

Dial feature are discussed under "Operational Sequences (Switched Line)." These sequences are divided into four categories:

1. Specific and General Poll.
2. Selection addressing.
3. Write and control type commands.
4. Read-type commands.

The description of each category is associated with a Sequence/Response Diagram, which shows (1) all 3270 CU responses to program-generated transmissions by the TCU and (2) normal program-handling of 3270 CU transmissions. These diagrams show the I/O supervisor/access method as examining each 3270 response to determine which operation to initiate next; however, for specific applications, additional usage of command chaining in the channel programs may be desirable.

A selection addressing sequence selects a 3270 CU and an attached device for subsequent command operations. Polling sequences are selection sequences used specifically to obtain pending status at a device. Either a Specific Poll sequence requesting status from a particular device or a General Poll sequence sent to all devices may be executed.

Remote Chaining of 3270 Commands

For remote operations, 3270 command codes are included in the data stream of a Write CCW to the TCU. Remote chaining of 3270 commands is defined as the transmission of more than one command sequence to a 3270 CU following a single selection addressing or poll sequence. This chaining normally is accomplished with separate Write CCWs in the channel program. For example, the channel program could (1) write a selection addressing sequence and read the response for evaluation by the I/O supervisor/access method, (2) write a 3270 Write command and text block and read the 3270 response for evaluation, and then (3) write a 3270 Write command followed by a second text block and read the 3270 response for evaluation.

The program may chain 3270 commands following a selection addressing sequence, provided that the BSC rules governing limited conversational mode are observed.

(Refer to *General Information - Binary Synchronous Communications, GA27-3004*.)

The 3270 CU permits any valid command to be chained following a poll sequence; however, Read Buffer or Read Modified should not be chained because the BSC rules for limited conversational mode (a maximum of two consecutive data transfers without an intervening ACK) will be violated.

Any 3270 command (except Erase All Unprotected) may be chained from a Write, Erase/Write, Erase/Write Alternate, or Copy command. However, if the Write, Erase/Write, Erase/Write Alternate, or Copy command has started a print operation, the 3270 CU will abort the subsequent chained command (the print operation is completed normally).

General and Specific Poll Sequences

When a General or Specific Poll sequence is issued (Figure 6-2), one of three possible results occurs:

1. If status and sense information is pending with or without an AID present, a status and sense message is generated.
2. If status and sense information is not pending and an AID is present, a Read Modified command is executed.
3. If there is no status or sense information or no AID pending, an EOT response is generated.

Figure 6-9 lists the conditions under which status and sense messages are transmitted.

Note: When a program attention key is pressed at a 3275 Display Station, and status is not to be sent, the display station screen will momentarily go blank while the AID character is accepted during the polling cycle and a read or write type command reply is sent.

Control unit and device address bytes transmitted for the General and Specific Poll sequences are as follows:

1. General Poll address byte sequence:
3270 CU Poll Address } (See Figure 6-1.)
3270 CU Poll Address }
7F (EBCDIC) or 22 (ASCII) } Used in place of the two
7F (EBCDIC) or 22 (ASCII) } device-address bytes
2. Specific Poll address byte sequence:
3270 CU Poll Address }
3270 CU Poll Address } (See Figure 6-1.)
Device Address* }
Device Address* }

*For the 3275, this is always the address of device 0.

The selected 3270 CU remains selected at the completion of a poll operation so that the program can issue a Write, Erase/Write, Erase/Write Alternate, Copy, or EAU command without reselecting the 3270 CU and the device; command operations will be with (1) the device that was selected by Specific Poll or (2) the device from which a response was last received during the General Poll operation. Selection is dropped when the 3270 CU transmits EOT; the 3270 CU transmits EOT when the 3270 CU has no pending status or messages or after it receives NAK from the TCU in response to a message that ends with ENQ.

Specific Poll addresses the 3270 CU and one device to determine if status and sense information or a manually entered message is awaiting transfer to the TCU. The pending status and sense information or message is transferred automatically by the 3270 CU upon receipt of the Specific Poll addressing sequence.

