

SI-842-2A

FILE #DO1 & DO2

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**PROTOCOL AND DIAGNOSTIC  
TESTING**

OF

**3270**

and (3275)

**SERIES  
TERMINALS**

OCTOBER 1977

ATLANTIC RESEARCH CORPORATION

**TELEPRODUCT®**

ALEXANDRIA, VIRGINIA 22314

**NOTICE**

The information contained in this manual is believed to be accurate and is intended to be used as the Basis for testing the equipments described with an Atlantic Research Corporation INTERSHAKE Model DTM-2.

Due to the nature of software/firmware support and Variations in different manufacturers of these equipments, Atlantic Research Corporation can assume no responsibility or guarantee that the results achieved will match those described herein.

The user is advised that a revision letter appears after the PROM number on the program listing in Appendix A.

Any written comments for improving the test or this descriptive document are welcome.

SI 842-2A  
FILE #D01 & D02

PROTOCOL AND DIAGNOSTIC  
TESTING  
OF  
3270  
and (3275)  
SERIES TERMINALS  
MOD 2: 1920 Character CRT

Manufactured by:

ATLANTIC RESEARCH CORPORATION  
Teleproducts Division  
5390 Cherokee Avenue  
Alexandria, Virginia 22314

October 1977

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### SECTION I

### OPERATION

#### 1.0 GENERAL DESCRIPTION

This test is applicable to CRT terminals and printers using the protocol of the 3270 series or equivalent such as the teletype **DATA SPEED 40/4**. Provisions are included to test the more recent stand alone 3275 series which uses a slightly different error recovery algorithm.

Two major test requirements are: (1) to enable a terminal operator to verify that the terminal is operating properly (with minimal technical support), and (2) to provide in-depth diagnostic capability so the INTERSHAKE operator can localize a problem when the terminal is determined to be defective. Additional "editing" provisions are included to assist the operators in detail troubleshooting.

INTERSHAKE (DTM) is used to emulate the CPU or Front End Processor for numerous interactive message exchanges with the terminal. INTERVIEW displays selected transmissions for visual analysis of both transmit and receive signals.

Connection of the INTERSHAKE (DTM) into an operating system is accomplished at the RS-232 interface. Testing may be directed from the CPU location through modems or locally at the terminal without modems.

Point-to-point or multidrop (switched carrier) networks are accommodated to strengthen the versatility of the test.

Network layouts differ (especially for multidrop circuits), and a user should *thoroughly understand the consequences of taking any part of the system off-line* to run this test.

Unused space is available in the program to add short test routines that could be useful for special applications. The internal capacity of INTERSHAKE can contain *seven separate programs* of this overall sophistication.

#### 1.1 Features and Capabilities

The simplicity of permitting the terminal operator to verify correct terminal operation unassisted by test personnel is possible because the INTERSHAKE can store selected characters received from the terminal then retransmit these characters inserted into an instructional format for display on the terminal.

This "Selective Echo" capability is virtually self-checking, thereby servicing a wider range of operator skills. Additional in-depth diagnostics are also included to quickly and accurately define a fault condition.

### TESTS, VERIFICATION, AND ERROR CONDITIONS (of 3270 and Data Speed 40/4 Test)

This test provides a very thorough evaluation of a terminal. Its applications include:

- Data communication diagnostics
- Teaching tool for the BiSync Protocol

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- **Instruction vehicle for terminal operators**
- **Front End Processor emulator**
- **Development aid for terminal application software**
- **Basis for evaluating terminal vendors**
- **Printed record of the test completion**

The following paragraphs identify the detailed capabilities provided to the user by this test:

### 1.1.1 **Keyboard Logic Tests**

- a. All AID keys
- b. Manual TAB to next non-protected field
- c. Numeric keys (restricted)
- d. Upper-lower case
- e. Buffer address follows cursor (see Paragraph 4.1.3)
- f. Keyboard lockout by CPU
- g. —

### 1.1.2 **Display Logic Tests**

- a. Protected fields
- b. Protected hidden fields
- c. Nonprotected hidden fields
- d. Auto-tab to next nonprotected field
- e. Cursor addressing (insertion of cursor)
- f. Attributes
- g. Erase/write resets cursor home
- h. Write from last address
- i. Pincushion of top and bottom lines
- j. Screen focus and brightness
- k. Contrast adjustment pattern

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- l. Read the cursor address on the display (to the host CPU)
- m. —

### 1.1.3 Terminal Options Displayed

- a. Upper – lower case
- b. Highlight
- c. Blink
- d. Buffer – nonbuffered display
- e. Bell tone
- f. —

### 1.1.4 Terminal Communication Tests

- a. Automatic terminal “ENQ” recovery – Should the 3270 interactive communication not terminate, in an orderly fashion; e.g., with an EOT from the DTM, the 3270 will, after 3 seconds, generate an ENQ. The ENQ will be repeated from the terminal approximately every 3 seconds. Upon receiving an ENQ from the 3270, the DTM will interrupt and issue a RESET and GENERAL POLL. Normally an EOT response will be generated by the 3270. The “idle” condition will be RESET and SPECIFIC POLL by DTM with EOT responses from the 3270.
- b. Automatic text blocking at 256 characters
- c. Number of Sync characters
- d. Operation and timing of RTS, CTS, RLSD, DSR leads
- e. Real time display of turnaround time (for terminal to check BCC and reply)
- f. Terminal detection of BCC error. The error recovery routine of the terminal is fully exercised by forcing a BCC error and verifying that the terminal rejects it.
- g. Modem strapping options.
- h. Modem turnaround time.

### 1.1.5 BCC Error

Each transmission received from the 3270 has the BCC calculated by the DTM and verified. ANY BCC ERROR terminates the test to “END”. When the test ends, the INTERVIEW CRT will freeze the last DTM-3270 sequence. The DTM BCC error light will be ON.

### 1.1.6 No Terminal Response

After each DTM transmission, the interrupt timer is activated. If no response is received from the terminal in 3 seconds, the program issues a RESET and GENERAL POLL. The system will continue to issue Reset and General Polls at 3-second intervals until a response is received.

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### 1.1.7 Protocol Faults

The following faults are checked by the DTM program and terminate the test with END.

- a. Out of sequence ACK 0, ACK 1. Note that an AID message in response to a SPECIFIC POLL qualifies as an ACK 0, so the first ACK observed in response to AID ECHO is ACK 1.
- b. Receipt of RVI or WACK from the 3270.
- c. Receipt of any character from 3270 (as the first NON SYNC character) other than SOH, STX, DLE, NAK, EOT.
- d. Receipt of any character from 3270 after SOH other than %.
- e. Character received following % must be "/" or "R".

The reader should refer to the Receive Program Modules in Section II, Paragraph 2.0, for a definitive view of the program termination criteria.

### 1.2 EBCDIC versus ASCII

The Protocol is independent of the code used; therefore, there are only two changes required: (1) the characters must be changed to the correct code and (2) EBCDIC uses a CRC (2-character polynomial) whereas ASCII uses an LRC (1 character).

This document, as written, applies to both EBCDIC and ASCII. The Symbols and Hex characters are given for both situations in the applicable paragraphs. Section II contains the actual program variations.

### 1.3 Ordering Information

The order should specify:

File D01 PROM SET (3270/EBCDIC) or File D02 PROM SET (3270/ASCII)

The test described herein will be contained in cells G/H and the special "Form" message will replace Functions 66 EBCD and 67 (Baudot).

Special requests should be made if the user desires one single Prom set to contain BOTH D01 and D02.

Tapes may be available in the future for use with the external receive program features of the INTERKEY equipped INTERSHAKE.

## 2.0 3270 PROTOCOL

This protocol is of the general BISYNC format. Communication between INTERSHAKE and the terminal forms an interactive exchange of messages that cascades until it is several interchanges deep before proceeding to the next class of exchange.

A brief description and the protocol elements tested are summarized below. The appropriate users guide for the specific terminal (and support software) should be consulted for more details. Also, there may be slight variations in the way some "look-alikes" *actually implement the protocol*.

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The program exercises six different Categories of terminal operation.

1. INTERSHAKE generates a general poll after power up to retrieve status and sense (S&S) for each device (on the controller).
2. INTERSHAKE generates a specific poll to request the AID keys be operated; received AID characters are echoed to the 3270 screen.
3. Operating the 3270 Request Test Key (RQTST) causes the INTERSHAKE to generate a test message (form) to the terminal.
  - a. The first transmission of the form contains a forced BCC error.
  - b. A NAK response by the 3270 causes INTERSHAKE to retransmit the test message "form" with a good BCC.
4. The 3270 operator fills in applicable portions of the test message "form" on the CRT to check attributes.
5. The 3270 sends the entered data to the INTERSHAKE which ECHOES the data to the 3270 CRT to verify other attribute characteristics; e.g., (hidden fields).
6. Completion of the test writes "END OF TEST" on the 3270 screen and returns to a general poll.

Details of the protocol are shown in Paragraph 5.5.2.

### 3.0 3275 PROTOCOL

The 3275 protocol is substantially identical to the 3270 protocol except for the recovery from a BCC error received by the terminal. All six Categories of tests described in Paragraph 2.0 apply. Changes are to Category 3:

Operating the 3275 Request Test (RQTST) key generates a test message "form" to the terminal.

- a. The first transmission contains a BCC error.
- b. The terminal responds with an EOT.
- c. INTERSHAKE replies with reset and specific poll to retrieve the Status and Sense. S&S, when pending, takes priority over other possible replies. S&S for a BCC error is "A (SP)."
- d. An RVI response by DTM clears the S&S and the terminal responds with EOT to terminate the interchange. *Note:* for *unbuffered* 3275 displays the STATUS (error) light will remain ON until RVI is received even though the erroneous message is displayed.
- e. The 3275 RQTST key must be operated (the second time) to retrieve the message again from the DTM-2 . . . . this time with a good BCC.

Further details of the protocol are shown in Paragraph 5.5.2.

## 4.0 3270/75 OPERATION

This paragraph describes the operator interaction at the terminal. Refer to Paragraph 5.0 for DTM setup instructions. The operator should recognize that a *200 ms* polling delay is used. Refer to Paragraph 5.9 to decrease or increase the delay.

### 4.1 Operator Sequence 3270

The following sequence of terminal operator interactions with the terminal is shown in the preferred order and is illustrated by Figure 4-1. Variations are possible.

4.1.1 Power up terminal (and controller) and START the INTERSHAKE

4.1.2 CLEAR key clears CRT. After a delay, the CRT will display AID    at the home position. The aid SYMBOLS will be highlighted.

4.1.3 Operate the other AID keys and note the display.

<u>Key</u>	<u>Display</u>	
PF 1	AID 1	} Type Read
PF 2	AID 2	
PF 3	AID 3	
PF 4	AID 4	
PF 5	AID 5	} Long Read
PF 6	AID 6	
PF 7	AID 7	
PF 8	AID 8	
PF 9	AID 9	
PF 10	AID :	
PF 11	AID #	
PF 12	AID @	
ENTER or S/R	AID' (apostrophe)	} Short Read
PA 1	AID %	
PA 2	AID >	
PA 3	AID, (comma)	
Clear	AID <u>  </u> (underline)	

4.1.3.1 There are three major types of variations in the AID display depending upon the terminal manufacturer (and model vintage). The observed variations are described below. Other patterns MAY NOT be indicative of a faulty terminal; however, they *should* be called to the attention of the user as the application programs may be impacted where the response to an AID key is a WRITE instruction from the computer.

#### TYPE 1: IBM 3270 ET AL

- All "Long Read" keys and CLEAR will display "AID" and symbol at the HOME location.
- All "Short Read" keys will display "AID" and symbol at the CURSOR location.

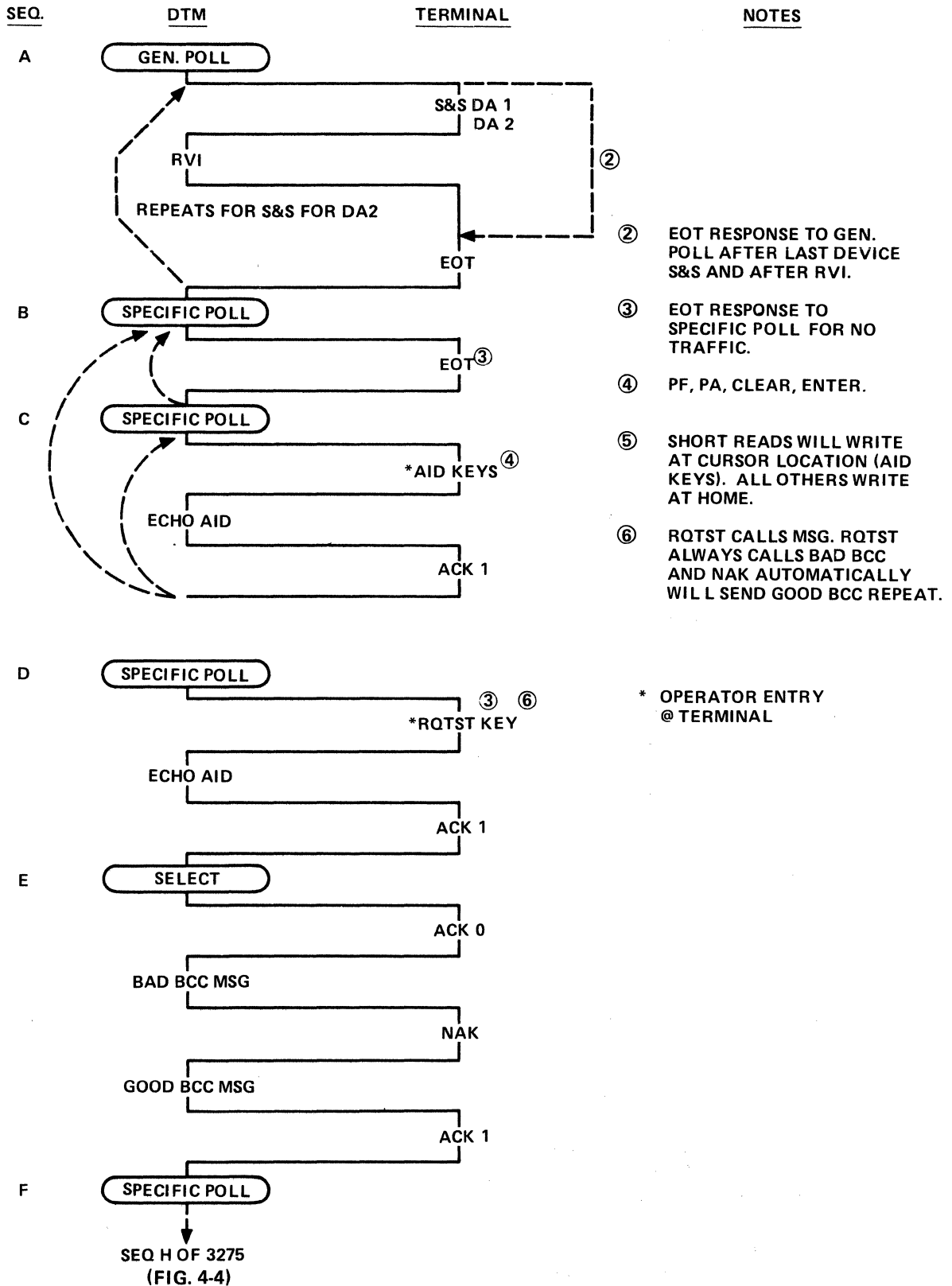


Figure 4-1. 3270 Flow Sequence (2 Devices).



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### TYPE 2: DATA SPEED 40/4 ET AL

- All Aid keys **except CLEAR** will display at the CURSOR location. The maximum number of AID(s) to be simultaneously displayed will be 21.
- CLEAR will display at the home location.

The recommended operator sequence for the Data Speed 40 is:

Line 1 CLEAR, PF1 to PF9 Displays:

AID \_ AID 1 AID 2 AID 3 AID 4 AID 5 AID 6 AID 7 AID 8 AID 9

Line 2 PF10, PF11, PF12, PA1, PA2, ENTER (S/R) Displays:

AID : AID # AID @ AID % AID > AID ' AID /

Note: RQTST will momentarily display AID / before the screen is erased and the test Form is displayed.

### TYPE 3: OTHER

- All Aid keys will display at the HOME location; therefore, only one AID will be displayed at a time.

4.1.3.2 After the AID symbol the cursor is left in a protected field and the operator may NOT enter data from the keyboard here or in the next position. A nonprotected field begins two positions to the right of the cursor following an AID echo.

4.1.4 Operate the CLEAR Key to clear the 3270 display.

4.1.5 Operate the Request Test (RQTST) key. *Momentarily* the screen will show AID 1.

The test message will display the RQTST "form" shown in Figure 4-2.

