediately preceding. When a message is sent containing alarm status, or when a test message is requested by the station attendant, the percent (%) and slash (/) characters are used to identify request-for-test, and the percent R (%) (R) characters are used to indicate that the message contains device alarm status.

3.10 As each message is received from the CPU it is checked for errors. Two methods of error checking as shown in Fig. 3 are used by DATASPEED 40/4: vertical redundancy checking (VRC), which is odd parity checking by characters as the data is received, and longitudinal redundancy checking (LRC), which is even parity and checks the message after reception.

3.11 The derived block check character (BCC), resulting from the longitudinal redundancy checking, is transmitted after each block of data

and compared at the receiving station. After each transmitted block, the receiving station normally replies with the alternate acknowledgments DLE 0 (ACK 0) or DLE 1 (ACK 1) (data accepted, continue sending); or with NAK (data not accepted resulting from an error condition, retransmit the previous block). Retransmission of a data block preceding an initial NAK is attempted up to seven times. If the transmitting station receives no reply, or if the reply was garbled, the transmitting station requests a retransmission of the reply by sending an enquiry (ENQ).

COMMUNICATIONS CONTROL CHARACTERS

3.12 In addition to the use of standard ASCII characters for transmission of text messages, commands, and orders, the following ASCII characters and character sequences are used for system controls. Each character is transmitted in an 8-unit frame. In the order of transmission, unit 1 through unit 7 represent bit 1 through bit 7 of the ASCII character transmitted, while unit 8 is inserted to provide odd parity inclusive of the eight units (refer to Fig. 3).

3.13 *DLE 0 (ACK 0) or DLE 1 (ACK 1):*
This character is an affirmative acknowledgment transmitted to indicate the previous block of data was received. Alternate ACK 0 or ACK 1 is transmitted to ensure the acknowledgment is relative to the preceding block of data received. (See 3.15).

3.14 *BCC:* The block check character is derived from the binary accumulation of bits during a transmitted block of data. The BCC is transmitted following each respective block and compared at the receiving station. This character determines the validity of the block and results in the receiving station transmitting either a DLE 0, DLE 1, or NAK. (See Fig. 3.)

3.15 *DLE:* The data link escape character is used as an extension of the ASCII code in order to provide ACK 0, ACK 1, WACK and RVI. The DLE control character provides the following functions:

- Alternating acknowledgements—DLE 0, DLE 1 (ACK 0, ACK 1, respectively)
- Wait acknowledge—DLE SEMICOLON (WACK)
- Reverse interrupt—DLE LESS THAN (RVI).

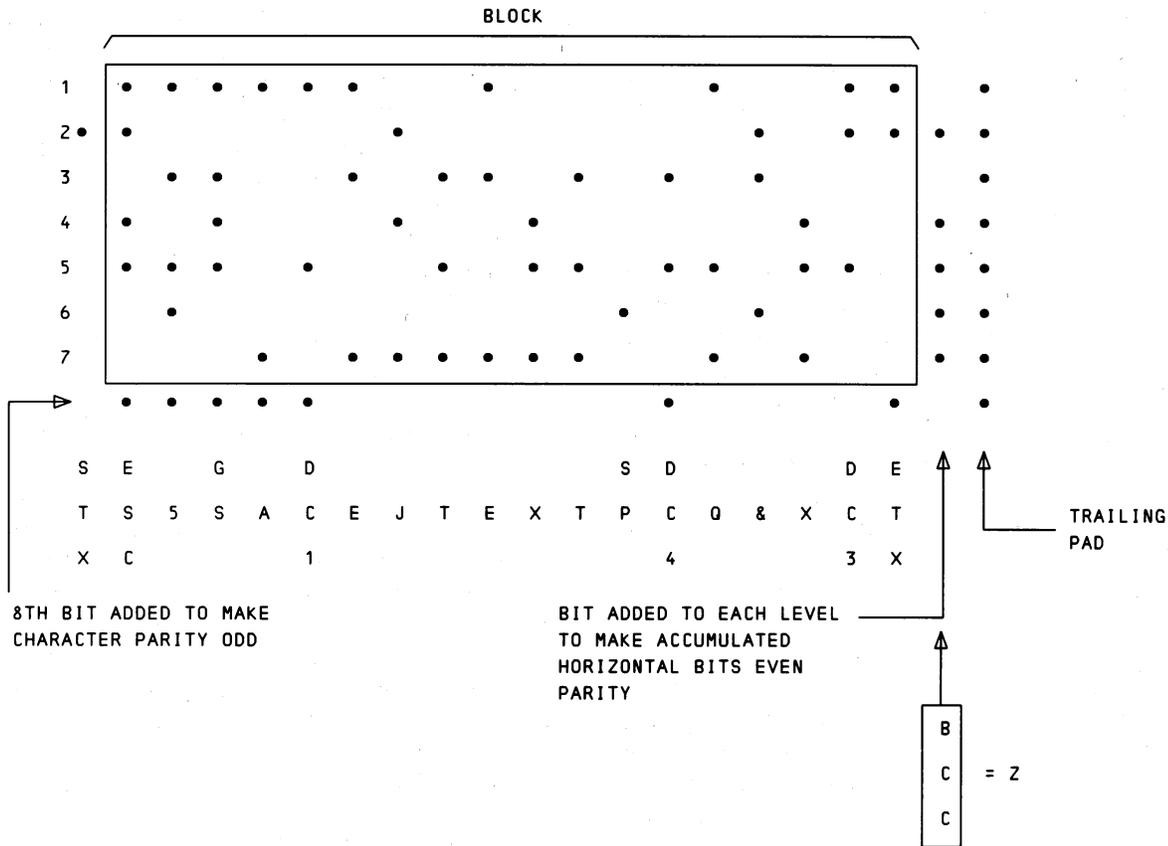


Fig. 3—Parity Checking

3.16 EOT: The end of transmission character indicates the end of a message transmission which may contain one or more blocks, including test and associated headings. A DATASPEED 40/4 station transmits EOT to indicate the following:

- No further blocks to send
- Abnormal condition and cannot continue transmitting
- Response to a poll when no message traffic is present.

3.17 ETB: The end-of-transmission-block character indicates the end of a message block which started with SOH or STX. A BCC is transmitted immediately following ETB, which requires a response indicating the status of the receiving station.

3.18 ETX: The end-of-text character terminates a block of characters started with STX or SOH and transmitted as an entity. All blocks except the last block of a message end with ETB BCC. The last block of a multiblock message and all 1-block messages end with ETX BCC. A response to the sequence of ETX BCC is required by the receiving station.