General Poll addresses the 3271, 3275, or 3276 and examines each attached device in sequence (starting at a random device address) to determine if a status and sense or a manually entered message is awaiting transfer to the TCU. When a General Poll addresses the 3274, each attached device is examined in the order in which the ENTER key was pressed. If a message is present, it is transferred to the TCU. Each message is accompanied by the address of the device from which it originated. The 3275 responds to a General Poll the same as a 3271, 3274, or 3276 with one device attached.

Upon completion of this transfer, an ACK response from the program causes the 3270 CU to continue the General Poll operation, either by transferring another block of a text message or by examining other attached devices for pending messages. The program could issue a command rather than ACK to the device from which the message was just received, only after inbound blocks that end with ETX. The 3274 and 3276 will ignore any commands that are sent in response to a block of data that ends with ETB. Once the 3270 CU has examined all attached devices and has successfully transferred all pending messages, it generates EOT and returns to control mode. If the program wishes to terminate the General Poll, an RVI may be issued to the 3270, forcing an EOT response. A command issued rather than the ACK (after blocks that end with ETX) will also terminate the General Poll.

Figure 6-3 shows the message formats. The Test Request, Read Modified, and Short Read operations and the resulting data are described under "Read Modified Command" in Chapter 2. Note that a device address is not provided in the heading of a Test Request message. An address must be manually entered by the operator as part of the text; this is because the operator may specify the address of another device for test operations with the program.

The status and sense bits are described later in this chapter under "Status and Sense (S/S) Bytes."

Selection Addressing Sequence

The selection addressing sequence (Figure 6-4) specifies a 3270 CU and an attached device in preparation for write-, control-, or read-type command sequences. It is similar in format to a Specific Poll sequence in that a CU address is sent, followed by a device address, but different I/O characters and hex codes are used to represent the CU address bytes.

Column 1 in Figure 6-1 lists the characters and hex codes used to complete the selection addressing sequence. Comparative examples showing CU and device address codes for General Poll, Specific Poll, and selection addressing sequences are given at the bottom of Figure 6-1.

For the 3270 CU, the selection addressing sequence performs a function similar to a local Select command in that it causes a device-to-control unit buffer transfer. The 3271 and 3275 return ACK 0 if the selection and buffer transfer were completed successfully. The 3274 and 3276 provide a positive response to a selection sequence before transfer of a device buffer to the 3274 or 3276. If an error occurs during buffer transfer, following receipt of a valid selection addressing sequence a positive response to the selection sequence is provided by the 3274 or 3276, and DC and US status are internally set. EOT is sent in response to the following 3270 command.

When a 3275 is to be selected, note that device number 0 is always addressed (Figure 6-1, Note 1).

Write-Type and Control-Type Command Sequences

The program initiates a Write, Erase/Write, Erase/Write Alternate, Copy, or EAU operation (Figure 6-5) by first writing a command and, except for EAU, a data sequence to the selected 3270 CU and, then, reading the response. All write-type commands and Copy commands must be followed by a minimum of one data byte (the WCC or CCC byte). If the program reads a positive response (ACK) from the 3270 CU, it can terminate the operation or continue with another command. The program can write blocks of text to the 3270 CU by initiating, after receipt of each ACK, a Write command sequence for each block to be written.

The blocking of write data to devices attached to a 3271 Control Unit is accomplished as follows: Each time the 3271 receives a selection addressing sequence it transfers the entire device buffer contents to the 3271 buffer before any data is received. After the 3271 has successfully completed execution of the Write command, the entire 3271 buffer contents are transferred to the device buffer. If the transfer of a block of write data to the 3271 is unsuccessful (e.g., NAK reply), the 3271-to-device-buffer transfer is not performed. However, the 3271 can receive retransmission of that block; upon receipt of the command, the 3271 retrieves the device buffer contents (these contents include any previous text blocks that were written successfully) before any write data is received.