*High-light* attribute options can be determined as follows from the top line:

"3270 75" is intensified.

"TEST" is blinked.

Some models provide for both options. The specific manufacturer's manual should be consulted to determine whether independent fields will interact.

*Cursor* position is placed at the start of the first *non-protected* field. The entire screen is protected except for the three non-protected fields defined by > <. The operator manually fills the three fields.

4.1.5.1 The ALPHA field is filled with any alpha-numeric characters such as the name of the terminal system. When the cursor is on the "<" symbol at the end of the alpha field, the screen is protected. Operate the cursor tab key to move the cursor to the next field.

4.1.5.2 The NUMERIC field is filled with only numeric digits, minus ( - ) and period ( . ) such as the date of the test. The last (10th) character in the numeric field will automatically tab the cursor to the alpha - non-displayed field.

Row

```
1           3270 75 TEST
2
3 *****
4 .....PROTECTED.....
5           >  DISPLAYED <
6           >           < NON-DISPLAYED
7
8 .....NON-PROTECTED.....
9           > ..... < ALPHA
10          > ..... < NUMERIC
11          >           < ALPHA NON-DISPLAYED
12
13
14 INTERSHAKE Analyzes And Finds Your Data Communications Problems Fast! 1234567890
```

**NOTES:**

1. 3270 75 is highlight.
2. TEST is Blink.
3. Row 14 is highlight.
4. Cursor is at Row 9.
5. Pincushion of top row of \*\*\*.
6. Leave cursor at end of field on Row 11.

Figure 4-2. RQTST Display.

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4.1.5.3 The ALPHA NON-DISPLAYED field is also filled with any alpha-numeric characters such as the operator's name. The cursor should be positioned on the "<" symbol at the end of the field.

4.1.6 Operation of the ENTER key sends the data entered onto the form (plus selected parts of the form) to the DTM which then ECHOES the message to be displayed on the screen as shown in Figure 4-3.

4.1.6.1 Note that the *protected*, *hidden* (or non-displayed) field of the original form is now displayed "NON-DIS." All operator entered data in the three fields will also be displayed for verification.

4.1.6.2 Should the original form be displayed in a default condition, i.e., the proper ACK was not received prior to operating ENTER, the "AID ' " would have appeared at the home cursor position of the form. This is most likely to occur in a non-buffered terminal or when the terminal does not detect the erroneous BCC properly.

4.1.6.3 The three characters at the home location of the screen show the echo'd ENTER aid character and the echo'd cursor address (Row, Column) when the ENTER key was operated.

- ( ( is displayed when the form has been completely filled in and the cursor is positioned on the < symbol at the end of the third field.

- ' & S is displayed when the form has not been filled in and the cursor is unmoved from the position directed by the RQTST key (Row 9, Column 45).

- ' ) ' is displayed for the cursor location at the last character position on the screen (Row 24, Column 80).

Consult the terminal manual for verification of any other cursor address on the terminal display. Many application programs "read" the cursor position from the terminal to verify that the operator has followed the operating instructions properly. This is an important aspect of the test.

4.1.6.4 After the Enter form (Figure 4-3) is displayed, the terminal Bell will sound (if so equipped and enabled).

4.1.6.5 A Record of the test (Figure 4-3) will be printed automatically by the printer attached to the terminal after the terminal Bell sounds. For terminals that do not contain a printer this operation is ignored.

4.1.6.6 The printed record may contain *additional operator* entered data such as Circuit Number, Data Rate, etc.

Although the "form" in Figure 4-2 is protected except for the three indicated fields, an AID echo will open up an additional nonprotected field beginning two character positions after the aid symbol.

- a. Operate the RQTST key.
- b. After filling in the three standard fields the operator should position the cursor to "1" in the test message.
- c. Move the cursor down nine rows to the bottom row and operate the PA1 or PA2 key.
- d. Observe the AID symbol is echoed as an *addition* to the form.
- e. Move the cursor "right" two strokes and it will be at the Home location.

```
ROW
1  [ ] ( ( 3270 75 TEST
2
3
4
5
6          NON-DIS
7
8  .....NON-PROTECTED.....
9          > ATL RES CO <
10         > 12 17 1977 <
11         > MS T JONES <
12
13
14
15
16
17
18 INTERSHAKE and INTERVIEW Join Together To Quickly Simulate and Analyze Your Data
19 Communications Problems! 1234567890 #&@/-.....
20 .....
21 .....
22 .....
23 .....
24 .....END OF TEST
```

**NOTES:**

1. Enter Key Symbol at cursor at Home position.
2. Cursor address (Row) character at position 1 "C" for Row 11.
3. Cursor address (column) character at position 2 "C" for Column 46.
4. NON-DIS on Row 6 was hidden before.
5. Fields on Rows 9, 10, 11 appear as entered.
6. Rows 18, 19 are highlight.
7. Row 19 Column 1 is a space (quickly identifies 80 character row above).
8. END OF TEST takes the last character position.
9. Bell rings.
10. Printer prints contents of CRT.
11. Row 24 of Dots checks for Pincushion.

Figure 4-3. Enter Response Display (after RQTST).

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- f. Up to 32 characters may be operator entered on the form until the protected "3270" field is encountered.
- g. Operation of ENTER will echo the Form as shown in Figure 4-3 with the additional descriptive operator entered data on the top line as shown in Figure 4-3a.

### NOTES

1. The ENTER and cursor address characters normally displayed at the home position are written over and do not appear.
2. The AID symbol is overwritten by END OF TEST.
3. Terminals that position all "write" instructions at the home locations require entering AID at home and this shortens the space available.
4. Other nonprotected fields can be established with any AID Echo'd anywhere on the screen.
5. Care must be exercised not to enter more than 46 characters since the block will then exceed 256 total characters. See Paragraph 4.5.1.

4.1.7 The test will continue with a general poll, etc., except the keyboard will be locked out. The operator should operate the Reset/Local key to resume the test.

Refer to Paragraph 5.0 for various edit options to terminate the test, restart the test, or perform an "ENDURANCE" checkout.

4.1.8 At the end of the test the operator may select the local print mode of the terminal (if so equipped) to obtain a printed record of the test as shown in Figure 4-3.

### 4.2 Operator Sequence 3275

This paragraph describes the *deviation* to the 3270 procedure given in Paragraph 4.1.5 required for the 3275. Figure 4-4 shows the flow chart of operation.

4.2.1 Operate the Request Test (RQTST) key. Momentarily AID 1 will be displayed.

The test message will begin immediately to be written on an unbuffered CRT, and when complete, the STATUS LED will illuminate on the 3275 panel momentarily. On a buffered terminal, only the STATUS light will blink on.

The operator must operate the RQTST key again and observe that the form is displayed and the STATUS light did *NOT* blink on.

Each operation of RQTST will alternate a bad message, then a good message, than a bad message, etc.

```
Row
1  CKT 43K16Y-4  ADRS ABA  4.8KBS  3270 75 TEST
2
3
4
5
6                      NON-DIS
7
8  .....NON-PROTECTED.....
9                      > ATL RES CO <
10                     > 12 17 1977 <
11                     > OP T JONES <
12
13
14
15
16
17
18  INTERSHAKE and INTERVIEW Join Together To Quickly Simulate And Analyze Your Data
19  Communications Problems! 1234567890 #&@/-.....
20  .....
21  .....
22  .....
23  .....
24  .....END OF TEST
```

Figure 4.3a. Enter Response Display (after RQTST).

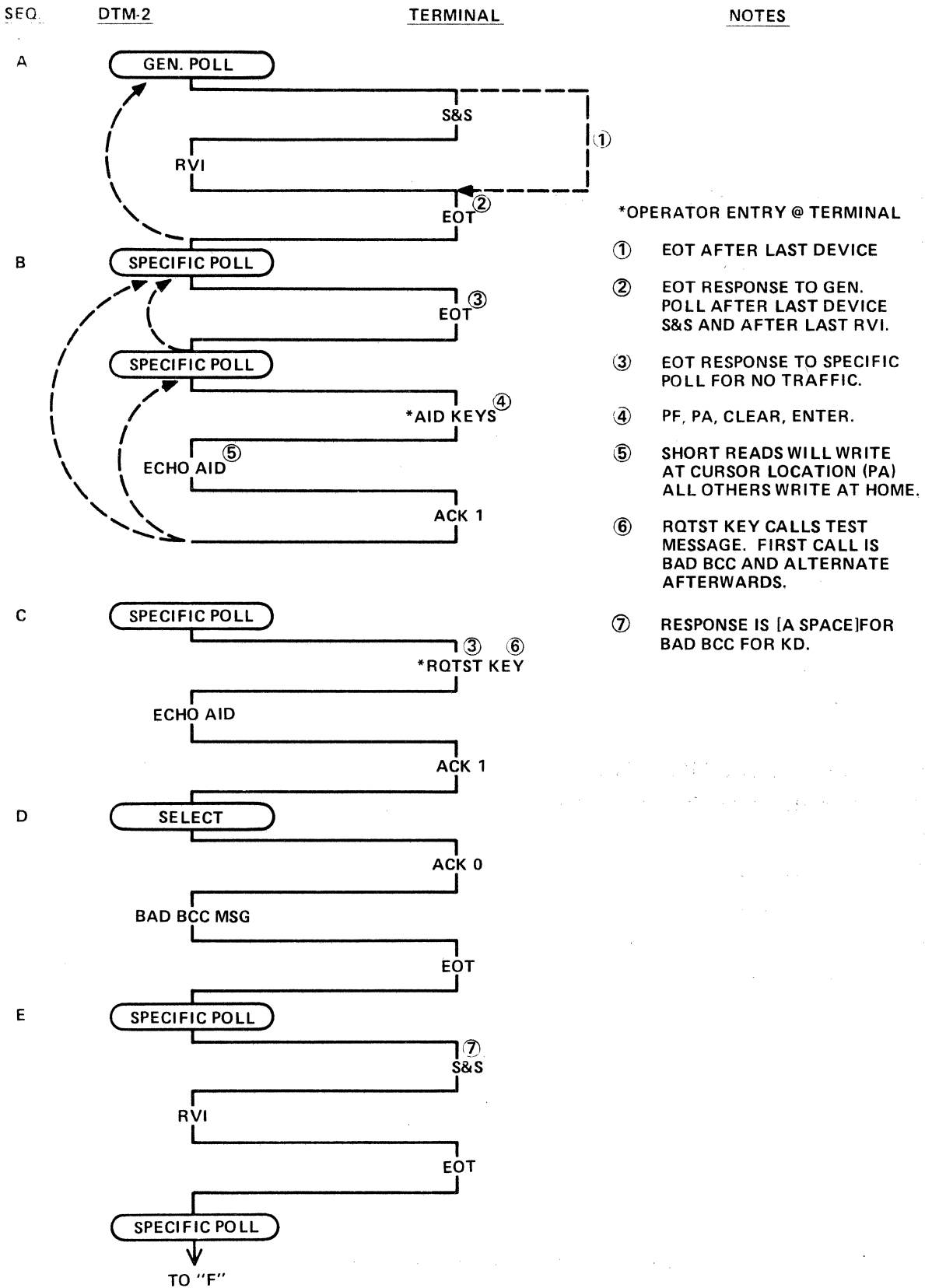


Figure 4-4. 3275 Flow Sequence (One Device).

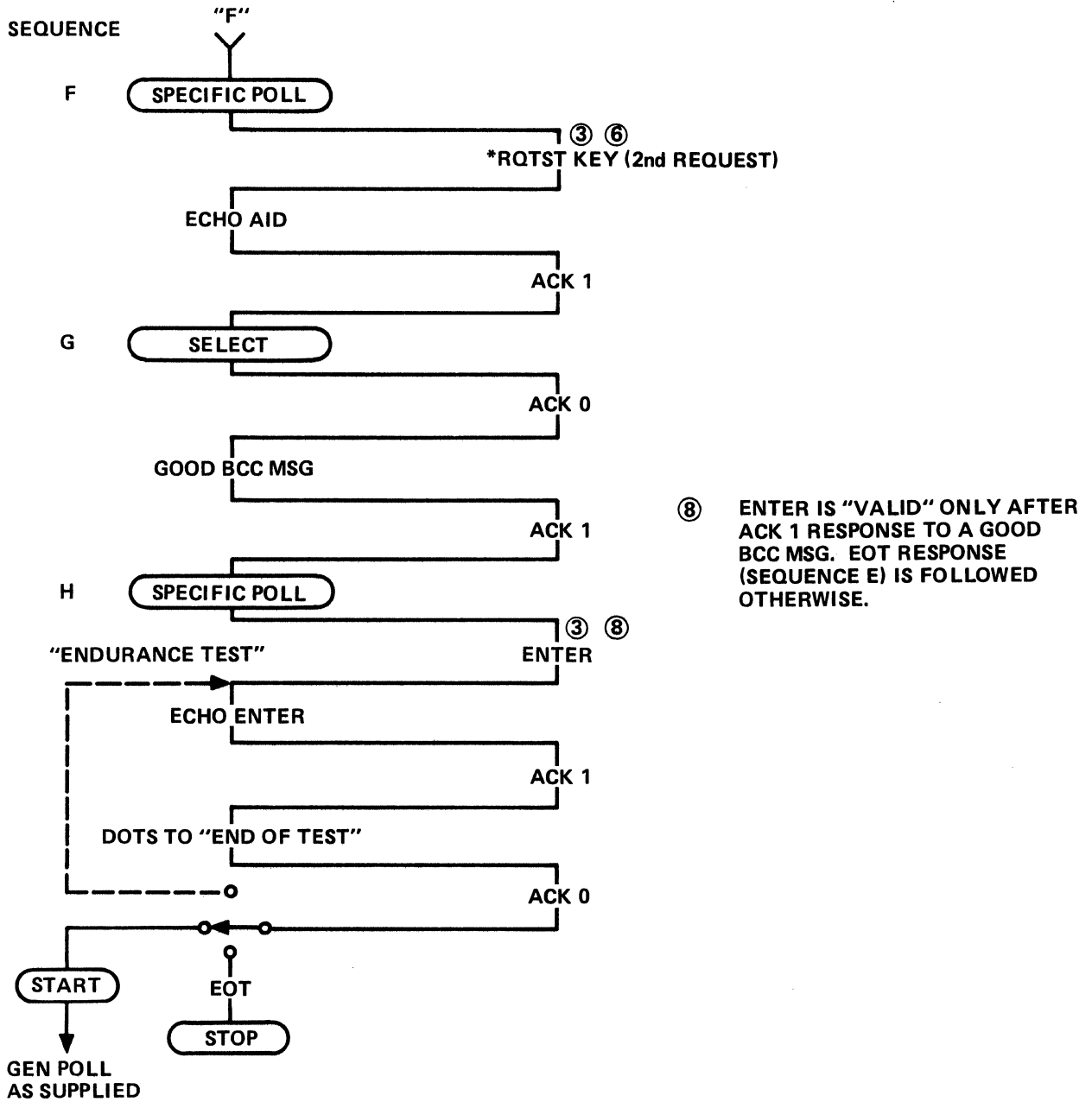


Figure 4-4. 3275 Flow Sequence (Continued).



#### 4.3 Indicators: 3275

The 3275 terminal contains an indicator panel. The major communication-oriented indicators are described below for the BISYNC, non-dial models.

SYSTEM READY, terminal and signal source are connected together.

SYNC SEARCH, blinks during communication.

SELECTED is on when the CRT is being addressed by the CPU, e.g., during receive message.

INPUT INHIBITED is on when the keyboard is locked out due to CPU direction or operator error, such as trying to type characters on a protected part of the display. Operate the RESET key to enable the keyboard. In the "Endurance" test, the keyboard is locked out to prevent interruption of the test.

TRANSMIT is on when the terminal transmits. Observation of transmit should show a wink for each poll answered.

STATUS is on for problem conditions within the terminal, e.g., for a received BCC error.

#### 4.4 Auto-Interactive Mode

Set up of the DTM-2 determines whether communication is required between the 3270 operator and the DTM-2 operator.

4.4.1 In the AUTO mode, the DTM operator only sets up and starts the test for the 3270 operator. The poll rate is set to 200 ms. Refer to Paragraph 5.9.

The 3270 operator can control the tests if all the tests perform properly. Tests may fail in two ways.

A "soft" failure will be detected by the operator (and perhaps not be detected by the DTM). An example of a soft failure would be an echo of the wrong AID key such as the PF 2 key displaying AID 3.

A "hard" failure is detected by the DTM and terminates the test. The test can only be restarted by the DTM operator. A hard failure will automatically freeze the last transmission from the DTM and the response from the terminal.