3.19 ENQ: The enquiry character is used to request a repeat transmission of the response to a message block if the original response was garbled or not received. A station transmits ENQ if no response, or an invalid response, is received within 2.5 seconds after the termination of a block transmission. Upon receiving ENQ, a station will perform one of the following functions:

- Repeat the previous reply if in receive text mode

- Reply NAK if the received ENQ aborted a block
- Prepare to transmit or receive if the ENQ was part of a valid poll or selection sequence.

3.20 ITB: The intermediate-transmission-block character is used to divide a message for error checking purposes without causing a reversal of transmission direction. A BCC which resets the block-check count is transmitted immediately following an ITB. Neither an ITB or BCC is processed by the DATASPEED 40/4 receiving device. Transmission turnaround occurs after the last intermediate block, which is terminated by ETB or ETX. When one of these characters is received, the receiving station will respond to the complete transmission. If a block check error is detected, a NAK is transmitted requiring all intermediate blocks to be retransmitted.

3.21 NAK: The negative acknowledgment character is used to indicate the previous block was received in error and the receiver is ready to accept retransmission. A NAK is transmitted by the station when any of the following conditions are present:

- A block containing a parity error is received
- A block containing an invalid BCC is received
- A block terminating in ENQ is transmitted after an STX has been received.

3.22 PAD: The pad character is used to ensure that the carrier in the data set is not turned off while the last message character is transmitted. The pad character consists of eight marking bits and is transmitted immediately after each block following the BCC.

3.23 SID: The station identity character and device address (DA) character are an identification that is unique to a specific station and device. Using the ASCII code as shown in Table I, the SID characters are used to address the station and specific device during polling or selection. The SID characters are included in the first response block to a poll. Each character of the SID is repeated twice on each poll or selection by the LCU, as block character checking of address sequences is not employed by the DATASPEED 40/4 system.

3.24 SOH: The start of heading character will precede a block of heading characters which contain auxiliary information necessary for the system to process the text portion of the message. Example applications are test messages and alarm status conditions.

3.25 STX: The start of text character is transmitted preceding a block of text characters to identify the text characters. STX is not included in the BCC count. STX also functions to terminate a heading.

3.26 SYN: The synchronous idle character is used to establish and maintain synchronization where four consecutive SYN characters are generated by the transmitting station before any transmission. Two consecutive SYN characters are required by the receiving station before any line information is accepted. Received SYN characters are not included in the BCC or presented to the DCC or addressable device.

3.27 RVI: The reverse interrupt character sequence is a positive response used instead of ACK 0 or ACK 1 (DLE 0 or DLE 1). RVI is transmitted by a receiving station to request termination of the current transmission. Successive RVI (DLE <) characters cannot be transmitted, except in response to ENQ. The transmitting station processes the RVI as a positive acknowledgment and responds by transmitting all data that prevents transmission turnaround. When a station receives RVI in response to an alarm message, EOT is transmitted and alarm flags are reset for selected devices. When a station receives RVI in response to text, all alarm flags are reset. If the block does not end in ETX, the station transmits EOT and aborts the transmission.

3.28 TTD: The temporary text delay sequence (STX ENQ) is transmitted by the LCU to retain the channel when not ready to transmit. A response of NAK is transmitted by the SCC in response and awaits further transmission from the LCU.

3.29 WACK: The wait-before-transmit positive acknowledgment character indicates a temporary not-ready-to-receive condition to the transmitting station. Transmission of WACK (DLE;) is a positive acknowledgment to the received data block or to selection by the LCU. Upon receipt of WACK from the LCU, a station will transmit ENQ causing

the LCU to transmit successive WACK characters until ready to continue transmitting data.

SPECIAL CONTROL CHARACTERS

3.30 In addition to the preceding ASCII control characters, the DATASPEED 40/4 system uses the following special characters to control message transfer.

A. Commands

3.31 Commands are transmitted by the LCU to provide instructions to the receiving station on how to process the received data. The commands are not displayed nor printed by the receiving station. The following commands in response to the codes given in Table A are used in the DATASPEED 40/4 system.

TABLE A
COMMANDS

COMMAND	PROGRAM SEQUENCE
Write	E W S 1 C C C
Erase-Write	E W S 5 C C C
Erase All Unprotected	E S ? C
Copy	E C D S 7 C A C C
Read Modified	E S 6 C
Read All	E S 2 C

3.32 Write—This command followed by a write control character instructs the receiving device to write the data that follows into the storage buffer. This data can consist of text to be displayed or printed, but neither function occurs until the block check is performed and acknowledged.

3.33 Erase-Write—Functionally, the erase-write command is the same as the write command except the receiving device is instructed to erase all existing data before writing the received data that follows. This command also sets the buffer address and cursor to the home position.

3.34 Erase All Unprotected—This command instructs the receiving device to erase all unprotected data entered in the storage buffer. Protected data, if any, remains.

3.35 Copy—This command followed by a copy control character instructs the device to copy the data contained in the buffer of the device whose address is specified by the DA character. When this function is completed, both device buffers contain identical data. For example, this command would be used to transfer information from a keyboard display to a printer.

3.36 Read Modified—This command when transmitted by the LCU causes the device to transmit all modified, unprotected data contained in the storage buffer, and produces the same function as polling the device.

3.37 Read All—This command causes the device to transmit all data contained in the buffer as it actually appears in the buffer. Blank spaces (not SP) would be transmitted as NUL, each field would be preceded by AC (attribute character), and the entire sequence preceded by GS (group separator). A read all command can be used as a diagnostic aid.

B. Write Control Characters (WCC)

3.38 These characters, when transmitted succeeding a write or erase-write command, instruct printout of the data following the WCC, provided the station is equipped with a printer. A WCC can also be used to reset the keyboard, change attributes, and sound the tone of a keyboard display. The WCCs and respective codes are given in Table B.

TABLE B

WRITE CONTROL CHARACTERS

WCC							
START PRINTER	SOUND TONE	RESET KEYBOARD	RESET ATTRIBUTES	CHAR/LINE VIA NL/EM	40 CHAR/LINE	64 CHAR/LINE	80 CHAR/LINE
				SP	&	-	Ø
		•	•	A	J	/	1
		•		B	K	S	2
		•	•	C	L	T	3
	•			D	M	U	4
	•		•	E	N	V	5
	•	•		F	O	W	6
	•	•	•	G	P	X	7
•				H	Q	Y	8
•			•	I	R	Z	9
•		•		[]		:
•		•	•	.	\$,	#
•	•			<	*	%	@
•	•		•	()	-	'
•	•	•		+	;	>	=
•	•	•	•	!	^	?	"

C. Copy Control Characters (CCC)

3.39 These characters, when transmitted succeeding a copy command, instruct printout of the data following the CCC, provided the station is equipped with a printer. The CCC and WCC are similar as a number of common functions are provided by each. The CCCs and respective codes are given in Table C.