The blocking of write data to devices attached to a 3274 or 3276 Control Unit is accomplished in a similar manner: Each time the 3274 or 3276 receives a selection addressing sequence it begins to transfer the device buffer contents to the control unit

Column 1 Use this column for: • Device Selection, • Specific Poll, • General Poll, and • Fixed Return Addresses				
CU or Device Number	EBCDIC I/O Char.	EBCDIC Hex (Note 3)	ASCII I/O Char.	ASCII Hex
0	SP (Note 1)	40	SP	20
1	A	C1	A	41
2	B	C2	B	42
3	C	C3	C	43
4	D	C4	D	44
5	E	C5	E	45
6	F	C6	F	46
7	G	C7	G	47
8	H	C8	H	48
9	I	C9	I	49
10	J	4A	J	5B
11	K	4B	K	2E
12	L	4C	L	3C
13	M	4D	M	28
14	N	4E	N	2B
15	O or I	4F	O	21
16	&	50	&	26
17	J	D1	J	4A
18	K	D2	K	4B
19	L	D3	L	4C
20	M	D4	M	4D
21	N	D5	N	4E
22	O	D6	O	4F
23	P	D7	P	50
24	Q	D8	Q	51
25	R	D9	R	52
26	I	5A	I	5D
27	\$	5B	\$	24
28	*	5C	*	2A
29)	5D)	29
30	:	5E	:	3B
31	^ or ^	5F	^	5E

Column 2 Use this column for: • 3270 CU Selection Addresses • Test Requests				
CU Number	EBCDIC I/O Char.	EBCDIC Hex (Note 3)	ASCII I/O Char.	ASCII Hex
0	-	60	-	2D
1	/	61	/	2F
2	S	E2	S	53
3	T	E3	T	54
4	U	E4	U	55
5	V	E5	V	56
6	W	E6	W	57
7	X	E7	X	58
8	Y	E8	Y	59
9	Z	E9	Z	5A
10		6A		7C
11	.	6B	.	2C
12	%	6C	%	25
13	-	6D	-	5F
14	>	6E	>	3E
15	?	6F	?	3F
16	0	F0	0	30
17	1	F1	1	31
18	2	F2	2	32
19	3	F3	3	33
20	4	F4	4	34
21	5	F5	5	35
22	6	F6	6	36
23	7	F7	7	37
24	8	F8	8	38
25	9	F9	9	39
26	:	7A	:	3A
27	#	7B	#	23
28	@	7C	@	40
29	'	7D	'	27
30	=	7E	=	3D
31	" (Note 2)	7F	"	22

Examples:

3271 Addressing				3275 Addressing			
General Poll CU5	CU Address	EBCDIC	ASCII	General Poll CU5	CU Address	EBCDIC	ASCII
		{ C5	45			{ C5	45
Device Address	Device Address	{ C5	45	Device Address	Device Address	{ C5	45
		{ 7F	22			{ 7F	22
Specific Poll Device 4 on CU5	CU Address	{ C5	45	Specific Poll CU5	CU Address	{ C5	45
		{ C5	45			{ C5	45
Device Address	Device Address	{ C4	44	Device Address	Device Address	{ 40	20
		{ C4	44			{ 40	20
Select Device 4 on CU5	CU Address	{ E5	56	Select CU5	CU Address	{ E5	56
		{ E5	56			{ E5	56
Device Address	Device Address	{ C4	44	Device Address	Device Address	{ 40	20
		{ C4	44			{ 40	20

Notes:

1. I/O character address (SP) is always used as the device address when selecting a 3275.
2. I/O character address (") is used as the device address to specify a General Poll operation.
3. Graphic characters for the United States I/O interface codes are shown. Graphic characters for EBCDIC 4A, 5A, 5B, 7B, 7C, and 7F might differ for particular World Trade I/O interface codes. Refer to *IBM 3270 Information Display System: Character Set Reference*, GA27-2837, for possible graphic differences when these codes are used.