Specifics of where the test failed (supplied by the 3270 operator to the DTM operator) will permit the DTM to be set up in the INTERACTIVE mode for detail diagnostics of the protocol by the DTM operator.

Response time measurements and other protocol details are displayed to the DTM operator in the AUTO mode to verify the test progress.

4.4.2 In the INTERACTIVE mode, the 3270 operator performs *all* of the same actions; however, each transmission from the DTM is *manually released* by the DTM operator. The DTM-2 operator is in control of the test and "interacts" with the DTM as well as with the terminal operator.

Verbal communication is normally necessary in this mode, though not essential since the 3270 responses displayed on the INTERVIEW show:

- a. What key was operated
- b. The contents of the 3270 display.

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A precaution is necessary when using the interactive mode. If the operator delays in releasing the next message to the terminal for greater than *3 seconds*, the terminal may time out and respond with ENQ (except after an EOT from the DTM). The DTM will interrupt itself when receiving an ENQ and reply with RESET & GEN POLL.

### 4.5 Additional Tests

#### 4.5.1 256-Character Block

The terminal will automatically limit transmitted text to a maximum size of 256 characters per block. A "full" block of 256 characters will end with ETB instead of ETX. This INTERSHAKE test will withhold its response to an ETB from the terminal. After the terminal senses that 3 seconds has elapsed without a response, the terminal will send an ENQ. INTERSHAKE will detect the ENQ and reply with a "reset and general poll". The terminal will then resume normal EOT replies to polls.

#### Terminal OPERATION

- a. Operate CLEAR and observe AID \_\_ on the terminal.
- b. Move cursor 2 characters to the right into the start of the NONPROTECTED field of the Display.
- c. Operate the "." (period) key in the repeat mode to write 4 lines of dots on the display. Approximately 320 characters of text are now on the screen.
- d. Operate ENTER (S/R) to send the first 256-character Block. The data paths will then become quiet for 3 seconds, then Polling will resume *ONLY* if the terminal times out and generates an ENQ.
- e. The DTM operator will observe on the INTERVIEW the 256-character message ending with ETB followed by the ENQ which resumes the normal poll response.
- f. Operate CLEAR on the terminal and observe the Echo'd AID \_\_ as this test cycle is now complete.

#### 4.5.2 Three-Second Terminal "ENQ" Recovery

When the terminal does not receive an anticipated reply within 3 seconds, an ENQ will be generated. The terminal will repeatedly send ENQ at 3-second intervals unless the last transmission received ended with EOT. A technique for verifying this ENQ recovery is described in Paragraph 4.5.1.

### 5.0 DTM-2 OPERATION (AND EDITING)

This program is a rather inclusive general purpose program. Extensive features are built in that they may be enabled or disabled, or parameters may be edited, etc. Table 5-1 lists the Edit options described in Paragraphs 5.2 through 5.11. Edit steps are identified in the program in Appendices A and B.

EDITING THE PROGRAM. The address of the step to be edited is written as STEP-PAGE and HEX ( ) to accommodate the widest possible user experience and familiarity with numbering systems.

ADDRESS EXAMPLE: 63-1 (7F)  
STEP – PAGE – (HEX)  
63 – 1 – (7F)

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As a further aid to the user the data or function to be edited is enclosed ( ) on the program listings in Appendices A and B.

### 5.1 Loading the Program

This program requires that the DTM operate in the 256-step cell mode. Internal switch #5 must be ON and the LEFT decimal ON at the PAGE display to indicate the 256-step cell is selected. (The decimal OFF indicates the 128-step cell mode.)

5.1.1 The program may be manually loaded into cells C/D, E/F, or G/H. The program should not be *manually* loaded into cell A/B under normal situations as cell A/B is reserved as a scratch pad for all stored tests.

5.1.2 This test is available as special firmware PROMS which can be installed as one of the INTERSHAKE STORED TESTS. This test is supplied in cell G/H. Operating the DTM with the LOAD toggle in AUTO will place the program into RAM cell A/B where the program may be edited. Since RAM A/B is non-volatile (has battery backup), an edited program can be saved until another stored test has to be called into A/B.

#### NOTE

As soon as the stored test program has been loaded, move the LOAD toggle to MANUAL.

### 5.2 Terminal ADRS – The 3270 Protocol Utilizes Three Addresses

SPA Station poll address (e.g., to master controller)  
 SSA Station select address (e.g., for device controller)  
 DA Device address (for each device on the controller)

These addresses are manually entered into the DTM program for the terminal/controller(s) under test. Only one device can be tested at a time with this program. Other programs can automatically sequence through controllers and devices for other tests.

The program is supplied with address number 0 for SPA, SSA, DA.

5.2.1 Station addressing uses the following sequential assignments where station number "0" corresponds usually to the CPU site test terminal (so it can access any "port"):

Number	SPA/DA			SSA		
		*	**		*	**
0	SP	40	20	-	60	BD
1	A	C1	C1	/	61	2F
2	B	C2	42	S	E2	D3
3	C	C3	C3	T	E3	54
4	D	C4	44	U	E4	D5
5	E	C5	45	V	E5	D6
6	F	C6	46	W	E6	57
7	G	C7	C7	X	E7	58
8	H	C8	C8	Y	E8	D9
9	I	C9	49	Z	E9	5A
10	[	4A	5B		6A	7C
11	.	4B	AE	,	6B	2C
12	<	4C	BC	%	6C	25

\*EBCDIC (HEX), \*\*ASCII (ODD parity) (HEX).

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5.2.2 *ADDRESS ENTRY* of the address characters into the test program is easily accomplished by "scrolling." Function 98 (No-Op) precedes each address entry to facilitate scrolling to the desired location. Select Function 98 and Data F0 on the DTM panel switches, operate STEP and then UP. The program will display Step 12 Page 0. Stroke UP once to display Step 13 for the *general poll*.

DTM Address		As Supplied		Enter
Step	Page	(HEX)		
13	— 0	(OD)	40	SPA
14	— 0	(OE)	40	SPA
Operate UP to scroll to <b>Specific Poll</b>				
22	— 0	(16)	40	SPA
23	— 0	(17)	40	SPA
24	— 0	(18)	40	DA
25	— 0	(19)	40	DA
Operate UP to scroll to <b>Select</b>				
37	— 0	(25)	60	SSA
38	— 0	(26)	60	SSA

5.3 **REMOTE: Test Modem**

An outline of the DTM panel is set up as referenced to Figure 5-1.

- Zone 1: Bit rate — EXTERNAL  
Sync  
Info Bits — 8 (ASCII = 7)  
Parity — None (ASCII = odd)
- Zone 2: EIA/Mil to EIA  
Power ON
- Zone 3: Control EIA to OFF  
TEST MODEM  
MON SIGS OUT TO NORMAL
- Zone 5: RTS OFF (7x)  
CTS OFF  
DSR OFF  
RLSD OFF  
DTR ON  
RI OFF
- Zone 6: Counter Input — Duration 8x  
Duration xxx. Milliseconds

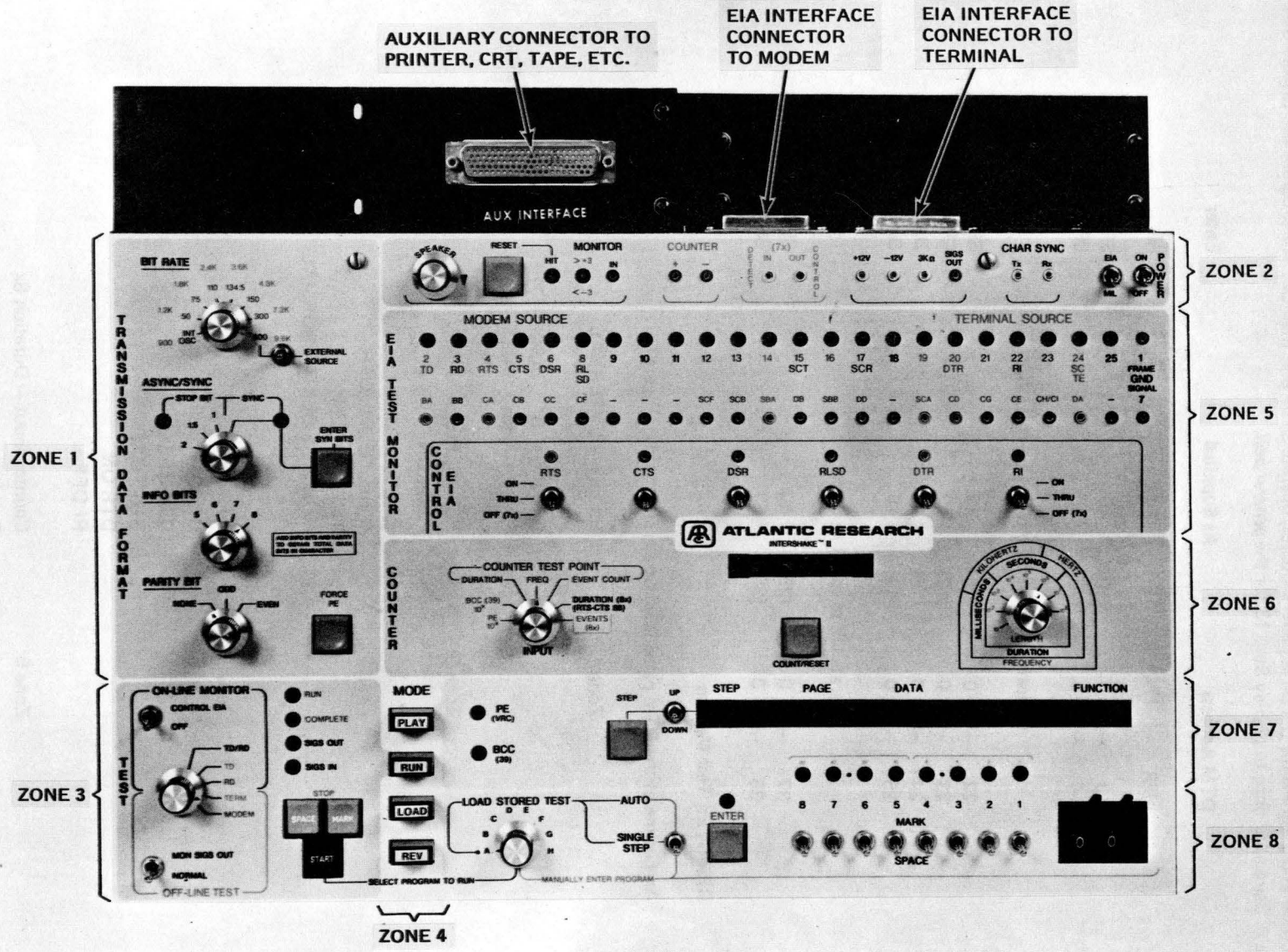


Figure 5-1. DTM-2 Front Panel Controls and Indicators.

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Internal Controls: Select 256-step (switch 5). The 256-step program mode is indicated by the LEFT hand decimal for the PAGE display ON.

As supplied, the program controls the modem interface and measures TERMINAL response time. No editing is required for INTERSHAKE to test a remote terminal via a modem.

**5.4 LOCAL: Test Terminal**

Set up the DTM panel controls is referenced to Figure 5-1.

Zone 1	Bit rate – 4800 (or per system spec) Sync Info Bits – 8 (ASCII = 7) Parity – None (ASCII = odd)
Zone 2	EIA/Mil to EIA Power – ON
Zone 3	Control EIA to OFF TEST TERMINAL MON SIGS OUT to NORMAL
Zone 5	RTS OFF CTS ON DSR ON RLSD ON DTR OFF RI OFF
Zone 6	Counter Input – Duration (8x) Duration – xxx Milliseconds

Internal Controls: Select 256-step (switch 5). The 256-step program is indicated by the LEFT hand decimal for the PAGE display ON.

5.4.1 For FDX operation directly connected to the terminal the following program instruction should be edited. As supplied, the program controls the modem interface and measures terminal response time.

AS SUPPLIED				EDIT	
ADRS	DATA	FUN			
16-2 (90)	10	73	Det RLSD OFF	02-98	NO-OP

5.4.2 To simulate SWITCHED CARRIER, some terminals require CTS control as an active signal. The following program instructions should be edited. CTS toggle should also be positioned to OFF (7X).

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ADRS	DATA	FUN	EDIT
16-2 (90)	10	73 DET RLSD	80 73 DET RTS OFF
17-2 (91)	80	70 RAISE RTS	40 71 DROP CTS
19-2 (93)	40	72 DET CTS	02 98 NO-OP
35-2 (A3)	12	83 12 BITS	30 84 3 SEC INT
37-2 (A5)	30	84 3 SEC	0C 97 ENABLE TIME INT
38-2 (A6)	0C	97 ENABLE INT	80 72 DET RTS ON
39-2 (A7)	80	71 DROP RTS	40 70 RAISE CTS

### 5.5 Auto Mode

In the auto mode, the DTM operates in an unattended manner once the operator presses START (after setup per Paragraphs 5.3 and 5.4).

5.5.1 Operator sequence for the auto mode is outlined in Paragraph 4.0. If the test terminates due to a fault, the DTM operator may have to "restart" the test. The DTM-2 operator should, however, observe the INTERVIEW CRT display for any abnormalities.

5.5.2 INTERVIEW: Each transmission sequence is displayed. Transmit is displayed first (low intensity) followed by the receive (normal intensity). Refer to Figures 5-2 and 5-3. Certain characters or groups of characters in the receive messages are reverse imaged to call them to the attention of the operator.

Each sequence will remain displayed for 200 ms, then the display will clear and another sequence appear. Edit of one step will disable the INTERVIEW CRT clear to display a screen full of transmissions. The poll rate of 200 ms may also be altered. Refer to Paragraphs 5.6.2 to EDIT CRT and 5.9 to EDIT POLL RATE.

### 5.5.3 INTERVIEW Setup

HDX/FDX toggle = HDX  
CODE = EBCDIC (or ASCII)  
FREEZE = RUN  
HIGHLIGHT = 00 (or ID to enhance the attribute GS characters)  
PAGE = 1 (1 + 2 for message capture)  
TOTAL SCREEN = TEXT  
CONTROL CHARACTERS = ABBREV

### 5.5.4 INTERVIEW Display

Figures 5-2 and 5-3 show the characters displayed on the INTERVIEW for the transmit sequences and the receive sequences. Full abbreviations are used, e.g., EOT, whereas the font displays E<sub>T</sub>. Each character in these figures is also presented in HEX for EBCDIC and ASCII.

### NOTES

1. Pad character symbol is shown.
2. Ending Pad on transmit sequences does not display.
3. IGNORE the transmitted BCC on EBCDIC. One random character will be displayed after ETX.

GENERAL POLL (w/RESET)

	S <sub>Y</sub>	S <sub>Y</sub>	S <sub>Y</sub>	E O T	///	S <sub>Y</sub>	S <sub>Y</sub>	S <sub>Y</sub>	S P A	S P A			E N Q
EBCDIC	32	32	32	37	FF	32	32	32	/	/	7F	7F	2D
ASCII	16	16	16	04	FF	16	16	16	/	/	A2	A2	85

SPECIFIC POLL (w/RESET)

	S <sub>Y</sub>	S <sub>Y</sub>	S <sub>Y</sub>	E O T	///	S <sub>Y</sub>	S <sub>Y</sub>	S <sub>Y</sub>	S P A	S P A	D <sub>A</sub>	D <sub>A</sub>	E N Q
EBCDIC	32	32	32	37	FF	32	32	32	/	/	/	/	2D
ASCII	16	16	16	04	FF	16	16	16	/	/	/	/	85

SELECT (w/RESET)

	S <sub>Y</sub>	S <sub>Y</sub>	S <sub>Y</sub>	E O T	///	S <sub>Y</sub>	S <sub>Y</sub>	S <sub>Y</sub>	S S A	S S A	D <sub>A</sub>	D <sub>A</sub>	E N Q
EBCDIC	32	32	32	37	FF	32	32	32	/	/	/	/	2D
ASCII	16	16	16	04	FF	16	16	16	/	/	/	/	85

RVI

	S <sub>Y</sub>	S <sub>Y</sub>	S <sub>Y</sub>	D L E	@	///								
EBCDIC	32	32	32	10	7C	FF								
ASCII	16	16	16	10	/	FF								

EBCDIC (SYMBOL) ASCII

FIELD / BC

Figure 5-2. Transmit Display.