TABLE C

COPY CONTROL CHARACTERS

CCC								
START PRINTER	SOUND TONE	Copy			CHAR/LINE VIA NL/EM	40 CHAR/LINE	64 CHAR/LINE	80 CHAR/LINE
		ATTRIBUTES	PROTECTED	UNPROTECTED				
		•			SP	&	-	Ø
		•		•	A	J	/	1
		•	•		B	K	S	2
		•	•	•	C	L	T	3
	•				D	M	U	4
	•			•	E	N	V	5
	•		•		F	O	W	6
	•		•	•	G	P	X	7
•					H	Q	Y	8
•				•	I	R	Z	9
•			•		[]		:
•			•	•	.	\$,	#
•	•				<	*	%	@
•	•			•	()	-	'
•	•		•		+	;	>	=
•	•		•	•	!	^	?	"

D. Orders

3.40 These characters instruct the receiving device where to display or print the received data. An exception can occur where the print line requirement of the WCC or CCC overrides a received order. The orders and respective codes are given in Table D.

E. Attribute Characters (AC)

3.41 These characters define the characteristics of displayed data and are received by the device from the LCU. As part of a write command, the AC causes the functions given in Table E to be performed upon receiving the respective codes.

F. Attention Identification (AID)

3.42 These characters are generated upon depression of the respective device keys to provide instructions to the CPU. Data contained within the KD buffer is transmitted pending the next polling sequence by the LCU. The AID characters and associated keys are given in Table F. The following functions are performed using AID characters.

- S/R—Transmits all modified data
- CLEAR—Erases all displayed data and updates CPU
- PA1 and PA2 (Program Access)—Requests a preformatted form from CPU
- PF1 through PF12 (Program Function)—Requests a software function to be performed by the CPU and transmits all modified data.

TABLE D

ORDERS

ORDER	PROGRAM SEQUENCE
Set Buffer Address	D B B C A ₁ A ₂ 1
Start Field	G A S C
Insert Cursor	D C 3
Program Tab	H T
Repeat to Address	D B B C A ₁ A ₂ C 4
Erase Unprotected to Address	D B B C A ₁ A ₂ 2

TABLE E
ATTRIBUTE CHARACTERS

NOT PROTECTED		PROTECTED		TYPE OF DISPLAY				MODIFIED FIELD		ATTRIBUTE CHARACTER (AC)			
ALPHA-NUMERIC	NUMERIC	NOT AUTO. SKIP	AUTO. SKIP	NORM.	BLINK	H. LITE	NONE	NO	YES				
•				•				•		SP	D	B	F
•				•					•	A	E	C	G
•					•			•					
•					•				•	.			
•						•		•		H			
•						•			•	I			
•							•	•		<	+		
•							•		•	(!		
	•			•				•		&	M	K	O
	•			•					•	J	N	P	L
	•				•			•					
	•				•				•	\$			
	•					•		•		Q			
	•					•			•	R			
	•						•	•		*	;		
	•						•		•)	^		
		•		•				•		-	U	S	W
		•		•					•	/	V	T	X
		•			•			•					
		•			•				•	,			
		•				•		•		Y			
		•				•			•	Z			
		•					•	•		%	>		
		•					•		•	-	?		
			•	•				•		0	4	2	6
			•	•					•	1	5	3	7
			•		•			•		:			
			•		•				•	#			
			•			•		•		8			
			•			•			•	9			
			•				•	•		@	=		
			•				•		•	'	"		

TABLE F

ATTENTION
IDENTIFICATION
CHARACTERS

KEY DEPRESSED	A I D
S/R	'
PA1	%
PA2	>
PF1	1
PF2	2
PF3	3
PF4	4
PF5	5
PF6	6
PF7	7
PF8	8
PF9	9
PF10	:
PF11	#
PF12	@
CLEAR	—
none†	—
none‡	Y

† Response from KD
if no key is depressed

‡ Response from printer

G. Status and Sense (SS)

3.43 The status and sense characters are generated by the device to indicate current status to the SCC. Any of the troubles shown in Table G can cause the SCC to transmit RVI (DLE<) if the terminal in trouble is selected by the CPU, and can cause the specific SS characters given in Table G to be transmitted if the station is polled by the CPU.

H. Control Character Set

3.44 These characters are transmitted in 2-character sequences following DC1, DC3, or DC4 commands by the CPU to control the station and device buffers. Within the device, these characters are used to specify the buffer address which defines the position for received data to be stored in the device. Data can be stored in any of 1920 buffer locations as shown in the abbreviated Table H. Refer to E.L. 4084 for the complete listing of ASCII address character buffer locations.

TABLE G

STATUS AND SENSE CHARACTERS

TROUBLE	S S ₁	S S ₂
Invalid Command	SP	A
Device Unavailable	SP	&
Command not Valid for Device	SP	—
Device Busy	H	SP
From Device Busy	H	A
From Device Unavailable	SP	J
Device no Longer Busy	B	SP
Printer Paper Out	B	C
Internal Timing Error	SP	B

TABLE H
ABBREVIATED SEQUENCE OF BUFFER ADDRESSES

SEQUENTIAL ADDRESS	DISPLAY		ODD PARITY GRAPHICS	
	ROW	COLUMN		
0	1	1	SP	SP
1	1	2	SP	A
2	1	3	SP	B
3	1	4	SP	C
↓	↓	↓		↓
63	1	64	SP	”
64	1	65	A	SP
65	1	66	A	A
66	1	67	A	B
↓	↓	↓		↓
127	2	48	A	”
128	2	49	B	SP
129	2	50	B	A
130	2	51	B	B
↓	↓	↓		↓
1919	24	80)	”

SYSTEM OPERATION

3.45 Operation of the synchronous DATASPEED 40/4 system is described in this section by the use of a typical message transfer. This example illustrates most of the system capabilities and functions through the normal sequential flow of information from CPU to device, and device to CPU.

A. System Initialization

3.46 Since the CPU controls the DATASPEED 40/4 system, initial activity begins with a “system ready” message transmitted from the CPU and acknowledged by each device in the system. In order to transmit this “system ready” message, each device must be selected and polled.