Figure 6-1. Remote Control Unit and Device Addressing

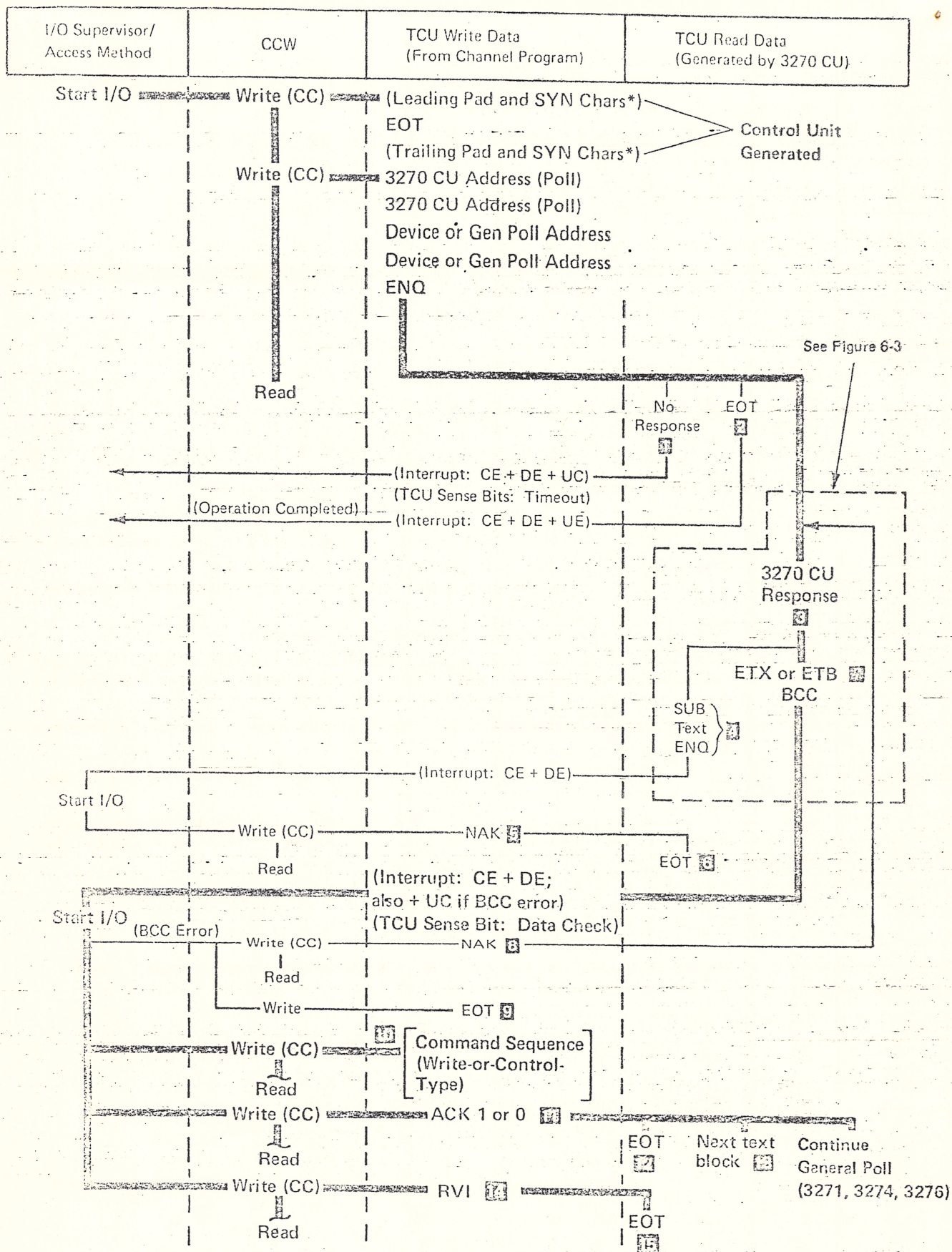


Figure 6-2 (Part 1 of 2). General Poll and Specific Poll, Sequence/Response Diagram

Notes:

- 1 The 3270 CU will fail to respond to the addressing or polling sequence, causing a TCU timeout, for any of the following reasons:
 - e The 3270 CU is "unavailable" (has power off, is "offline", or is not attached).
 - e The 3275 is "unavailable" to a Specific Poll sequence because the Security Keylock is in the "off" position.
 - e Any character in the polling sequence is invalid.
 - e The characters in the polling sequence are out of order.
 - e The polling sequence is incomplete (less than seven characters).
 - e The 3270 CU address is incorrect in the write data stream.
 - e The addressed 3270 CU was left selected from the previous transmission.
- 2 There is no I/O pending nor pending status. For General Poll, the CU sends EOT only after polling all devices.
- 3 The device response is a function of the kind of device and its status. Types of responses include: Text, Status, and Test Request messages. (Refer to Figure 6-3.)