MESSAGE

	S <sub>Y</sub>	S <sub>Y</sub>	S <sub>Y</sub>	S	.	.	.	.	.	.	.	.	.	.	.	.	.	E	B
				T	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
				X	.	.	.	.	.	.	.	.	.	.	.	.	.	X	C
EBCDIC	32	32	32	02	.	.	.	.	.	.	.	.	.	.	.	.	.	03	/
ASCII	16	16	16	02	.	.	.	.	.	.	.	.	.	.	.	.	.	03	/

MESSAGE CONTENTS  
REFER TO SECTION II, PARA 4

SEE NOTE 3

ECHO ENTER

	S <sub>Y</sub>	S <sub>Y</sub>	S <sub>Y</sub>	S	E	.	.	.	.	.	.	.	.	.	.	.	.	E	B
				T	S	.	.	.	.	.	.	.	.	.	.	.	.	T	C
				X	C	5	1	.	.	.	.	.	.	.	.	.	.	X	C
EBCDIC	32	32	32	02	27	F5	F1	.	.	.	.	.	.	.	.	.	.	03	/
ASCII	16	16	16	02	9B	B5	31	.	.	.	.	.	.	.	.	.	.	03	/

CONTENTS OF 3270 CRT THAT ARE MODIFIED ARE RECEIVED AND STORED IN DTM MEMORY WITH THE ADDRESS OF EACH FIELD.

INDIVIDUAL FIELD ATTRIBUTES ARE NOT ECHO'D.

SEE NOTE 3

AID ECHO

	S <sub>Y</sub>	S <sub>Y</sub>	S <sub>Y</sub>	S	E	1	2	G	/	S	P	A	I	D	G	Z	*	S	D	G	/	E	B
				T	S																		
				X	C																		
EBCDIC	32	32	32	02	27	F1	F2	1D	61	40	C1	C9	C4	1D	E9	/	40	13	1D	61	03	/	
ASCII	16	16	16	02	9B	31	32	9D	2F	20	C1	49	C4	9D	DA	/	20	13	9D	2F	03	/	

\* AID CHARACTER RECEIVED FROM 3270 AND STORED IN DTM MEMORY.

Figure 5-2. Transmit Display (Continued).

EOT (NO TRAFFIC)

	S <sub>Y</sub>	E O T	///	**
EBCDIC	32	37	FF	
ASCII	32	04	FF	

Device Available	B	SP
BCC Error (3275)	A	SP
Device Not Available	SP	&

TYPICAL RESPONSE

STATUS AND SENSE

	S <sub>Y</sub>	S O H	%	R	S T X	S P A	D A	S S 1	S S 2	E T X	B C C	///	**
EBCDIC	32	01	6C	D9	02	/	/	/	/	03	/	FF	
ASCII	16	01	25	52	02	/	/	/	/	83	/	FF	

AID REPLY - ("PF" KEY = LONG READ)

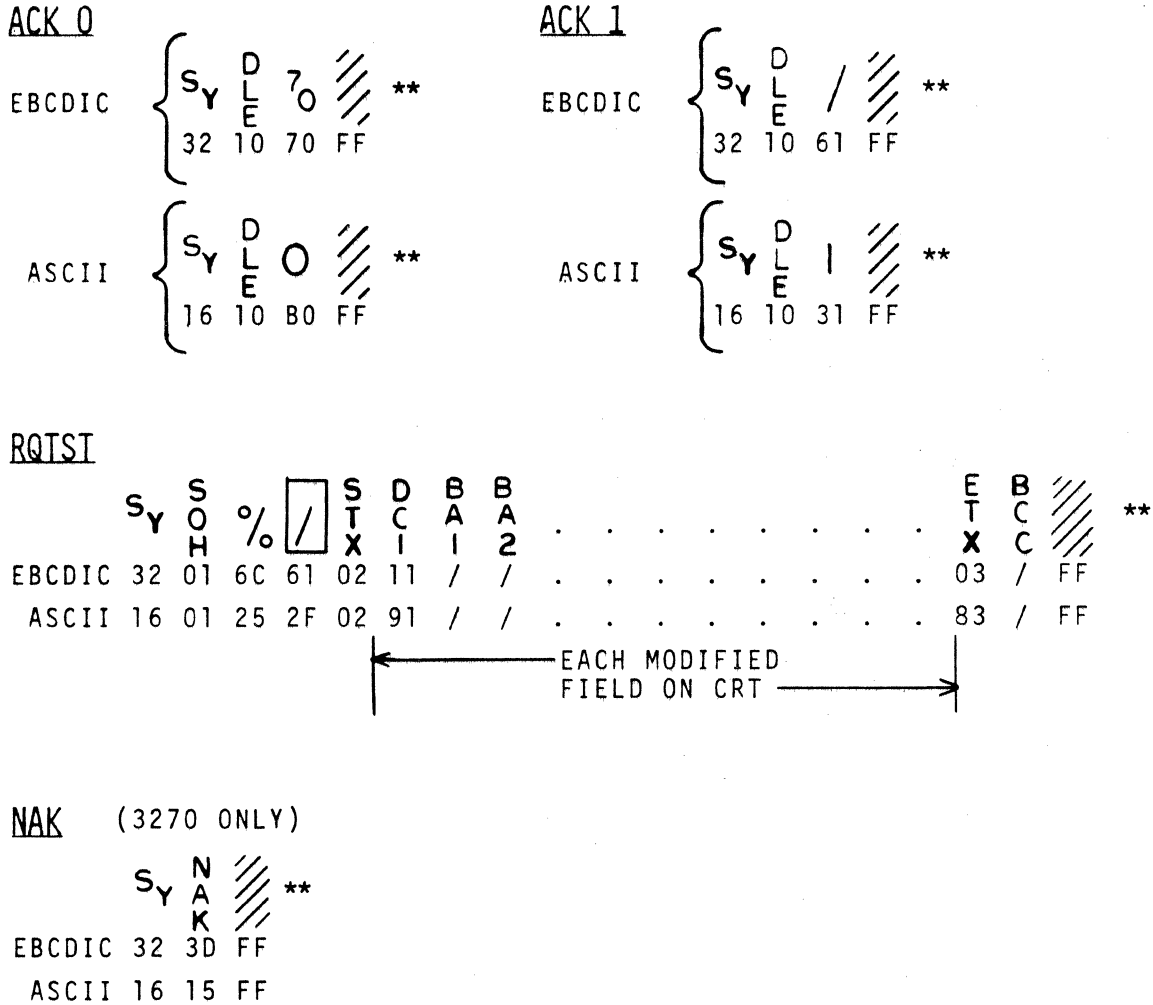
	S <sub>Y</sub>	S T X	S P A	D A	A I D	C A <sub>1</sub>	C A <sub>2</sub>	D C <sub>1</sub>	B A <sub>1</sub>	B A <sub>2</sub>	MODIFIED DATA ON CRT DISPLAYED HERE	E T X	B C C	///	**
EBCDIC	32	02	/	/	/	/	/	11	/	/	. . . . .	03	/	FF	
ASCII	16	02	/	/	/	/	/	91	/	/	. . . . .	83	/	FF	

CURSOR LOCATION      SET BUFFER ADRS FOR EACH DATA GROUP

AID REPLY - ("PA" AND "CLEAR" KEY = SHORT READ)

	S <sub>Y</sub>	S T X	S P A	D A	A I D	E T X	B C C	///	**
EBCDIC	32	02	/	/	/	03	/	FF	
ASCII	16	02	/	/	/	83	/	FF	

Figure 5-3. Receive Display.



\*\* NON PAD characters observed after one or more PAD symbols in the TEST MODEM configuration usually indicates that the receive modem may be strapped for "1-second holdover" or some combinations of "new sync" or "soft carrier turn off." Any pulses observed on the data leads will show up as "garbage characters" and may cause transient operational problems on the system. Normally when the receive signal terminates, RLSD will clamp the Rx lead mark (or in new sync . . . the clock will be clamped).

Figure 5-3. Receive Display (Continued).

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4. RECEIVE CHARACTERS ARE BRIGHTER than transmit characters.
5. The first 2 SYNC characters in a RECEIVE sequence are "absorbed" and are not displayed. The sequence shows *one* SY displayed depicting a circuit containing 3 SYNC characters.
6. All transmit characters are displayed (including SYNCs).
7. Reversed characters on the CRT to highlight specific receive sequences are boxed
8. The received BCC on EBCDIC is comprised of two characters. The received BCC on ASCII is only one character.
9. Refer to Section II, Paragraph 4.0, for description of the "non-protocol" character sequences in the message for control of the 3270.

### 5.6 Interactive Mode

In this mode, operation of the test is a coordinated interaction between the 3270 operator and the DTM operator. For diagnostic purposes, the DTM operator releases each DTM transmission manually and instructs the 3270 operator to perform specific key tasks associated with the fault condition.

5.6.1 Operational sequences outlined in Paragraph 4.0 can be used as a guide; however, the flow chart shows that certain steps can be repeated or deleted to more quickly focus on a problem.

5.6.2 Displayed data will be the same as shown in Paragraph 5.5.4. The data will remain for up to 3 seconds unless the STEP button is operated to release the next transmission. After 3 seconds, the terminal will time out and initiate an ENQ to which the DTM will respond with a reset and General Poll.

The operator may at any time manually freeze the INTERVIEW display.

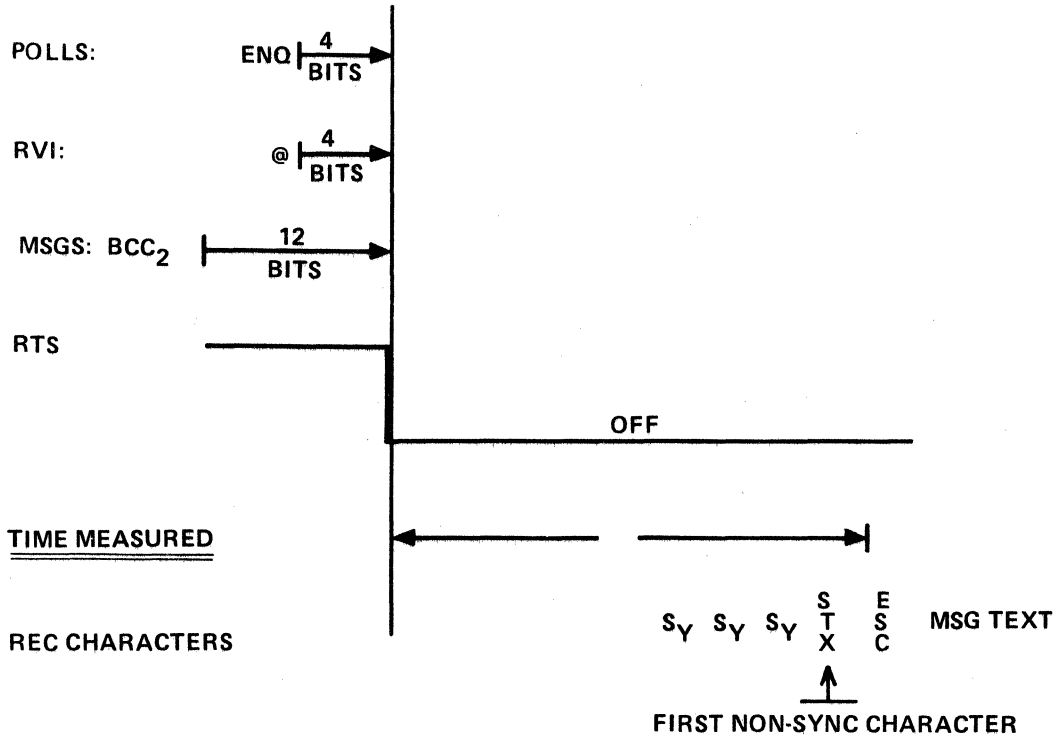
To obtain a full screen of data, the CRT CLEAR can be edited to disable.

ADRS	DATA	FUN	EDIT
13-2 (8D)	01	94	Clear CRT ON . . . . . 02-98 NO-OP

### 5.7 Time Measurement

5.7.1 Terminal Response time is measured (as the program is supplied). The measurement begins at the end of the transmit sequence and ends after the first NON-SYNC character that is received. The time, therefore, includes all system parameters: Modem, Ending PAD, leading SYNCs and *one* data character. Exact timing for each transmit sequence is shown below. Note that the delay between the last transmit character and activation of RTS is related to the bit rate.

Response time measurements will be encountered from 10 ms to 800 ms depending upon the terminal vendor, error checking techniques, buffer transfer method, etc. This is an important system parameter to advise the user.



5.7.2 RTS-CTS Delay Measurement may be accomplished by editing two steps in the program.

AS SUPPLIED			FOR RTS/CTS TIME EDIT TO	
ADRS	DATA	FUN		
18-2(92)	02	98	NO-OP . . . . .	01-87 Start Timer
36-2(A4)	01	87	Start Timer . . . . .	02-98 NO-OP

- Select counter to "Duration (8x)"
- Select range to the appropriate delay anticipated, e.g., xxx milliseconds or xx.x milliseconds if the maximum delay is expected to be less than 100 ms.

5.8 Endurance Test

The test returns normally to a general poll after completion. A simple PASS-FAIL endurance test can be implemented to repeat blocks up to 10<sup>8</sup> times. By editing only six steps, the DTM will write a predetermined number of alternating blocks of data to the 3270 and verify the ACK 0, ACK 1 response. An erroneous ACK response will stop the test. Using the front panel counter to select the number of received ACKs, the endurance test can run for 10 to 10<sup>8</sup> blocks. For example, the test will stop automatically "END" when 10<sup>3</sup> blocks are sent or when an incorrect ACK occurs. Actually every transmission is included in the block count so that the ENDURANCE test can be run only with polling. Operate the counter reset key on the DTM when the "form" is echo'd to restart the counter to count only ACK responses.

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Editing of the program is described below:

ADRS	AS SUPPLIED		FUN	EDIT/ENTER	
	DATA				
18-2 (92)	01		87 (EDITED)	02 98	NO-OP
36-2 (A4)	01		87 (EDITED)	02 98	NO-OP
38-2 (A6)	0C		97 ENABLE INT	0B 97	END = INT
43-2 (AB)	08		97 DISABLE INT	00 85	ADVANCE BASE COUNT
27-3 (DB)	00		41 PRESET	55 41	PRESET ECHO ENTER
00-0 (00)	50		47 MSG = 0	7F 40	JUMP TO END

- Select counter to "EVENTS IN 10<sup>x</sup>".
- Select counter range to 10<sup>3</sup> and test will stop after 1000 transmissions from the terminal.

Displayed during the endurance test will be the ECHO ENTER message (which begins with an *erase/write*) followed by END OF TEST (which begins with a write). The overall result will be a flickering END OF TEST message because it is erased during ECHO ENTER and must wait one Poll Rate delay to be displayed. Visual effects differ according to the poll rate and whether the 3270 is buffered or not. The operator is able to observe that the test is in process – and the keyboard of the 3270 will be locked out.

The terminal must calculate the BCC and check it before the ACK response is generated. This will exercise the terminal logic rather well. Depending upon the manufacturer's design, a variation in response time may be observed, since one message is longer than the other.

Termination of the endurance test is described to stop at END; however, it could be edited to resume with the general poll.

**5.9 Poll Rate**

The program is supplied with a 200 ms poll rate. The poll rate is determined by a delay between the last received character and the beginning SYNC character transmitted by the DTM. After the delay, the INTERVIEW CRT is cleared so that the next transmit-receive sequence is displayed. Adjustment of the poll rate is achieved as follows:

ADRS	AS SUPPLIED		EDIT/ENTER							
	DATA	FUN								
12-2(8C)	02	82	200 ms . . . . .							
			<table border="0"> <tr> <td rowspan="3" style="font-size: 3em; vertical-align: middle;">}</td> <td>02-98</td> <td>NO-OP = MIN* DELAY</td> </tr> <tr> <td>30-82</td> <td>3 SEC = MAX DELAY</td> </tr> <tr> <td>00-00</td> <td>Manual Halt</td> </tr> </table>	}	02-98	NO-OP = MIN* DELAY	30-82	3 SEC = MAX DELAY	00-00	Manual Halt
}	02-98	NO-OP = MIN* DELAY								
	30-82	3 SEC = MAX DELAY								
	00-00	Manual Halt								

\*Total delay is obtained by adding three delays in the program:

ADRS		
10-2(8A)	15 ms	"Beep" for each transmission
12-2(8C)	– ms	Poll RATE
14-2(8E)	2 ms	Clear CRT screen delay
	17 ms	MINIMUM

The operator may desire to "NO-OP" all three delays under special test situations to simulate "zero turnaround delay by the CPU".

**5.10 Program Termination**

After the message is ECHO'd back to the 3270 display with "END OF TEST", the normal program returns to a general poll and leaves the 3270 keyboard locked out. The test may be repeated by operating the RESET or LOCAL key.

By editing one step, the program can terminate with END or automatically alternate two blocks for an ENDURANCE test. The ENDURANCE test is described in Paragraph 5.8.