B. Selection

3.47 Each selection sequence transmitted by the CPU consists of EOT, a minimum of two consecutive synchronization characters (SYN SYN), the station selection address (SSA), the specific device address (DA), and ENQ.

Note: In all succeeding examples, the required minimum of two SYN characters following EOT are not shown for simplicity.

E S S D D E }
O S S A A N } *from CPU*
T A A Q }

Each transmitted selection sequence selects a specific device at a specific station. For this purpose, each station has a unique SSA character and each device has a unique DA character, assigned at the time of installation. Addressable devices located on different SCC may have the same DA.

3.48 Assuming that both station and device selected are capable of receiving, the SCC or MCC transmits DLE 0 (ACK 0).

D }
L 0 } *reply from station to CPU*
E }

3.49 After receiving DLE 0, the CPU transmits the “system ready” message. This message consists of STX, which precedes all system messages, an erase-write command (ESC 5), a write control character (WCC), text of the message, ETX, and a BCC. Only the text following the WCC is displayed by a KD or printed by a printer. Before being displayed, the transmission block is checked for transmission errors upon receiving ETX followed by the block check character.

S E W E B }
T S 5 C TEXT T C } *from CPU*
X C C X C }

The received BCC is compared with the locally derived BCC, and if they are identical, the station transmits DLE 1 (ACK 1).

D }
L 1 } *reply from station to CPU*
E }

Upon receiving this reply, the CPU terminates the message by transmitting EOT, which permits only the text of the message to be displayed or printed.

E }
O } *from CPU*
T }

C. Polling

General Poll

3.50 If the station receives a general poll from the CPU, any KD in turn having a message to send can transmit to the CPU. However, only one KD can respond per general poll. If more than one KD has a bid, the station must be polled repeatedly until all messages have been transmitted to the CPU. A general poll consists of EOT, the station polling address (SPA) transmitted twice, the quote character (") transmitted twice, and ENQ.

E	S	S	"	"	E	} <i>general poll from CPU</i>
O	P	P			N	
T	A	A			Q	

Specific Poll

3.51 A specific poll is similar to the general poll except only the addressed KD having a message to send can transmit to the CPU. A specific poll consists of EOT, SPA transmitted twice, the device address (DA) transmitted twice, and ENQ.

E	S	S	D	D	E	} <i>specific poll from CPU</i>
O	P	P	A	A	N	
T	A	A			Q	

3.52 The station replies to a general or specific poll with EOT if no message is ready to be transmitted, or transmits the message.

D. Types of Message Formats

3.53 A typical message transmission on a DATASPEED 40/4 system conforms to one of the following message formats. When polled by the CPU, a station replies with EOT if no message is stored in the KD buffer awaiting transmission. If a station has a message ready for transmission, the appropriate response as shown in the following examples is transmitted.

Normal message:

S	S	A		E	B	P	
T	P	D	I	Text in	T	C	A
X	A	A	D	buffer	X	C	D

Test request message:

S		S	S	A	E	B	P		
O	%	/	T	P	D	I	T	C	A
H		X	A	A	D	X	C	D	

Alarm status message:

S		S	S		E	B	P			
O	%	R	T	P	D	S	S	T	C	A
H		X	A	A	S ₁	S ₂	X	C	D	

3.54 As can readily be observed from the preceding examples, text is not a component of a test request or status message; therefore SOH is used instead of STX to begin these messages. The characters % / define a test request while % R characters are used to define a status message. In addition, the status message contains two SS characters which define an alarm condition.

E. Form Request

3.55 The KD operator can request a preformatted form from the CPU by either of two methods, by depressing the appropriate function key (PA1, PA2, or PF1 through PF12), or by entering form request data from the keyboard. Each method causes a message identifying the form requested to be transmitted to the CPU when the KD is polled. A typical example follows:

S	S	A		E	B			
T	P	D	I	C	C	FORM 914C	T	C
X	A	A	D	A ₁	A ₂	X	C	

The KD operator enters only the text (FORM 914C), while the system control characters are automatically generated by the station. After generating STX to identify the beginning of the message to the CPU, the station generates the unique SPA and DA sequence to identify the station and device requesting the form. The next character (AID) generated by the station identifies which key

was depressed to request the form. Following the AID character, two characters (CA₁ and CA₂) indicating the cursor position by row and column respectively, are generated. Succeeding the data entered on the keyboard is the standard message ending (ETX and BCC).

3.56 When the KD is again polled by the CPU the message is transmitted, and if the transmitted BCC compares with the locally generated BCC, the CPU replies with the sequence DLE 1 and the station terminates the request with EOT. The CPU responds to the form request and selects the requesting station as follows:

```

E S S   D D E
O S S   A A N
T A A   A A Q

```

If the station is ready to receive, the reply DLE 0 is transmitted by the station. The CPU then transmits the form as follows:

```

S E   W [ Text of form ] E B
T S 5 C [ (see Fig. 4) ] T C
X C   C [                   ] X C

```

As before, the message format begins with STX. The erase-write command (ESC 5) erases the form request data from the KD monitor if the operator has entered a request instead of depressing the appropriate program access (PA) key. The WCC can sound an audible tone to alert the operator when the form is received and unlock the keyboard so that data entry can begin. In addition, the WCC sets the buffer address to the home position, which determines where the next character will be displayed. Following the WCC are the many details of the form. To better understand the detailed message format, a typical message as shown by Fig. 4 will be used as an example. The line numbers and boxes representing operator-entered data are not displayed but are added for the purposes of explaining this example.

FORMAT (FROM COMPUTER) AS DISPLAYED

NAME	COMPANY		
ADDRESS	ADDRESS		
TEL. NO.	TEL. NO.		
PART NO.	QTY	DESCRIPTION	PRICE
APPROVAL			

FORMAT AS IT WILL APPEAR FILLED OUT BY OPERATOR

NAME	JOHN A. GRANT	COMPANY	BINKES INC.
ADDRESS	2655 JANSON BLVD. CHICAGO, ILL. 60634	ADDRESS	4321 N. SOUTH ST. CHICAGO, ILL 60621
TEL. NO.	321-543-7666	TEL. NO.	321-746-5434
PART NO.	QTY	DESCRIPTION	PRICE
344567	6	CIRCUIT CARD	\$15.00
576342	2	CABLE	3.70
272895	12	CONNECTOR	2.40
APPROVAL JONATHAN BINKES <input type="checkbox"/>			