3271, 3274, 3276: For General Poll, the search for a response starts at some random device address and continues sequentially (as long as ACKs are received in response to text transmissions) until all devices are given the opportunity to respond.
- 4 Upon detection of an internal parity check or a cursor check, the 3270 CU (1) substitutes the SUB character for the character in error, (2) records Data Check status, and (3) transmits an ENQ in place of ETX (or ETB) and BCC at the end of the text block. The General Poll process is stopped.
- 5 Mandatory program response to a text block terminated in ENQ.
- 6 Terminates the operation. The nature of the error (parity or cursor check) does not warrant a retry. This response indicates that status and sense information is stored and that internal 3271/device polling is stopped. The status retrieval information included in Figure 6-6, Note 2, applies.
- 7 ETB is used to frame each block of a blocked text message, except the last block. ETX is used to frame the last block of a blocked text message.
- 8 BCC error has been detected. The program issues NAK to cause the 3270 CU to repeat its last transmission.
- 9 Response issued by the program to terminate the operation if the TCU is unsuccessful in receiving a valid BCC following "n" attempts by the 3270 CU to transmit the message. This response does not cause the 3270 CU to reset its sense/status information. Therefore, the same status message will be transmitted if a Specific Poll is immediately issued to the same device.
- 10 This transmission must be a write or control-type command sequence (described in Figure 6-5). A read-type command would violate BSC standards on limited conversational mode.

3271, 3274, 3276: For General Poll, this transmission stops the polling operation. The General Poll must be reinitiated to ensure receipt of all pending device messages.
- 11 Positive acknowledgment. The text block has been successfully received by the TCU. The program issues ACK 1 in response to the first and all odd-numbered text blocks and issues ACK 0 in response to the second and all even-numbered text blocks. This response to a text block terminated in ETX turns on the 3275 SYSTEM AVAILABLE indicator.
- 12 Normal termination of a Specific Poll

3271, 3274, 3276: Normal termination of a General Poll.

3275: No additional response is generated by the 3275 at the end of a General Poll.
- 13 The second and all succeeding text blocks are framed as the first except they do not include the 3270 CU/device address sequence.
- 14 RVI to terminate polling sequence.
- 15 Termination of polling sequence on receipt of RVI.

LEGEND:

(CC) = Chain Command (CC) Flag in CCW is set to 1.

(Interrupt) = TCU-generated interrupt (CE = Channel End, DE = Device End, UE = Unit Exception, UC = Unit Check).

16 Reversed numbers refer to notes.

*Only the critical framing characters (sync pattern and pad) are shown. All other framing characters are also hardware-generated as required. See *SL General Information - Binary Synchronous Communications*, GA27-3004, for a complete description.

Figure 6-2 (Part 2 of 2). General Poll and Specific Poll, Sequence/Response Diagram

buffer. As the Write command data is received by the control unit, updating occurs, and the result is asynchronously transferred to the buffer of the addressed device. The device buffer contents not affected by the write data stream remain unaltered in the device buffer. If the transmission of a block of data to the control unit is successful (ACK reply), a device-to-control-unit-buffer transfer is begun. If the transmission of a block of write data to the control unit is unsuccessful (e.g., NAK reply), the buffer contents previously stored in the control unit buffer are immediately transferred to the device buffer before another Write command is received. These contents include any previous text blocks that were written successfully. Thus, the 3274 and 3276 can receive retransmission of the block that was unsuccessfully received.

The blocking of write data is of less value with a 3275 since the 3275 buffer is also the device buffer. Thus, if text-blocking is used and the 3275 fails to receive the block successfully, the buffer should be entirely written because orders within the unsuccessful data block may have affected data in any area of the buffer, possibly destroying the integrity of the buffer.

Read-Type Command Sequences

Programming Note: Read Buffer is used primarily for diagnostic purposes, and Poll (General and Specific) is normally used in place of Read Modified for remote read operations.

The program initiates a read operation (Figure 6-6) by first writing a command sequence to the selected 3270 CU and then reading the response. If the 3270 CU responds with text followed by ETB, and if BCC comparison at the TCU is successful, the program should write ACK to retrieve the next text block. This should continue until an error is detected or until a text block is followed by ETX. After ETX is received, the program should write ACK to the 3270 CU and then read the EOT reply. The three types of Read Modified message responses are shown in Figure 6-3.