Terminating the test with END shuts down communication with the terminal in an orderly fashion by sending EOT to the 3270. The 3270 will be inoperable because DTM polling will cease. Restarting the program is accomplished by operating START on the DTM.

**5.11 Audible Status Indication**

After each response is received from the 3270 (to a DTM transmission), an audible BEEP is produced. This chirp lasts 15 ms and contributes to the delay between receiving the last character of a 3270 message and initiating the response transmission by the DTM. The volume of the beep is not controlled by the DTM volume control, but it may be shortened.

AS SUPPLIED					EDIT/ENTER
ADRS	DATA	FUN			
10-2(8A)	15	80	15 ms . . . . .	}	04-80 "TICK" sound
					02-98 NO-OP deletes beep
					99-82 9.9 seconds maximum

**6.0 REFERENCE DOCUMENTS**

**6.1 Industry Sources**

Numerous documents are available covering the BI-SYNC protocol, and other communication techniques. A few of these documents are referenced for the aid of the reader.

General Information – Binary Synchronous Communications IBM # GA27-3004-2

IBM 3270 Information Display System Component Description IBM # GA27-2749-6

Operators Guide for IBM 3270 Information Display Systems IBM # GA27-2742-4

SYSTEM OPERATION FOR SYNCHRONOUS MODEL 40/4 DATA TERMINAL  
Teletype Corporation, Technical Reference Part 2, Article 7

EIA RS-232

**6.2 ARC Documents**

DTM-2 Operator's Manual, OM842

INTERVIEW Operator's Manual, OM860

DTM-2 Function List Folder, TP-148-3-77.

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Table 5-1. Edit Options.

AS SUPPLIED				EDIT/ENTER	
ADRS – DATA – FUN					
(FDX)					
<b>TEST MODEM</b>			<b>TEST TERMINAL</b>		
16-2(90)	10 - 73	DET RLSD OFF	.....		02-90 NO-OP
		Test Modem (Remote)			Test Terminal (Local)
		e.g., Switched Carrier			
		Select Test Modem			Select Test Terminal
		EXT Clock			Select Speed
		DTR ON			DSR, RLSD ON, CTS ON
		RTS OFF (Auto)			
(SWITCHED CARRIER)					
	ADRS	DATA	FUN	EDIT	
	16-2 (90)	10	73 DET RLSD	80 73	DET RTS OFF
	17-2 (91)	80	70 RAISE RTS	40 71	DROP CTS
	19-2 (93)	40	72 DET CTS	02 98	NO-OP
	35-2 (A3)	12	83 12 BITS	30 84	3 SEC INT
	37-2 (A5)	30	84 3 SEC	0C 97	ENABLE TIME INT
	38-2 (A6)	0C	97 ENABLE INT	80 72	DET RTS ON
	39-2 (A7)	80	71 DROP RTS	40 70	RAISE CTS
<b>AUTO MODE</b>			<b>INTERACTIVE MODE</b>		
12-2(8C)	02 - 82	200 ms POLL DELAY	.....		00 - 00 Halt = Interactive
		= Auto Mode			mode. DTM-2 operator releases
					each DTM-2 transmission manually.
<b>CLEAR CRT DISPLAY</b>			<b>CONTINUOUS DISPLAY</b>		
13-2(8D)	01 - 94	Clears CRT	.....		02 - 98 NO-OP for continuous
		before each DTM-2 transmission			display
<b>TIME MEASUREMENT</b>			<b>RTS-CTS DELAY</b>		
<b>MEASURE TERMINAL RESPONSE</b>					
18-2(92)	02 - 98	NO-OP	.....		01 - 87 Start Time
					RTS → CTS
36-2(A4)	01 - 87	Start Timer	.....		02 - 98 NO-OP
		to begin to measure time from			
		Last Transmitted Char to 3270 Reply			
<b>BEEP</b>					
10-2(8A)	15 - 80	15 ms Beep ON Time	.....		04 - 80 = "Tick"
		15 ms beep occurs before each			Variable to suit user
		transmission of DTM-2			



Table 5-1. Edit Options (Continued).

AS SUPPLIED ADRS - DATA - FUN			EDIT/ENTER		
ENDURANCE TEST			ENDURANCE TEST		
(SWITCH CARRIER) (Continued)					
ADRS	DATA	FUN	EDIT		
18-2 (92)	01	87 (EDITED)	02 98	NO-OP	
36-2 (A4)	01	87 (EDITED)	02 98	NO-OP	
38-2 (A6)	0C	97 ENABLE INT	0B 97	END = INT	
43-2 (AB)	08	97 DISABLE INT	00 85	ADVANCE BASE COUNT	
27-3 (DB)	00	41 PRESET	55 41	PRESET ECHO ENTER	
00-0 (00)	50	47 MSG=0	7F 40	JUMP TO END	
					<ul style="list-style-type: none"> <li>- Select Counter to "EVENTS in 10<sup>X</sup>" The interrupt on time out is disabled; therefore, the 3 sec. timer is not operable in the DTM. A failure of the 3270 to reply will cause the program to HALT.</li> <li>- Select Counter Range to 10<sup>3</sup> and test will stop after 10<sup>3</sup> Blocks (longer or shorter tests may be selected 10<sup>N</sup>)</li> </ul>
<b>POLL RATE*</b>			<b>VARIABLE RATE</b>		
12-2(8C)	02 - 82 Delay . . . . .		30 - 82	is max delay of 3 sec. between responses. Unless interactive mode is selected.	
	prior to DTM-2 transmission = 200 ms				
<b>PROGRAM TERMINATION (after "End-of-Test")</b>			<b>ECHO ENTER alternates with END OF TEST</b>		
27-3(DB)	00 - 41 Preset . . . . .		55 - 41	Presets Echo Enter Alternates 2 messages for "Endurance" Test (Checks ACK 0 - ACK 1 Response ... Stop by DTM-2. Keyboard of terminal is locked out)	
	to START/GEN POLL				
			<b>END</b>		
27-3(DB)	00 - 41 Preset . . . . .		7F - 41	End Terminates Test. DTM-2 Restarts Test.	
	to START/GEN POLL				

\*For total delay, add the delay at 3 address: 8A + 8C + 8E. (Refer to paragraph 5.9).

## SECTION II

### DTM-2 PROGRAM

#### 1.0 PROGRAM DESCRIPTION

The DTM program consists of several "program modules". Each program module treats a specific part of the protocol. There are two major types of modules: Receive and Transmit.

One single concept is the key to this program: All received signals are first processed by the "REC Module". After the REC module identifies the type of message being received, two further decisions are performed:

- a. Is this the correct response to the last transmit message, and
- b. What is the *next* transmit message to respond to this received message?

A second key ingredient in this program is the use of a transmit subroutine which contains all the "housekeeping" chores to control the RS-232 interface modem, Interview CRT, time delay measurements, polling delays and operator interaction. This subroutine is common to (precedes) all transmit sequences and includes SYNC characters, etc.).

A third key concept is the use of the fact that since all transmit modules are followed by the REC module, the factors normally considered "transmit shut down" can be assigned to the REC module. These features: delay after the last transmit character prior to controlling the RS-232 interface leads, time delay measurements, Interview CRT control, etc., occur only once . . . . in the REC module.

#### 2.0 PROGRAM MODULES

Figure A shows a Program Module Flow Chart. This flow chart shows the linkages of the major program modules relative to their inputs and outputs. JUMP instructions are used to direct the program flow between these modules.

This technique of using modules substantially simplifies the understanding (and writing/debug) of otherwise complex programs. Each module is written as a stand-alone program and is then incorporated into the overall program as determined by Figure A.

How big a module should be depends upon the purpose of the module. Note that the REC module in Figure A generates several outputs directly controlling send modules. There is, however, further processing of the DLE by the ACK module and further processing of SOH and STX by the S&S and AID module. Generally a module should have a defined input (or two) and a well-defined exit point (or several outputs).

Comparison of the Program Module Flow Chart in Figure A to the Interactive Flow Diagram in Figure A-1 will reveal a similarity. Figure A is oriented toward the program in the DTM and Figure A-1 is related to using the DTM program to generate the protocol sequence required to the 3270 terminal.

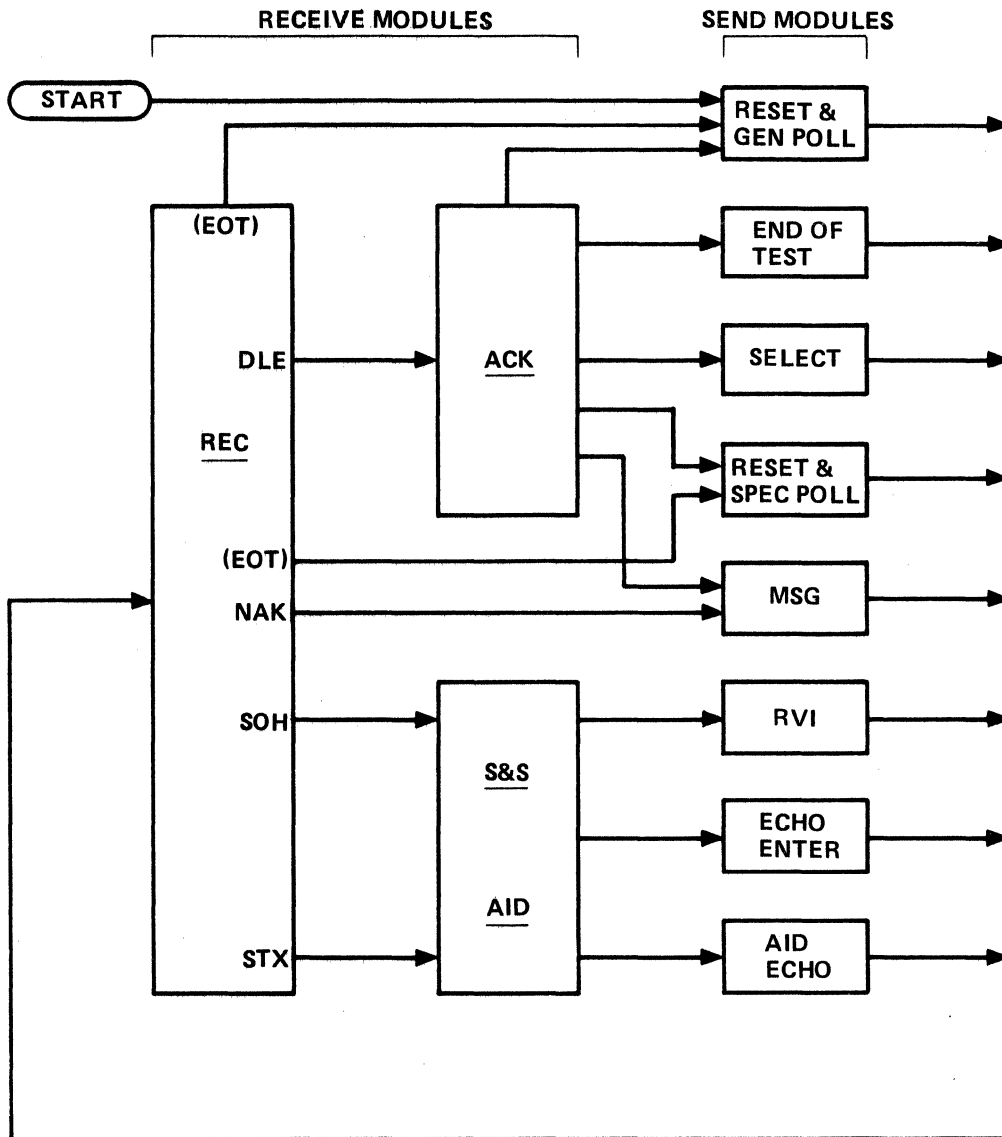


Figure A. Program Module Flow Chart.

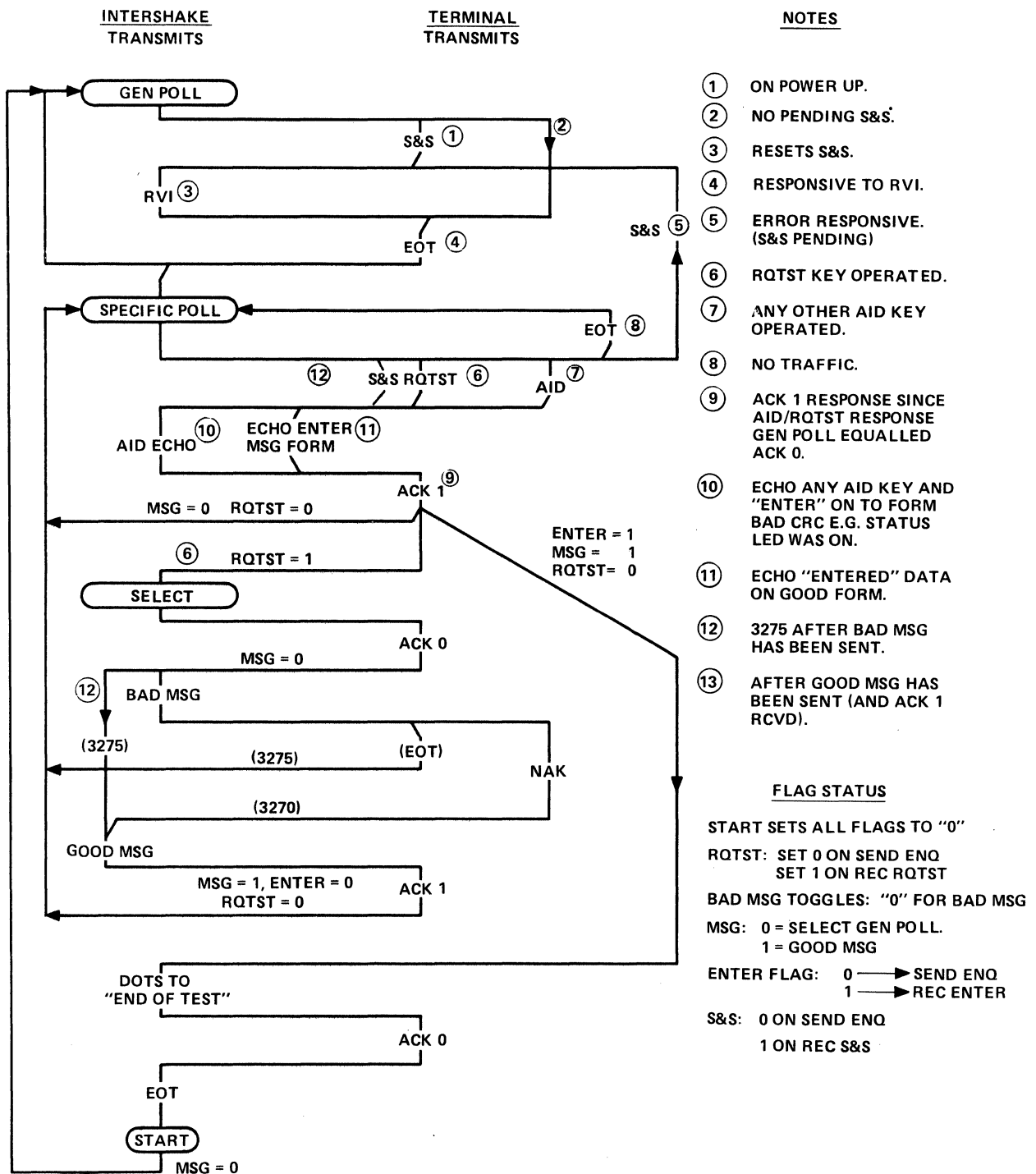


Figure A-1. Interactive Flow Diagram.

A further study of the individual program modules will indicate the sequential protocol criteria for decisions that are not labeled in Figure A, but implied in Figure A-1.

Figure A-2 shows the flow chart symbols used in the program modules. There are four major program criteria: (1) input/output, (2) actions, (3) conditional tests/JUMPS, (4) subroutines.

## 2.1 Receive Modules

There are three receive modules. Figure B-1 shows the REC module which is basic to the entire program concept. Note that there are a number of actions related to terminating the transmit operation prior to actually beginning to receive data. Processing of EOT depends upon the status of the S&S flag.

Figure B-2 shows the ACK module. This is perhaps the most complex module, since it both tests for a valid ACK 1-0 sequence and also determines where in the operational sequence (Figure A-1) the program is.

One of the prime features of the DTM-2 is the availability of 8 flags. These flags are set to "1" or "0" at various stages of the program and can be tested at any time to determine whether an action has or has not been previously taken.

Note that the termination of the test (right most path) can be edited from the General Poll to Echo Enter or END as shown by the dotted lines.

Figure B-3 shows the S&S and AID module. These are really two modules; however, they both share many common features and are joined to conserve program steps.