OPERATOR ENTERED DATA REMOVED, LINE REFERENCE NUMBERS ADDED

(1) NAME	<input type="text"/>	COMPANY	<input type="text"/>
(2)			
(3) ADDRESS	<input type="text"/>	ADDRESS	<input type="text"/>
(4)	<input type="text"/>		<input type="text"/>
(5)			
(6) TEL. NO.	<input type="text"/>	TEL. NO	<input type="text"/>
(7)			
(8) PART NO.	QTY	DESCRIPTION	PRICE
(9)			
(10)	<input type="text"/>	<input type="text"/>	<input type="text"/>
(11)	<input type="text"/>	<input type="text"/>	<input type="text"/>
(12)	<input type="text"/>	<input type="text"/>	<input type="text"/>
(13)			
(14)			
(15)			
(16) APPROVAL	<input type="text"/>		

Fig. 4—Form Request as Discussed in Text

3.57 The following text is a line-by-line explanation of the character sequence which results in the received message. The data stream immediately follows the WCC and each succeeding data stream for each line of the form follows. No received data is actually displayed until the block check at

the end of the message is completed. All received data is stored in the device buffer until the block check is verified. For the purpose of this example, each line of the message will be described as if it were being displayed line by line.

Received from computer for line (1)

G A N A M E C B B G A C B B G A C O M P A N Y G A
 S C 1 A₁ A₂ S C 1 A₁ A₂ S C S C

Line (1) of screen (boxes not displayed)

(1) NAME COMPANY

In line (1), the GS (group separator) character indicates to the KD that the next character is an attribute character (AC). The attribute characters occupy a position on the monitor and cannot be covered with another character but are displayed as spaces. The AC determines the attributes for the characters that follow in the data stream up to but not including the next AC. In this way, a field is defined by having the attributes of the preceding AC. The first field in line (1) of the illustration is occupied by NAME and has the attributes of protected, alphanumeric, displayed, and unmodified. Following NAME in the data stream is the control DC1 (device control 1) followed by two BA (buffer address) characters. This is an SBA (set buffer address) sequence which moves the buffer address to the location specified by the BA characters. (BA₁ and BA₂ specify row and column, respectively.) In this case it moves the

buffer address to the position just ahead of the blank following NAME. This same placement of the buffer address (and cursor) could have been accomplished by receipt of 3 SP (spaces) following NAME. This is a typical example of the varied decisions which must be made by the CPU software programmer to determine the most efficient use of the DATASPEED 40/4 terminal. Following the first SBA sequence is another GS AC sequence which defines the blank field following NAME and has the attributes of unprotected, alphanumeric, displayed, and unmodified. The next SBA sequence positions the buffer address to the left of COMPANY and the GS AC sequence inserts the attributes of protected, alphanumeric, unmodified, displayed, and highlighted. Since only one space is required following COMPANY, the next GS AC sequence follows immediately without an SBA sequence.

For line (2)

D B B G A
 C 1 A₁ A₂ S C

(1) NAME COMPANY
 (2)

In line (2), the form requires that the entire line be skipped. The BA is set to the beginning of

the line and a protected, non-displayed, alpha or numeric, unhighlighted, unmodified AC inserted.

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For line (3)

D B B G A D B B G A D B B G A
 C B B G A A D D R E S S G A C B B G A A D D R E S S G A
 1 A₁ A₂ S C S C 1 A₁ A₂ S C S C

(1) NAME COMPANY

(2)

(3) ADDRESS ADDRESS

In line (3), the buffer address is positioned at the start of the line followed by the GS AC sequence for protected, highlighted, displayed, and alphanumeric,

then ADDRESS. The next GS AC sequence defines the following field as unprotected, unhighlighted, etc; likewise for the second ADDRESS.

For line (4)

D B B G A D B B G A D B B G A D B B G A
 C B B G A C B B G A C B B G A C B B G A
 1 A₁ A₂ S C 1 A₁ A₂ S C 1 A₁ A₂ S C 1 A₁ A₂ S C

(1) NAME COMPANY

(2)

(3) ADDRESS ADDRESS

(4)

(5)

(6) TEL. NO. TEL. NO.

In line (4), four fields are required to be alternately protected and unprotected, and alternately highlighted and unhighlighted. Each SBA sequence sets the buffer address to the position preceding each field

and then the GS AC sequence to establish the desired field and attributes. Line (5) is completely protected as done previously in line (2).

For line (6)

D B B G A T E L . N O . G A C D B B G A D B B S T E L . N O . G A C D B B G A
 C B B G A T E L . N O . S C 1 A₁ A₂ S C 4 A₁ A₂ P T E L . N O . S C 1 A₁ A₂ S C
 1 A₁ A₂ S C

In line (6), the GS ACs are purposely located to limit the length of the field to 12 digits. Also they specify the blank fields as numeric (assuming that telephone numbers will not have letters in them). Numeric fields permit the operator to enter

only numbers, hyphens, commas, and periods. A different method is used to position the buffer address from the end of the first blank field. An RA (repeat to address) order is used, consisting of DC4 (device control 4) followed by two BA

3.60 When polled, the station transmits the following message:

Formatted Message (from station)

```

S S D A C C D A A J O H N S P A . S P G R A N T
T P I C C A A
X A A D A1 A2 1 A1 A2

```

```

D A A B I N K E S S P I N C .
C A1 A2
1

```

```

D A A 2 6 5 5 S J A N S O N S P B L V D . (etc) E B
C A1 A2 P T C
1 X C

```

As can readily be observed, form data is not transmitted because a polled station transmits only operator-entered fields (modified data) to the CPU. Unentered display fields are also not transmitted because each display position is a NUL (null) character unless replaced by the operator. Each field of operator-entered data is preceded by its address, given by the sequence DC1 (device control 1) AA (attribute address plus one space). This is done so that the CPU can verify the location of the data on the form even though it did not receive the form.