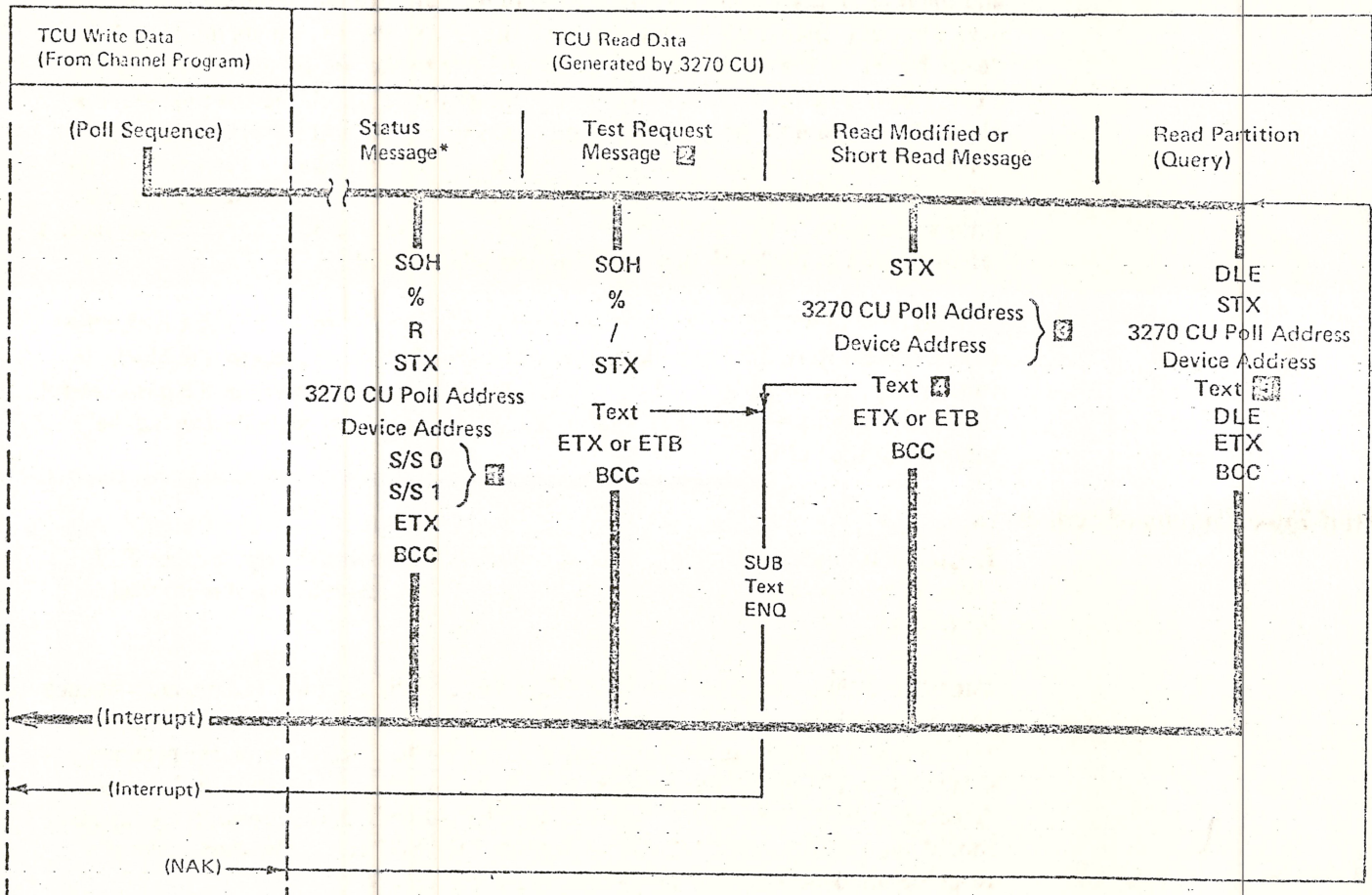
The 3274 and 3276 will retransmit text up to 15 times when NAK or an incorrect ACK is received or when ENQ is received in response to a conversational text reply to a Read command. The 3274 and 3276 support limited-conversational-text mode. If the host transmits a text block following receipt of a text transmission which ends in ETB, a timeout occurs at the 3274 or 3276 unit and ENQ is sent to the host.