The S&S path sets flags denoting S&S or RQTST and controls the Interview to Reverse image to highlight this important character sequence for the operator.

The AID path and RQTST logs the AID character into a predetermined location of Results Memory so that the same character received from the 3270 will be echoed back to the 3270.

"Enter" aid must also be flagged to properly echo the data manually entered in the "form" on the 3270. Figure B-2 shows the ACK 1 path testing the enter flag so END OF TEST can be generated.

## 2.2 Transmit Modules

There are 8 basic transmit modules. The "Start TX" subroutine and "END" modules do not show up on the overall Program Module Flow Chart in Figure A because they are common to many segments of the program.

Figure C-1 shows the START TX subroutine. This subroutine is used for all transmit modules. All start-up controls are included in this subroutine for RS-232 control, time delay measurements, Interview CRT control, audible alert to the operator that a message was received, and operator interaction, e.g., HALT and poll rate. Most of the EDITING for various features is performed in this part of the program.

START TX has the primary function of generating 3 SYNC characters that start each transmission.

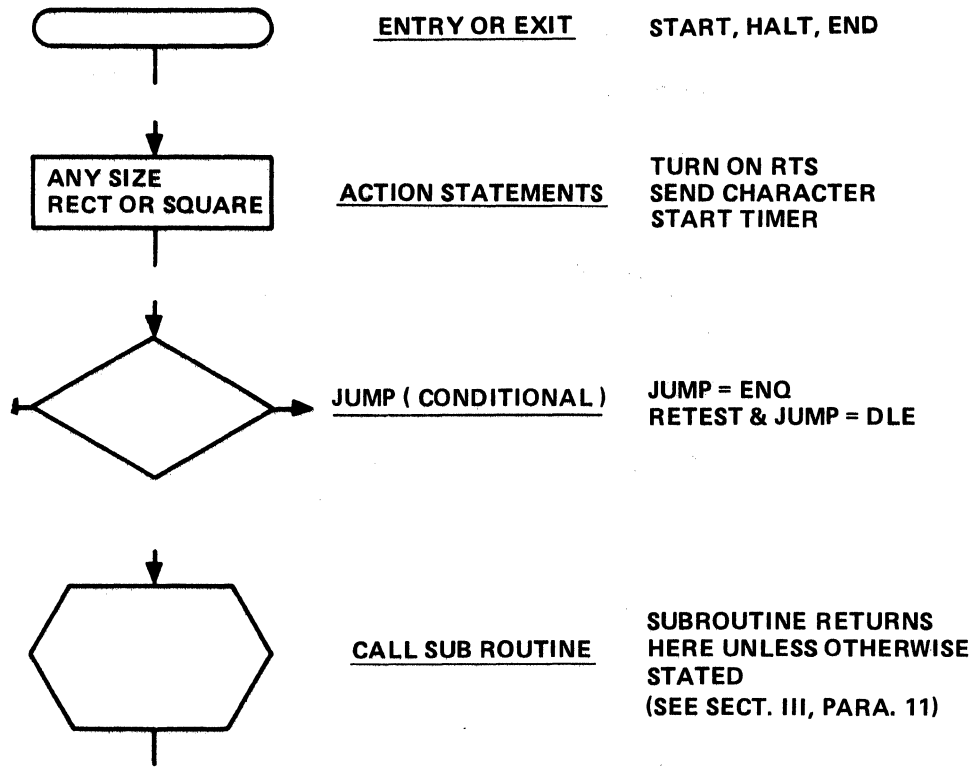


Figure A-2. Intershake Program Flow Chart Symbols.

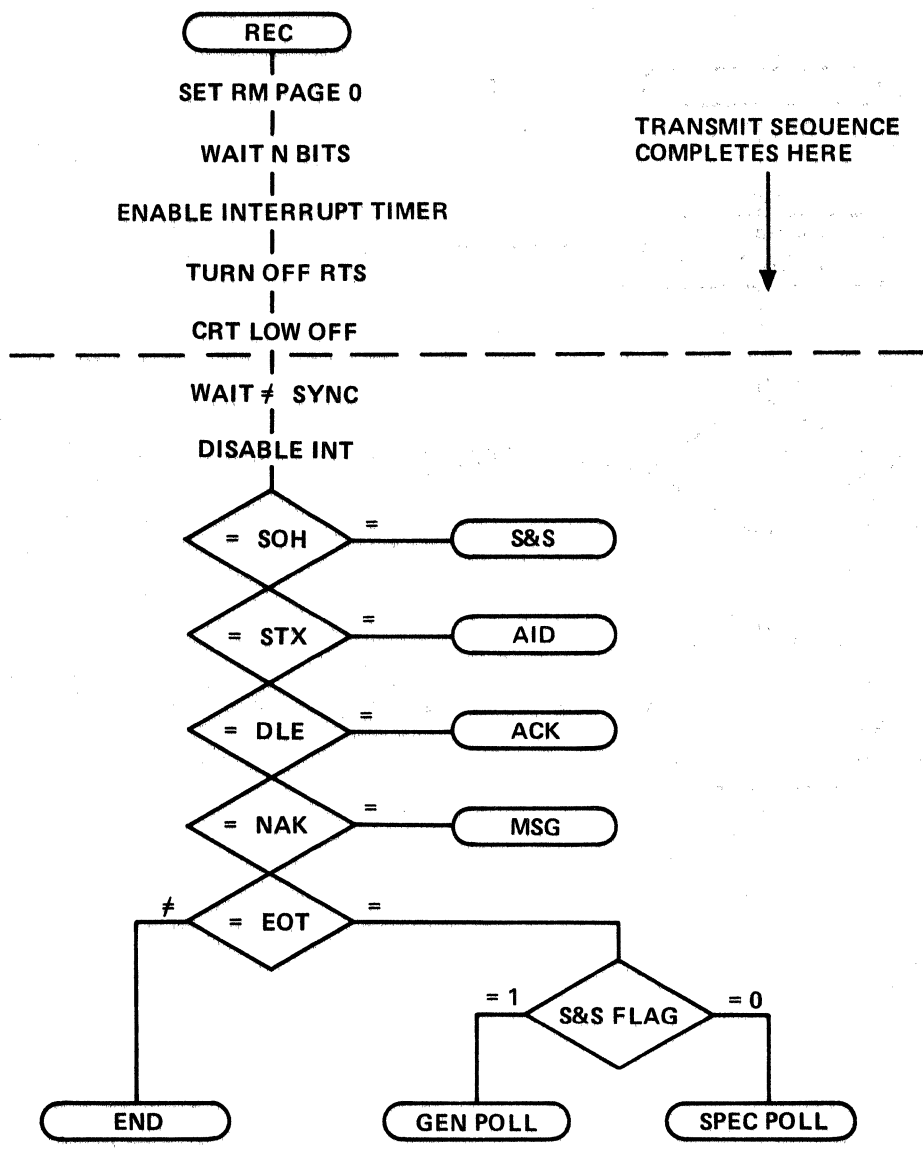


Figure B-1. Receive Module

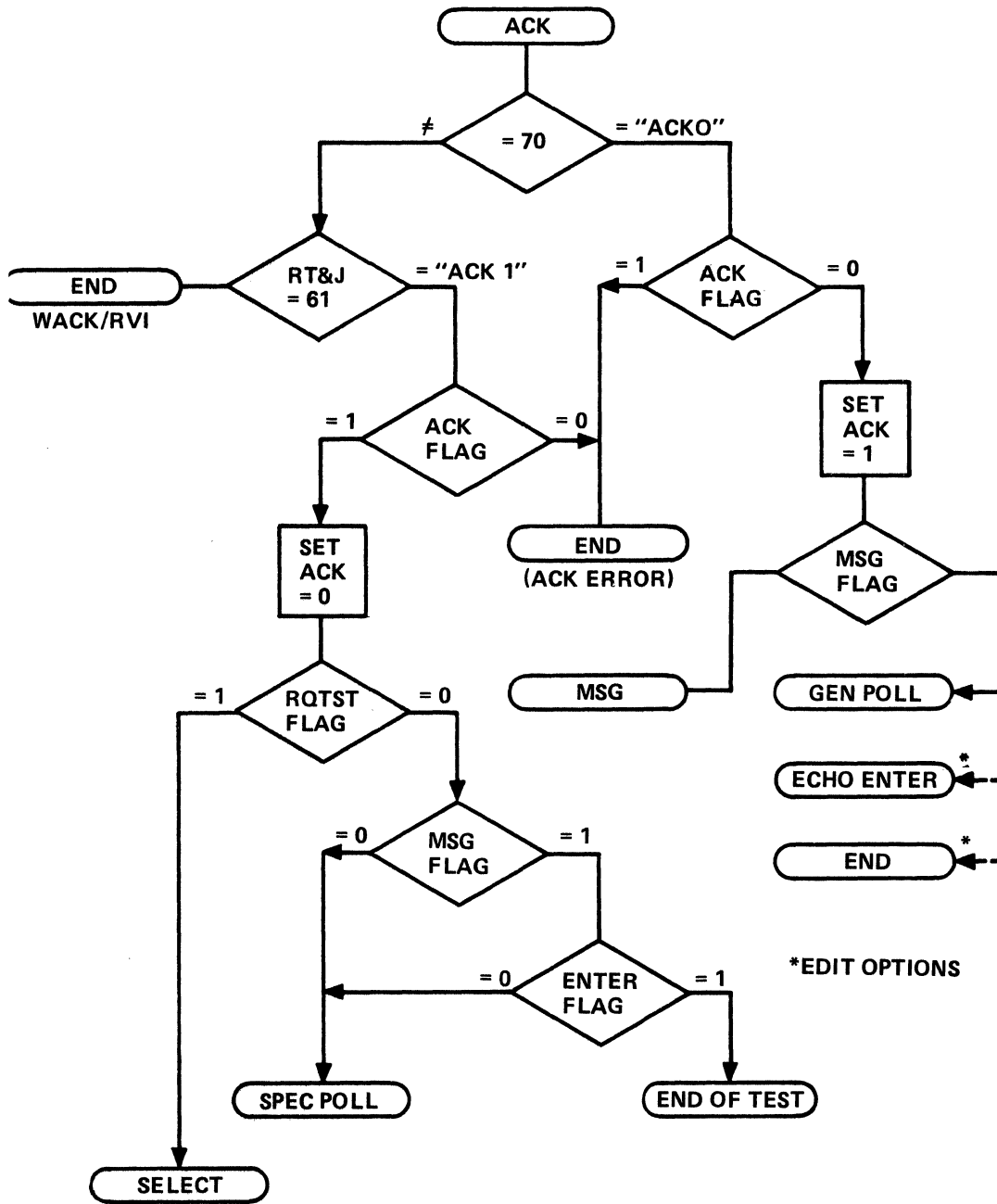


Figure B-2. ACK Module.



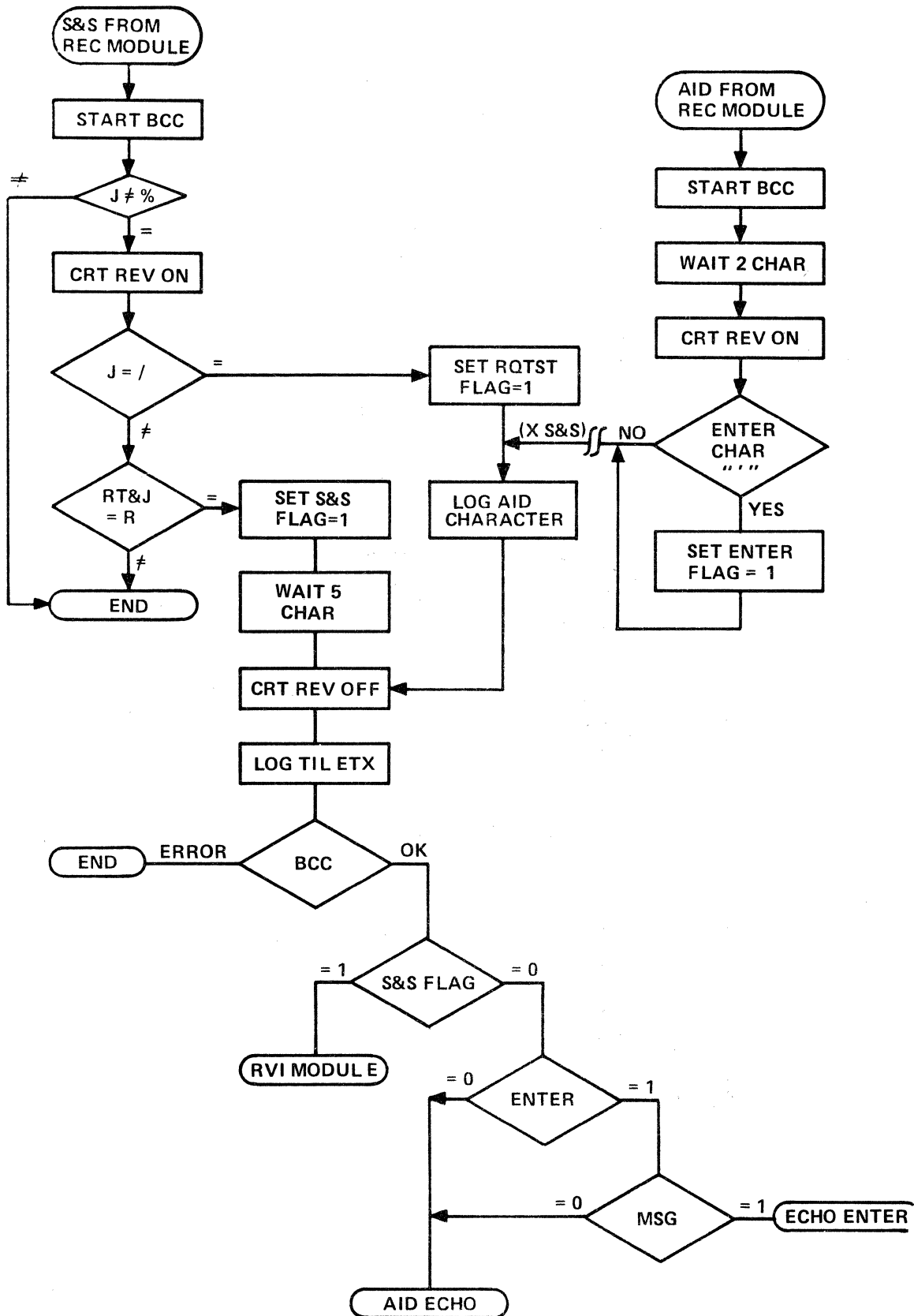


Figure B-3. S&S and AID Module.

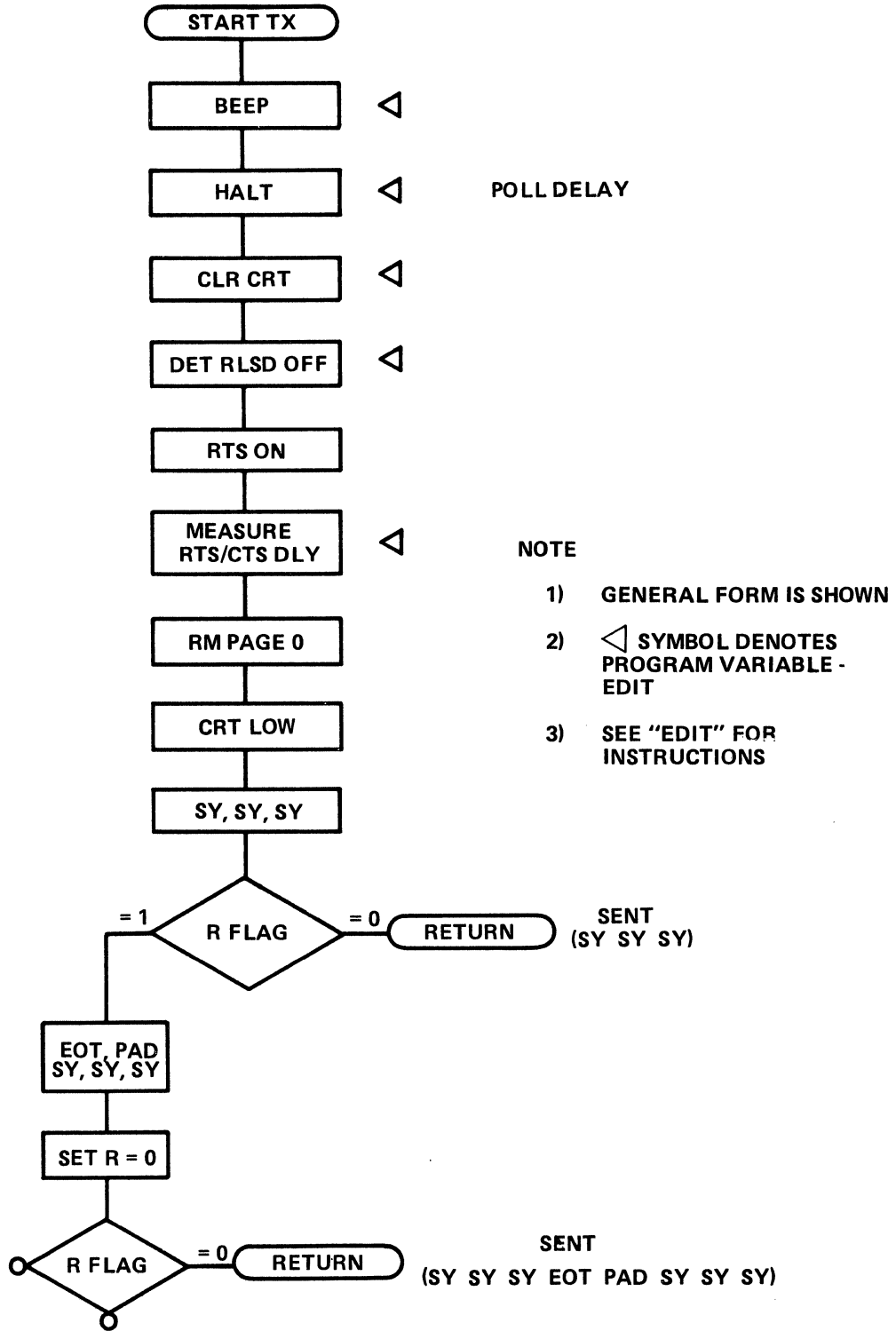


Figure C-1. Send Module Start TX (Subroutine).