Invalid Data Entered by Operator

3.61 On receipt of formatted data from a station, the CPU normally examines each field for valid operator entries. In this illustrative example, the operator has entered an invalid part number. To indicate this to the operator, the CPU selects the KD and then transmits an error message as follows:

Selection (from computer)

```

E S S D D E
O S S A A N
T A A Q

```

Reply to Selection (from station)

```

D }
L 0 } (ACK 0, able to receive)
E }

```

Message (from computer)

```

S E W D B B G A S S U C H S P N O .
T S 1 C C A1 A2 S C N O P
X C C 1

```

```

S A S S 5 7 6 3 4 2 S P R E - E N T E R
P

```

```

D B B D B B D B B D E B
C A1 A2 2 A1 A2 1 A1 A2 3 X C

```

In contrast to previous messages from the CPU, this message will begin with a write command (ESC 1) instead of an erase-write (ESC 5). The KD does not need to be erased in order to indicate the invalid part number. The SBA sequence that follows moves the buffer address to an unused display line at the bottom of the screen, and the GS AC specifies a protected, high-lighted, alphanumeric, displayed, unmodified field at that location. Toward the end of the message is another SBA sequence to position the buffer at the beginning of the erroneous number. This sequence is followed by DC2 (device control 2) and two buffer address characters comprising an EAU (erase all unprotected) order. This EAU order removes all unprotected data from the present BA up to but not including the following BA, which in this case follows the erroneous number. The erase order from the CPU is not required, as the operator could use the editing function keys to obtain the same results, but again emphasis is placed on system efficiency.

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Following the erasure order is an order to position the buffer address to the beginning of the erroneous number field and DC3 to position the cursor to that location as shown below.

NAME	JOHN A. GRANT	COMPANY	BINKES INC.
ADDRESS	2655 JANSON BLVD. CHICAGO, ILL. 60634	ADDRESS	4321 N. SOUTH ST. CHICAGO, ILL. 60621
TEL. NO.	321 - 543 - 7666	TEL . NO .	321 - 746 - 5434

PART NO.	QTY	DESCRIPTION	PRICE
344567	6	CIRCUIT CARD	\$ 15.00
□	2	CABLE	3.70
272895	12	CONNECTOR	2.40

APPROVAL JONATHAN BINKES

NO SUCH NO. AS 576342 RE-ENTER

Thus, the error message to the KD operator indicates an error, points out where the error occurred, clears the field, and positions the cursor for corrective action.

3.62 The required acknowledgment by the station is not shown for simplicity. A response to the BCC must be transmitted by the station in order for the CPU to complete the message transmission with EOT.

3.63 To obtain the corrected information, the CPU must specifically poll the KD as follows:

Specific Poll (from CPU)

```

E S S D D E
O P P A A N
T A A Q
    
```

Assuming that the operator has made the requested correction, the reply consists of the following message:

Message (from station)

```

S S D A C C D A A E B
T P D I C C C A A 5 3 3 2 9 6 T C
X A A D A1 A2 1 A1 A2 X C
    
```

The station transmits **only** the data containing the corrected number for the following reasons:

- Operator-entered data into a field automatically changes the AC from unmodified to modified.
- When polled, a station only transmits modified fields to the CPU.
- The CPU can reset all modified fields to unmodified by a WCC.

When the form was originally received from the CPU, all ACs were specified as unmodified. Then as the operator entered each field to fill in the form, each field changed from unmodified to modified. Thus, each operator-entered field was sent to the CPU when the station was polled. Then on receipt of the error message from the CPU, the WCC at

the beginning of the message reset all modified fields back to unmodified, such that only the field entered by the operator to make the correction would be changed to modified and therefore sent to the CPU when the station was next polled.

3.64 The CPU indicates acceptance of the corrected form by selecting the KD and erasing all operator-entered data as follows:

Message (from CPU)

```
S E E
T S ? T
X C X
```

The message begins with an ESC (erase unprotected data command) which erases all operator-entered (unprotected) data from the display screen (modified or not), resets all ACs to unmodified, positions the buffer address and the cursor to the beginning of the first unprotected field, and unlocks the keyboard. The operator could then re-use the form if desired.

CPU-Entered Data

3.65 The CPU can enter data on the form and request verification for accuracy from the operator. To accomplish this, the CPU must select the KD and receive an acknowledgment in the normal manner. The following example message can then be transmitted to a station.

Message (from CPU) following Selection and Reply

```
S E W D B B F R E D S E . S A M E S H A M I T Y S C O . H 6 1 2 S S . S W A T E R S
T S 1 C C A1 A2 P E . P A M E S T A M I T Y P C O . T 6 1 2 P S . P W A T E R P
X C C 1
```

NAME	FRED E. AMES	COMPANY	AMITY CO
ADDRESS	612 S. WATER	ADDRESS	
TEL. NO.		TEL. NO.	
PART NO.	QTY	DESCRIPTION	PRICE

APPROVAL

Data to be entered in the field following NAME succeeds the WCC and the order setting the buffer address to the beginning of that field. At the end of the data for this first field, and after the data for each succeeding field, is program tab (HT) order, which causes the buffer address to be set to the beginning of the next unprotected field, and any unprotected data between the present and new buffer address to be erased. The ESC

(erase unprotected data command) could have been used at the beginning of the message to erase the KD display, but the HT order performs this function as the buffer address is set to the beginning of the field. This results in previously displayed unprotected data fields being erased by the HT order or replaced with received data. If the received data is valid, the operator transmits an acknowledgment and the message transmission terminates in the normal manner.

4. OPTIONS

4.01 The synchronous DATASPEED 40/4 system has five features provided by options which may be requested by the customer. These customer options must be installed in the station controller (SCC or MCC) as requested by the service order. A description of the customer options is given in the following paragraphs.

Station Identity Coding (Option 401)

4.02 There are 32 (0-31) station cluster or mini cluster controller identifications available using ASCII code, as shown in Table I. The SCC and MCC identifications (SPA or SSA) must be assigned using the option switches located on the programmable interval timer/station identification device card (PIT/SID). The device address (DA) of each addressable device (KD or printer) is automatically determined by the arrangement of standard serial interface (SSI) cabling at the time of station installation.

Type of Alarm on Receipt of Alarm WCC (Option 402)

4.03 Two types of audible alarm to indicate a trouble condition are available for the DATASPEED 40/4 terminal.

(a) **Continuous Alarm at 1-Second Intervals Until Acknowledged:** This alarm is a continuous sounding of a tone at 1-second intervals indicating to the KD operator that the CPU did not receive the previous message due to a trouble condition. The audible alarm continues until the KD is placed in the local mode or the alarm condition is cleared.

(b) **Momentary Alarm:** Functionally, this option is identical to the continuous alarm, but the momentary alarm sounds only once. This option should not be installed where the terminal is not constantly attended.

Blink Fields (Option 403)

4.04 This option provides a method of "highlighting" information that is displayed on the KD monitor.

(a) **No Blinking:** This option enables the station to override a received blink AC.