Status and Sense (S/S) Bytes

All remote status and sense conditions are combined into two bytes. These two bytes are always sent in a status message. In EBCDIC code, the bits are transmitted as indicated in Figure 6-7. If the sense bytes are transmitted in ASCII code, the EBCDIC code defined below is translated to ASCII before transmission.

Status and sense conditions are recorded by the 3270 for each device. These conditions may include busy or ready status or detected errors. Figure 6-8 shows how these status and sense conditions are interpreted for each error response transmitted by the 3270 in response to a poll sequence from the TCU.

(Note: This figure is referenced in Figures 6-2 and 6-6.)



* Response to General Poll or Specific Poll only (not program-generated Read Modified command)

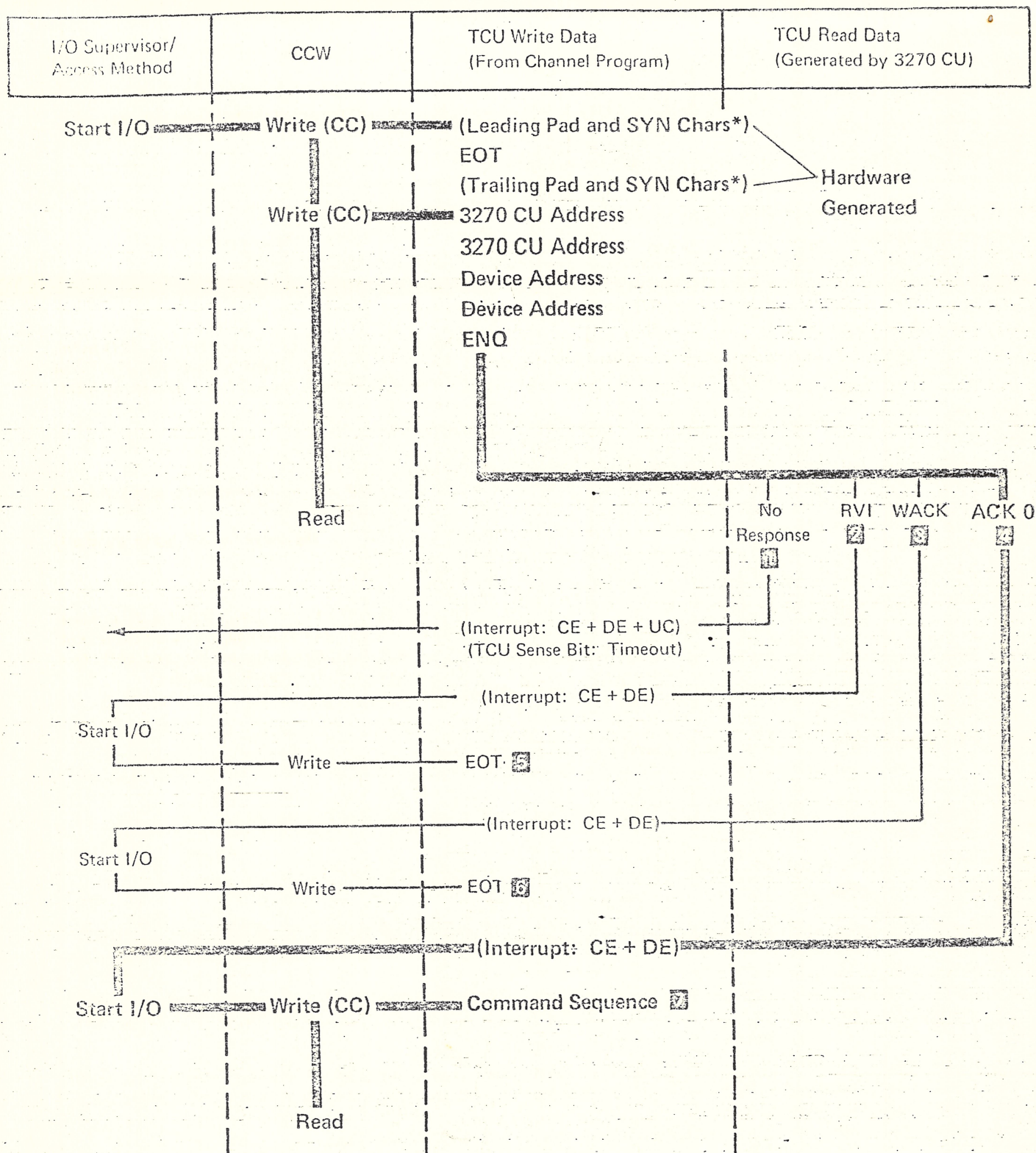
Notes:

- 1 A status message response is issued to a General or Specific Poll if (1) the 3270 CU has pending status (General Poll ignores Device Busy and device "unavailable" and, if the 3271, 3274, or 3276 continues polling of next device), or (2) if error status develops during execution of the poll. Status and sense bit assignments are described in Figure 6-7.
- 2 A Test Request Message response is issued to a General or Specific Poll if a TEST REQ key is pressed at the keyboard of a polled 3275 or 3277, or if a SYS REQ key is pressed at a 3278 attached to a 3274 or 3276.
- 3 This address is included only in the first block of a blocked text message.
- 4 The text portion of this message is the result of either a Read Modified or Short Read operation by the 3270 CU. Figure 6-5 lists each operator action and the resulting read operation that will be performed. The read operations and the resulting data are described under "Read Modified Command" in Chapter 2.
- 5 The text portion of this message is the result of a Read Partition (Query) structured field function.

LEGEND:

- (Interrupt) = TCU-generated interrupt.
- 6 Reversed numbers refer to notes.

Figure 6-3. 3270 CU Message Response to Polling or Read Modified Command



*Only the critical framing characters (sync pattern and pad) are shown. All other framing characters are also hardware-generated as required. See *SL General Information — Binary Synchronous Communications*, GA27-3004, for a complete description.

Figure 6-4 (Part 1 of 2). Selection Addressing, Sequence/Response Diagram

Notes:

- 1 The 3270 CU will fail to respond to the addressing or polling sequence causing a TCU timeout, for any of the following reasons:
 - The 3270 CU is "unavailable" (has power off, is "offline", or is not attached).
 - The 3275 is "unavailable" has the Security Keylock in the "off" position).
 - Any character in the polling sequence is invalid.
 - The characters in the polling sequence are out of order.
 - The polling sequence is incomplete (less than seven characters).
 - The 3270 CU address is incorrect in the write data stream.
 - The addressed 3270 CU was left selected from the previous transmission.
- 2 3271: The addressed device has pending status (excluding Device Busy or a Device End) or is unavailable, the device-to-3271 buffer transfer was unsuccessful, the 3271 detected an internal parity or cursor check, or the addressed printer became "not ready" (out of paper, unrecoverable "hang", power off, or cover open). The S/S information is stored in the 3271, and the internal 3271/ device polling is stopped.
- 3274, 3276: The addressed device has pending status (excluding Device Busy or Device End).
- 3275: The 3275 has pending status, excluding Device Busy or Device End.
- 3 The addressed 3271, 3274, or 3276 device or the 3275, including the 3284-3 Printer, is busy. No S/S information is stored. An RVI response takes precedence over a WACK response.
- 4 The address has been successfully received, no status is pending, and, in the case of the 3271, the device-to-3271 buffer transfer is successfully completed.
- 5 Termination of attempted addressing sequence:
 - 3271, 3274, 3276: Availability of valid status and sense information cannot be ensured unless a Specific Poll is issued to the responding device as the next addressing sequence issued to this 3270 CU. Successful completion of a Specific Poll addressed to the responding device, a device selection addressed to any other device on the same 3271, or a General Poll addressed to the same 3271, is required to start the internal 3271 device polling operation.
 - 3275: A Specific Poll to the 3275 retrieves the status existing at the time the RVI response was made.
- 6 Termination of attempted addressing sequence.
- 7 Refer to Figure 6-5 or 6-6 for the desired command sequence.

LEGEND:

(CC) = Chain Command (CC) Flag in CCW is set to 1.

(Interrupt) = TCU-Generated interrupt (CE = Channel End, DE = Device End, and UC = Unit Check)

8 Reversed numbers refer to notes.

Figure 6-4 (Part 2 of 2). Selection Addressing, Sequence/Response Diagram