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A capability is included to lengthen the subroutine (e.g., chain onto it another sequence of characters to the transmitted). By testing the R (return) flag, the RESET sequence used by General Poll, Specific Poll and the Select sequence is added to the Start TX only when needed.

Figure C-2 shows the modules that require the 3270 address characters. This chart indicates how portions of transmit programs that are common can be shared to reduce program steps.

After the ENQ, a number of flags are initialized. The receive modules may then test these flags for status (e.g., was the last transmission an ENQ . . . . and which one?).

Figure C-3 shows the generation of the messages having textual content.

An important feature is the alternating Good-Bad BCC for the message (form) sent to the 3270 at the request of the RQTST key. The E (error) flag keeps track of the status of good or bad BCC.

Several steps are saved in the program by common use of ETX and BCC.

Figure C-4 shows the three "canned" responses: RVI, END OF TEST, and END. END sends EOT to reset the 3270, then shuts down the DTM operation, leaving the INTERVIEW display showing the last transmit/receive sequence.

### 2.3 Module Linkages

This program is comprised of several smaller program modules. Table A includes receive, transmit, and other modules to describe the overall character of the program. Table A shows important characteristics of each module such as:

- Starting address (in Hex since Jumps use the Hex address)
- Module size (to show during program development how big the overall program is . . . . and where to place the module in the overall program)
- Exit (what other modules the program may jump to as it continues operation)
- SET flags (which flags are set in the module)
- TEST flags (which flags are tested in the module)

### 3.0 PROGRAM LISTING

The program listing is contained in Appendices A and B. EDIT DATA or FUNCTIONS are within ( ) brackets for ease of location.

This test is contained in a 256-step program cell. Fourteen steps are unused and are available for special purposes the user may define. One example is to cause the results memory contents to be transmitted to a printer, e.g., ASCII at 110 Baud using code conversion from EBCDIC. Figure 4-3 contains a record of the test and would be available at the DTM site as well as at the 3270 site (if the site is so equipped). This exercise is left to the user.

Each program module is separated by heavy horizontal lines and is titled within a circle near the right-hand JUMP arrow column.

Figure D shows the program listing as displayed on the INTERVIEW.

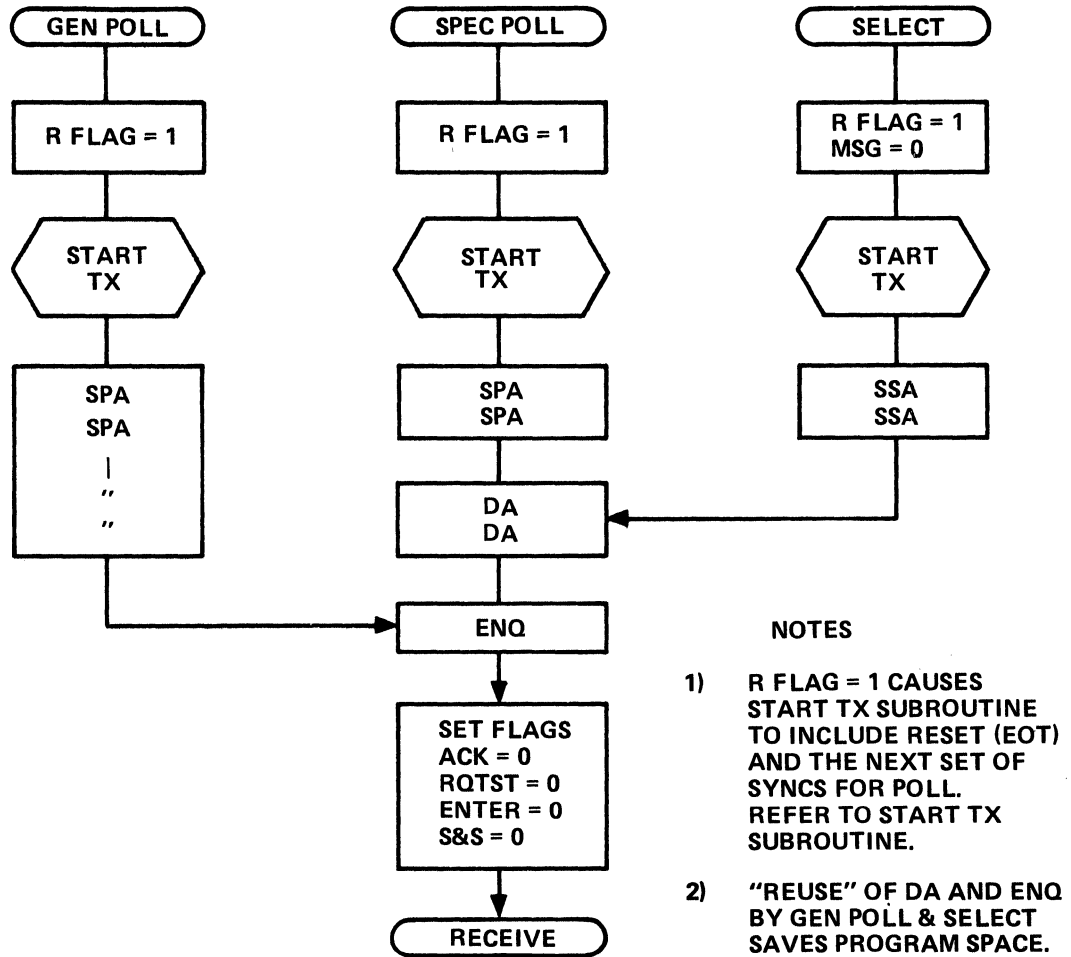


Figure C-2. Send Poll & Select Modules.

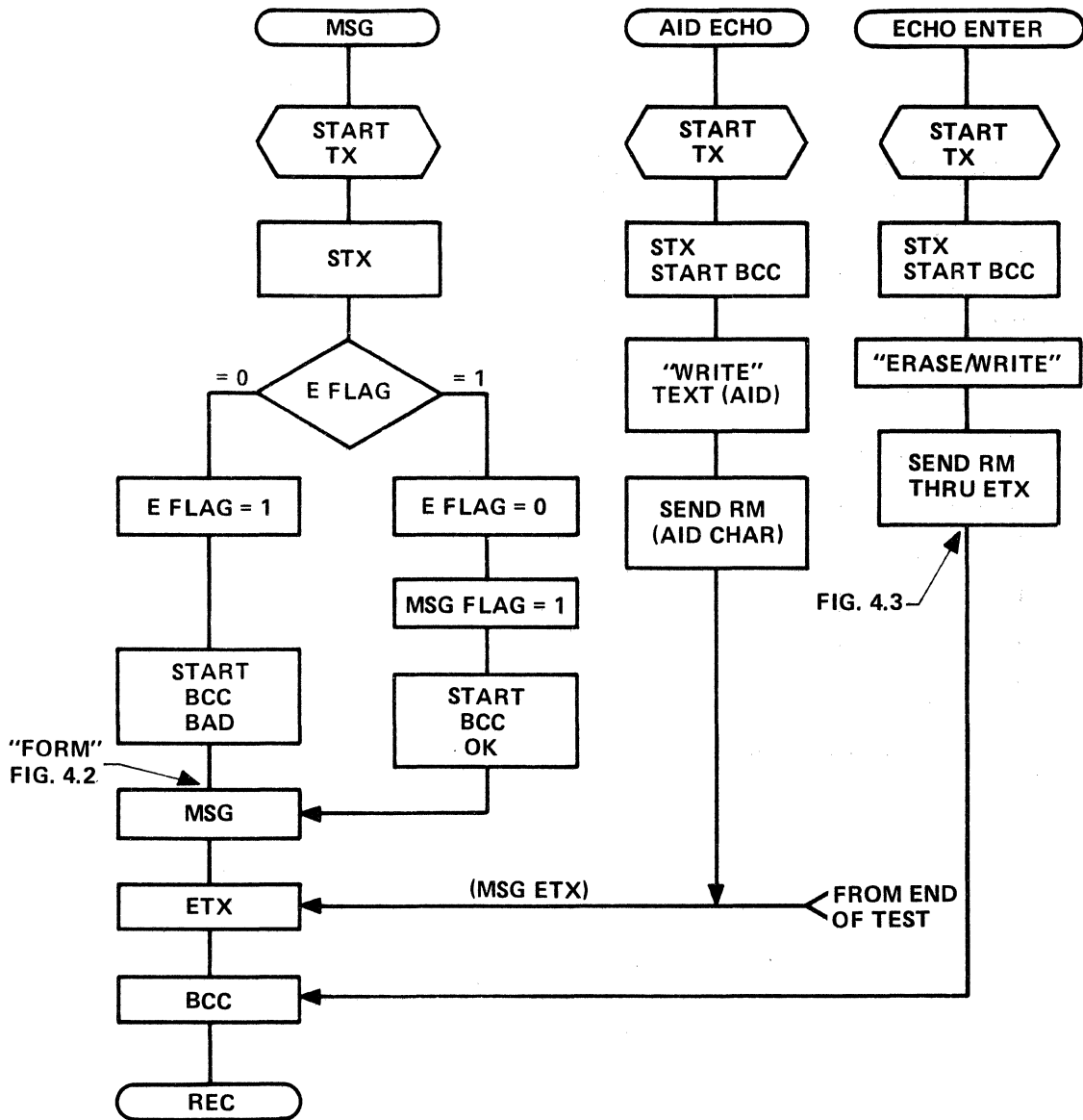


Figure C-3. Send Modules: MSG, AID, ENTER.

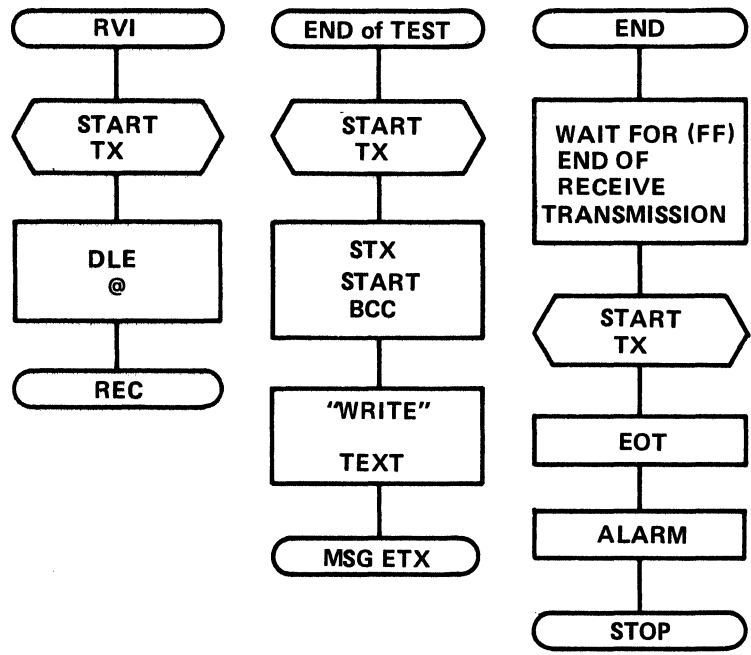


Figure C-4. Send Modules: RVI, END OF TEST, END.

Table A. Program Modules, Linkages, ADRS, Flags.

<u>Start ADRS</u>	<u>Title</u>	<u># Steps</u>	<u>Exit</u>	<u>Set Flags</u>	<u>Test Flags</u>
<b>1. <u>SEND/TRANSMIT</u></b>					
09	Reset & Gen Poll	9	REC	*	—
12	Reset & Specific Poll	14	REC	*	—
20	Reset & Select	8	REC	* MSG = 0	—
28	RVI	5	REC	—	—
2E	MSG	17	REC	E Toggles Good MSG = 1	E
3F	Aid Echo	21	MSG ETX	—	—
55	Echo Enter	9	MSG BCC	—	—
5F	End of Test	24	MSG ETX	—	—
7F	End	10	Stop	—	—
89	Start TX (Subroutine)	28	(Return)	R Flag = 0	R
<b>2. <u>RECEIVE</u></b>					
A2	Receive	25	S&S, AID, ACK MSG, GEN POLL, SPEC POLL	—	S&S
BA	S&S	24	RVI, AID ECHO, ECHO ENTER	ROTST = 1 S&S = 1	S&S
E7	AID	8	S&S	Enter = 1	
D3	ACK	20	SELECT, SPEC POLL END OF TEST, MSG, GEN POLL/ECHO/END	ACK = 1 ACK = 0	ACK, ROTST MSG, ENTER
<b>3. <u>MISC.</u></b>					
00	Start Up	9	GEN POLL	MSG = 0	—
FD	Interrupt Service	3	GEN POLL, START	—	—

\*Flags Set

ROTST = 0, Return = 0, Enter = 0, S&amp;S = 0, R Flag = 1

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For the convenience all addresses which are used as *destinations for Jumps are circled*. Major program features are listed under comments.

There are only two differences between the EBCDIC and ASCII programs: (1) code for characters and (2) BCC. Functions 38, 39, 58 and 59 are related to the BCC change from CRC (EBCDIC) to LRC (ASCII). Fill characters are not required for LRC and are deleted in ASCII.

### 3.1 EBCDIC

File D01 describes the EBCDIC test.

### 3.2 ASCII

File D02 describes the ASCII test.

For ASCII, the program is set up for ODD parity characters and EVEN LRC. The program checks for Parity errors as well as for LRC errors on all transmissions. A parity error will register on the PE LED but will be counted only if the counter is manually selected to PE in 10<sup>X</sup> and the timer Functions 87 are edited to NO-OP (at Hex address 92, A4).

### 3.3 Program Display

Figure D-1 shows the INTERVIEW display of the INTERSHAKE program (EBCDIC) in the LOAD mode. A horizontal presentation permits the text to be directly read. Program Characteristics are easily noted:

- a. One program sheet lists 32 steps which correspond to one line on the CRT. All 256 steps are displayed.
- b. The top and odd lines contain the Data and the Low intensity line shows the corresponding Function. Step 01 contains Data 2D and Function 19.
- c. Steps contain Data transmission character oriented functions are normal (White on Black). 2D in Step 01 is directing the receiver to look for an ENQ character.
- d. NON data or character oriented functions are displayed Reverse image (Black on White). Step 31 is a JUMP instruction to Address A2 Function 40.
- e. The Highlight switch is selected to 1D (Hex) to visually identify all GS (start attribute field) characters in the program. The Highlight switch could also enable the operator to see every step in which a specific function is used in the program.
- f. All Control characters can be easily highlighted by operating the "control characters = HEX" toggle on the INTERVIEW. Figure D-2 shows control characters in HEX. Note that SY (SYNC) and GS in Figure D-1 changed to 32 and 1D in Figure D-2.