TABLE I

STATION AND DEVICE IDENTIFICATION CODES

STN OR DVCE NO.	S P A	S S A	D A	STN OR DVCE NO.	S P A	S S A	D A
0	SP	-	SP	18	K	2	K
1	A	/	A	19	L	3	L
2	B	S	B	20	M	4	M
3	C	T	C	21	N	5	N
4	D	U	D	22	O	6	O
5	E	V	E	23	P	7	P
6	F	W	F	24	Q	8	Q
7	G	X	G	25	R	9	R
8	H	Y	H	26]	:]
9	I	Z	I	27	\$	#	\$
10	[!	[28	*	@	*
11	.	,	.	29)	')
12	<	%	<	30	;	=	;
13	(-	(31	^	"	^
14	+	>	+	32			-
15	!	?	!	33			/
16	&	0	&	34			S
17	J	1	J	35			T

Intensified data fields will be displayed if the required intensified AC is received.

(b) Intensity Shift by Station upon Receipt of Blink or Intensified AC:

This option is available on a station basis to any KD associated with the station controller. The option provides the blink functions for all displayed data fields that are defined by an

intensified AC. Receipt of either a blink or intensified AC activates the blink feature.

(c) **Intensity Shift by Device Upon Receipt of Blink AC:** This option is applicable on a specific device basis to any KD associated with the station controller. This option provides the blink function for all displayed data fields that are defined by a blink AC. Receipt of a blink AC only activates the blink feature.

Type of Block Abort Procedure Used (Option 404)

4.05 To indicate a message block received, the CPU normally replies ACK (DLE 1 or DLE 0) upon receipt of a BCC. If the CPU replies with a NAK, the station when next polled attempts to transmit the message block up to seven times. If the CPU does not reply to a BCC, the station transmits ENQ. Option 404 provides two methods of aborting a message transmission when the CPU is unable to receive.

(a) **Terminate with ETX:** After seven attempts, the station can terminate the message transmission by transmitting ETX when this option is installed.

(b) **Terminate with SUB, EXQ and prime AF:** Functionally, this option is the same as with ETX except SUB (substitute) or ENQ and prime AF are transmitted.



Certain CPU software programs may terminate station communications if this option is installed.

Device Identity Coding for MCC (Option 405)

4.06 This option is used only in an MCC arrangement and assigns an identification to each addressable device. Any of the 32 device address codes can be selected by the customer and programmed on the PIT/SID card in the MCC.

4.07 In addition to the preceding station controller options, the data sets and printers must be optioned as required by the service order. Refer to Part 6 of this section for the respective Bell System Practice containing option information.

5. TESTING AND MAINTENANCE FEATURES

5.01 The synchronous DATASPEED 40/4 station apparatus has self-diagnostic features to aid in maintenance and troubleshooting. Contained in the 40C400-type controller (SCC, MCC, or DCC) is a microprocessor to test the circuit cards of the controller automatically. A programmed test message can be requested from the operator console to test the display logic of the KD and associated controllers. In addition to local tests of the station apparatus, remote testing from the DATASPEED test position (located in DTC) is available for complete system testing.

Self Test

5.02 The self test checks the internal circuitry of the 40C400-type controller and display logic of the associated KDs. This test should be performed on initial installation or when warranted for maintenance and troubleshooting. To utilize the self-test feature, momentarily depress the TEST switch and observe the changing LED pattern. When the LED pattern ceases to change and the continue pattern is displayed, the CONTINUE switch must be momentarily depressed to step the microprocessor to the next test phase. Refer to Section 579-505-354 for LED test patterns and detailed test procedures. No additional test equipment is required to install or test a DATASPEED 40/4 station.

Local Test

5.03 The local test is a functional test of the DATASPEED 40/4 station, including the KDs and printers, the DCCs, and the SCC or MCC up to the data set interface. A test message is transmitted from a KD through the DCC to the SCC (or MCC), looped back, and returned to the terminal to be displayed. This test is initiated by the L/TEST key (CONTROL S) which momentarily disconnects the station from the system for approximately 200 ms. The messages and instructions from the internal program are looped back at the EIA interface. Specific instructions and test results are automatically displayed on the KD and are described in Section 579-505-354.

Remote Test

5.04 Assuming that the channel and line control unit (LCU) are installed, an on-line test can

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be requested from the LCU by momentarily depressing the R/TEST key (CONTROL A) on the KD. The test received, if applicable, depends on customer software programming which is beyond the scope of this BSP. A request for the remote test does not receive priority over a message request by other KDs.

6. REFERENCES

6.01 Documents listed in this part provide additional detailed information concerning the components of the DATASPEED 40/4 system.

SECTION	TITLE
579-505-350	DATASPEED 40 Terminals—Field Installation and Maintenance Practice
579-505-354	Synchronous DATASPEED 40/4—Field Installation and Maintenance Practice
582-210-100	Model 40 Printer—Description and Operation
582-213-100	DATASPEED 40 Display Monitor—Description and Operation
592-027-100	Data Set 208A Transmitter-Receiver—Description and Operation
592-029-100	Data Set 201C Transmitter-Receiver—Description and Operation
598-082-100	Data Auxiliary Set 829-Type—Channel Interface Units—Voiceband Private Line Channels—Description
668-125-503	Synchronous DATASPEED 40/4 Station Using 3270 Line Protocol—Test Procedures Using a DATASPEED 40 Test Set
999-300-123	Synchronous DATASPEED 40/4 Station Arrangements—How To Operate Manual

7. GLOSSARY

Acknowledge—A positive response to a message. The sequences ACK 0 (DLE 0) and ACK 1 (DLE 1) are used in this system.

Attached KD—Keyboard display mounted on an empty cabinet or free standing.

Attention Identification (AID)—A group of ASCII characters used for program attention generated by special keys on opcon.

Alarm Flag—ASCII character pairs (AF 0, AF 1) indicating alarm.

Attribute Character—Character following start field character (GS) that designates the characteristics of displayed characters in a formatted field.

Blink—An optional feature that allows intensified fields to be varied between an intensified and half intensified display.

Binary Synchronous—Transmission of data consisting of bi-state (mark or space) bit characters using identical clocks to maintain synchronization between sender and receiver.

Block—A group of up to 256 characters starting with STX or SOH, ending with ETB or ETX, and followed by a block check character (BCC).

Block Check Character (BCC)—A character derived from the binary accumulation of bits during a block.

Buffer Address—Any of 1920 column and row locations in the buffer represented by two characters.

Communications Control Characters—Characters used to control the data link in order to establish, change direction, signify alarm status of, or terminate communication.

Command Codes—Character sequences ESC 1, 2, 5, 6, 7, ? initiated by LCU to effect message transfer (write or read) or control operations.

CONTINUE Switch—Switch located in controller. Used during self test to continue test to additional areas of the controller when the self test stops due to empty card locations.

Controller—A DATASPEED 40/4 control unit used to interface with data sets and other control units or devices. Contains an interconnecting frame, power supply, cooling fans, I/O ports, and various arrangements of circuit cards.

Control Characters—Characters generated by combined use of the CONTROL and control type keys on the keyboard.

Copy—The transfer of data from one device to another device on the same device cluster controller (DCC) or single controller (MCC) station.

Copy Control Characters—Character following ESC 7 command that determines the type of data to be copied, sounding of alarm, printing, and line length.

Central Processing Unit—Provides system host program and control via the LCU to the remote stations.

Cursor—A white rectangular indicator on the display. In local operation the cursor is located at the address where the next character will be placed. Characters already in memory at the cursor location will be displayed within the cursor form.

Cursor Address (CA)—ASCII character pairs indicating buffer address of cursor.

Device—A keyboard-display or printer.

Device Cluster Controller (DCC)—A controller that provides control and interface ports for devices and interfaces with a station cluster controller.

Display—Unit with a CRT tube face capable of displaying up to 1920 characters.

Device Unavailable—An alarm condition (No SSI or fail to respond in 1/2 second).

Erase—A function that replaces stored characters with nulls.

Erase Write—A command causing a buffer to be erased to nulls, positions the cursor to home and resets the buffer address to 0. The command may be followed by a message to be printed or displayed under control of a write control character.

Erase All Unprotected—A command causing all unprotected locations in a buffer to be erased. Resets MDT and AID. Cursor sent to 1st field. KD returns to local mode.

Erase Unprotected to Address—An order causing all unprotected characters in the buffer up to a specified address to be replaced by nulls.

Enquiry (ENQ)—Character sent when receiver does not receive a response.

End of Transmission (EOT)—Character sent to terminate transmission.

End of Text (ETX)—Character sent from station as last character of last block.

Transmitted Block (ETB)—Character sent from station as last character of a block when additional blocks follow.

End Medium—The ASCII EM character, if present, defines the last buffer location which will be printed when fixed field line lengths are not specified in the WCC or CCC message control characters.

Field—An area on a formatted display defined by one attribute character to have certain display characteristics starting at the sequential address following the attribute character and ending one character before the next attribute character.

Field Address (FA 0, FA 1)—ASCII character pair that indicates address of character following an attribute character.

Formatted Display—Display with any fields designated by an attribute characters.

Free Standing KD—Keyboard display in which the keyboard and display are each mounted on a separate free-standing base.

General Poll—A communication initiated by the LCU requesting a message from any device on a station. A 2-character Station Identification Code (SID) is required.

Home Position—The 1st sequential address of a display—Row 1 Column 1, upper left corner of display.

Insert Cursor—An order to place cursor at the current buffer address.

Invalid Reply—Reply to a poll, selection, or command that has a parity error or wrong block check character.

Invalid Command—Incorrect characters in or following command sequences.

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Intermediate Transmission Block (ITB)—Character sent from LCU as last character of block when additional blocks are to follow.

Keyboard—Unit containing alphanumeric, control, and editing keys. Also referred to as an operator console.

Keyboard Display (KD)—Device containing both a keyboard and display unit. May be attached to the controller cabinet or mounted separately, ie either attached or free standing.

Line Control Unit (LCU)—A unit that provides binary synchronous line control procedures for all stations on a communications line and interfaces with a central processing unit (CPU).

Modified Data Tag (MDT)—A set of attribute characters used to indicate that data in a field has either been modified or is to be treated as modified. Character is set by CPU or by the operator when any data in a field is changed. Character can be reset by a write control character.

Message Control Character—Characters within a data stream that control message transfer.

Master Station—Station that is sending a data block.

Mini Cluster Controller (MCC)—A station controller that interfaces with the data set and up to three devices.

New Line (NL)—ASCII control character, if present, defines the end of a line on a printer when fixed field lengths are not specified in the WCC or CCC message control characters. (Otherwise prints ASCII space and is not performed.)

Null—ASCII character used to replace data in buffer. Not printed or displayed.

Not Acknowledged (NAK)—A negative response to a message

Orders—Characters in data stream following write commands.

Opcon—Abbreviation for operator console—also referred to as a keyboard.

PAD—ASCII even parity DEL character (8 marks) used after all transmissions.

Poll—General or Specific. Used to initiate communication and request a message

Program Attention—Characters used to alert the program at the host CPU for special action.

Program Access—PA 1 and PA 2—Special keys on opcon.

Program Function—PF 1 through 12—Special keys on opcon.

Program Tab—Order causing buffer address to be moved to the next unprotected field. The remainder of the current field is cleared to nulls if being written into at the time of the TAB order.

Protected Character—All characters in field with “protect” attribute. Attempts to enter data in these fields will result in an audible alarm. Data will not be changed or overwritten.

Random Access Memory—Temporary read/write memory. Data stored can be changed and is lost when power is turned off.

Read—Buffer function in which data in storage is transmitted.

Read All—Command that causes entire buffer contents to be transmitted.

Read Modified—Command that causes only modified fields on formatted displays to be transmitted depending on AID.

Read Command—Either read all or read modified.

Repeat to Address—Order (following write command) causes all characters in a buffer up to a specified address to be replaced by a specified character.

Reset MDT—See modified data tag.

Read Only Memory—Permanent memory. Data is stored permanently and can be read out repeatedly.

Reverse Interrupt (RVI)—A communications control character.

Selection—A communication initiated by the LCU that prepares device on a station to accept a command.

Self-Test—A switch on the IXL (B) card in the controller used to initiate an internal test and diagnosis of any troubles in the IXL circuits.

Set Buffer Address—An order (following a write command) causing a change in the buffer address to an address specified as part of the order.

Start Field—An order followed by an attribute character and address that indicates the type of a field.

Station Cluster Controller (SCC)—A controller that interfaces with a data set and at least one device cluster controller.

Station—A remote data communications facility that has a unique address or identity. Includes data set and data terminal.

Synchronous DATASPEED 40/4—A family of DATASPEED 40/4 stations using binary synchronous line control procedures.

Temporary Text Delay—A communications control character sequence.

Uninterpretable Reply—No reply or reply that has no recognizable character format.

Wait Acknowledge (WACK)—Communication control character sequence.

Write Control Character (WCC)—Character following ESC 1 or 5 write commands that determines if message is to be printed, alarm sounded, keyboard and AID reset, MDT reset, and length of print line.