### 3.4 Program Printout

When equipped with INTERKEY, the INTERSHAKE program (EBCDIC) may be printed on any ASCII, ASYNC printer. Figure D-3 shows a typical printout with the title manually entered. This program example has an Identifier character "A" prior to the "G" (Go) header character. This identifier is assigned to assist in retrieval of a specific program from a tape file containing many programs.



```

05 OF310080080 " " 11080 E 1234A
3F20062C192 AS192 00002

52080 -- 1128 R @ A38 S B661 SHHCN Ab5031
04192 80B9 209 X B310 201051

48 S 0 E 12 G / AID G ZN D G / B58 S 8 E 59 X 126
29 X 0 1 1 G Y D N & H G - D 4 ) 4 . END OF TEST 38
0 X 0 1 1 G Y D N & H G - D 4 ) 4 . END OF TEST 38

788 E 040001000001804006 S S S 0 E S S S
F4E 101015121200020201 Y Y Y 2 T Y Y Y

000130860 S 008 S E S D D 2 M B E 712007 % 5 C
02020C001 Y 28 A H 7 X B L E K 7 T F2290F % 13 /

C R 7 3 N 5 E 7 N 2 2 C 2 0 C 3 4 5 5 0 N D / 7 7 1 1 0 5 2 7 1
C F 1 U 0 X F U 8 3 F 1 5 4 F 2 2 5 8 U E / F F 3 1 9 3 E F 2

1 2 3 1 5 4 5 0 0 5 E / C 4 C O N N 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 3 2 2 2 F 0 2 1 0 4 1 4 0 U U 0 0 0 0 0 0 0 0 0 0 0 0 9 9 0

```

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Figure D-1. Program Listing on INTERVIEW.



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AG							
0298	5047	4241	9040	FF46	0047	CC41	1047
2D19	2441	8940	0250	7F40	0247	D946	2041
0397	0147	0250	0058	8441	0049	7F40	3347
FF57	8940	0058	2750	8E40	1283	3147	1241
3290	0298	2750	F150	3750	3084	0036	5247
1095	6050	F150	F150	0170	0C97	5094	4247
0007	6050	F250	1D50	4081	8071	0325	5F40
0641	1840	1D50	E850	0171	6094	7F41	0038
8247	1082	6150	1150	0099	0187	0039	0214
0C41	2R41	4050	D550	0170	3217	2841	5194
0147	8940	C150	5050	0480	0287	2347	ED41
8940	1050	C950	0164	0171	0897	CF40	7D44
0298	7C50	C450	1D50	1082	BA41	2147	C440
4050	A240	1D50	6050	0194	0146	0514	4147
4050	3041	E950	3C50	0280	E741	C440	C440
7F50	8940	0052	5D50	0094	0246	3F41	0000
7F50	0250	4050	F450	0298	D341	4247	0163
1A40	3B41	1350	4B50	8070	1046	5247	0350
1541	6347	1D50	4050	0298	2E41	5540	3940
0147	6147	6150	C550	0298	3D46	D841	0000
8940	1058	F140	D550	0287	B741	7044	0000
0298	0166	5741	C450	0049	3746	DE41	0000
4050	0167	8940	4050	6194	7F40	6146	0000
4050	F040	0250	D650	3250	1241	7F40	0000
4050	8350	8058	C650	3250	2247	7F41	0000
4050	0059	2750	4050	3250	0940	1347	0000
2D50	A240	F550	E350	0247	0038	1147	0000
1047	6047	F950	C550	3750	7F41	5541	0000
2047	5147	0353	E250	FF50	6C45	5347	0000
3047	0058	1147	E350	3250	5194	2E40	0940
4047	3540	3940	F140	3250	C341	7F41	0940
A240	1147	6141	8241	3250	6144	1247	0000
S*							

Figure D-3. Draft Listing Using Inter-KEY.

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Several important characteristics should be noted:

- a. Each column contains 32 steps corresponding to one side of a standard program sheet.
- b. Each column is separated into 4 groups of 8 steps to facilitate locating/counting steps.
- c. Eight columns correspond to 8 sheets or a full-cell test of 256-steps.
- d. An entire 256-step program will fit on a single 8½" x 11" sheet of paper for ease of filing.
- e. Printout of Data and Function is a readable format in the same form as the Program Sheet permitting easy transfers from Printout to Program Sheets or vice versa.
- f. All characters are printable, even for control characters; therefore, the program can be listed on any Printer and may even be sent over a TWX network.
- g. The character after the last "S" is a BCC check and may not print.

### 4.0 MESSAGE TEXT

Figure E shows the text of the message "FORM" transmitted by the DTM to the 3270. Figure 4-2 in Section I shows this form. Each character is presented several ways, including the purpose, symbol, EBCDIC HEX and ASCII HEX.

The user should consult the reference documents listed in Paragraph 7 of Section I for specific definitions. A brief description of the control character sequences used follows:

- ERASE/WRITE = "ESC 5". The 3270 terminal will reset the buffer address to home after erasing the display. Unless specified, the first character will be written at the home location.
- WRITE = "ESC 1". The 3270 will display the next received character where the cursor is manually positioned on the screen or at the next location from the last character written to the screen.
- SBA (Set Buffer Address) = "DC1 ROW COL". The two characters following DC1 define the row (1-24) and column (1-80) where the next character will be written.
- START FIELD = "GS Char". The (attribute) character following GS defines the characteristics of all characters written on the screen beginning at the next address and ending at the next GS. The attributes "wrap" around the display screen and can be used to generate various visual effects when writing on NON-BUFFERED terminals.

The selections for attributes are: *Protected* (e.g., operator cannot change the character displayed), *Hidden* (e.g., the character is present but not displayed such as privacy of security information codes), *Blink* (character blinks), *Highlight* (character is brighter than normal), *Numeric* (character can only be digits, minus and period) or *Modified* (a modified character is available to be transmitted from the 3270 to the CPU . . . generally all operator-entered fields are modified).

	ERASE/WRITE			SET BUFFER ADDRESS TO			START FIELD PROTECTED BRIGHT MODIFIED			START FIELD							
CHAR	ESC	5	:	DC1	SP	-	GS	Z	3	2	7	0	SP	7	5	SP	GS
EBCDIC	27	F5	5A	11	40	60	1D	E9	F3	F2	F7	F0	40	F7	F5	40	1D
ASCII	9B	B5	A1	91	20	AD	9D	DA	B3	32	37	B0	20	37	B5	20	9D

PROTECTED BLINK MODIFIED			START FIELD			PROTECTED			SBA			ROW 3			COL 1			REPEAT TO			ROW 4			COL 1			* SYMBOL			REPEAT TO			ROW 4			COL 35		
V	T	E	S	T	GS	-	DC1	B	-	DC4	C	-	*	DC4	D	K																						
F5	E3	C5	F2	F3	1D	60	11	C2	60	3C	C3	F0	5C	3C	C4	D2																						
56	54	45	D3	54	9D	AD	91	C2	AD	94	43	B0	2A	94	C4	CB																						

SYMBOL			REPEAT TO			ROW 5			COL 1			SYMBOL			SBA			ROW 5			COL 34		
.	P	R	O	T	E	C	T	E	D	DC4	E	SP	.	DC1	E	/	>						
4B	D7	D9	D6	E3	C5	C3	E3	C5	C4	3C	C5	40	4B	11	C5	61	6E						
AE	D0	52	4F	54	45	43	54	45	C4	94	45	20	AE	91	45	2F	3E						

SBA			ROW 6			COL 34			START FIELD PROTECTED HIDDEN MODIFIED								
D	I	S	P	L	A	Y	E	D	<	DC1	F	1	>	GS	?	N	0
C4	C9	E2	D7	D3	C1	E8	C5	C4	4C	11	C6	F1	6E	1D	6D	D5	D6
C4	49	D3	D0	4C	C1	D9	45	C4	BC	91	46	31	3E	9D	5F	CE	4F

Figure E. Message Form.  
(Part #842-002B)

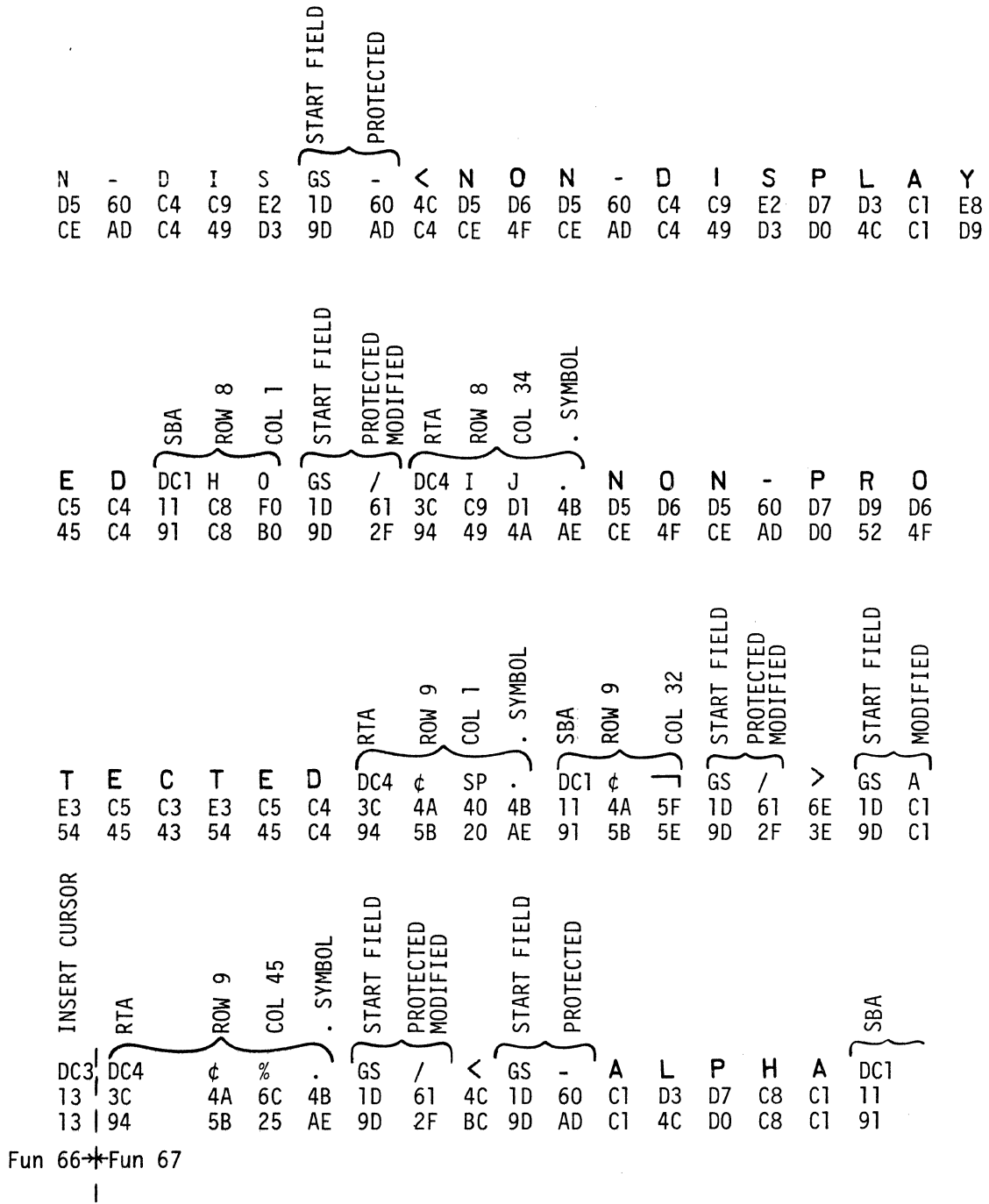


Figure E. Message Form (Continued).

ROW 10		COL 32		START FIELD		PROTECTED MODIFIED		START FIELD		NUMBERIC MODIFIED		RTA		ROW 10		COL 45		. SYMBOL		START FIELD		PROTECTED HIDDEN MODIFIED		AUTO TAB OPTION		START FIELD		PROTECTED	
.	?	GS	/	>	GS	J	DC4	.	:	.	GS	1	<	GS	-					GS	1	<	GS	-					
4B	6F	1D	61	6E	1D	D1	3C	4B	7C	4B	1D	F1	4C	1D					9D	31	BC	9D							
AE	BF	9D	2F	3E	9D	4A	94	AE	40	AE	9D	31	BC	9D															

N		U		M		E		R		I		C		SBA		ROW 11		COL 32		START FIELD		PROTECTED MODIFIED		START FIELD		HIDDEN MODIFIED		SBA		ROW 11	
D5	E4	D4	C5	D9	C9	C3	DC1	<	"	GS	/	>	GS	(	DC1	(			GS	/	>	GS	(	DC1	(						
CE	D5	CD	45	52	49	43	11	4C	7F	1D	61	6E	1D	4D	11	4D			9D	2F	3E	9D	A8	11	4D						
							91	BC	A2	9D	2F	3E	9D	A8	91	A8															

COL 45		START FIELD		PROTECTED MODIFIED		START FIELD		PROTECTED		A		L		P		H		A		SP		N		O		N		-		D		I	
<	GS	/	<	GS	-	A	L	P	H	A	SP	N	O	N	-	D	I																
4C	1D	61	4C	1D	60	C1	D3	D7	C8	C1	40	D5	D6	D5	60	C4	C9																
BC	9D	2F	BC	9D	AD	C1	4C	D0	C8	C1	20	CE	4F	CE	AD	C4	C9																

S		P		L		A		Y		E		D		SBA		ROW 14		COL 80		START FIELD		PROTECTED BRIGHT		
E2	D7	D3	C1	E8	C5	C4	DC1	J	J	GS	Y			DC1	J	J	GS	Y						
D3	D0	4C	C1	D9	45	C4	11	D1	5F	1D	E8			91	4A	5E	9D	E8						

Figure E. Message Form (Continued).

## SI 842-2A

- RTA (Repeat to Address) = "DC4 ROW Col Char". This instruction causes the character to be repeated from the present buffer address to *one less than* the specified row and column. Printing dots through column 70 would place a dot at column 70 and the column specified would be column 71.
- WRITE CONTROL CHARACTER. The first character after ERASE/WRITE or WRITE identifies the characteristics applicable to the write operation. These characteristics start the printer, sound the terminal audible, place the terminal keyboard in local (if not in local, the keyboard is locked out and not available to the operator), and defines the character fields entered by the operator (or prior CPU action) as available for transmission from the 3270 to the CPU.

### 5.0 FLAG ASSIGNMENTS

One key to this program is its ability to know what happened last . . . in order to determine if an error was made,,,, and to determine what happens next. As the program operates, it sets various one-bit memory latches called flags to either 1 or 0. There are 8 such flags available to the DTM user. Seven of these flags are used in this program. All flags are initialized to "0" by the DTM START switch.

FLAG 0 – The RETURN (R) flag "0" presets the subroutine exit point to generate only three syncs (or to "1" to include the reset sequence).

FLAG 1 – The ACK flag keeps track of whether the 3270 should reply with ACK 0 or ACK 1. This flag is tested to determine if an out of sequence ACK is received. The endurance test checks this flag to define an error.

FLAG 2 – The S&S flag is set to 1 for an S&S message received, e.g., on 3270 power-up, and causes the General Poll to continue until all device status is in or to start the Specific Poll after all device status is in.

FLAG 3 – The RQTST (Request Test) flag is set to a 1 for receipt of the RQTST message from the 3270. This flag causes the transmission of the message form to the 3270.

FLAG 4 – The ENTER flag is set to a 1 by receipt of the ENTER AID. The combination of ENTER and MSG and E tells the DTM that the operator has entered data into a good message and that ECHO ENTER is the next transmit module.

FLAG 5 – The MSG (Message) flag is set to 1 when the message form is sent to the 3270.

FLAG 6 – The E (Error) flag is set to 1 for a good BCC. This flag alternates beginning with a Bad BCC. The 3275 terminal requires the RQTST key request the form bad, then good, etc. . The 3270 RQTST will always call a Bad BCC first, then the NAK will always automatically call the Good BCC.

FLAG 7 – Not used.



SI 842-2A

SECTION III

PROGRAMMING HINTS

1.0 SEQUENCE OF WRITING A PROGRAM

The following method is recommended to more quickly generate programs, to reduce errors and provide documentation for operation, debug, and future changes.

The process is iterative, that is, certain aspects are repeated and updated as the program matures.

Each user will find individual preferences and techniques that are comfortable. This outline is provided as an aid especially to the beginner. Experienced programmers will have already developed their own "system".

1. Write a sequence of operation as shown in Figure 4-1. There should be columns headed:

DTM – Operations of the DTM, e.g., Send Data

Terminal – Operations of the Terminal/CPU, e.g., Send

Terminal Operator – Operator tasks at the terminal

DTM Operator – Operator tasks at the DTM, e.g., observe display, operate a key.

2. Consolidate the sequence of operations into a Program Module flow chart as shown in Figure A. This requires some estimating of which important parameters belong in what module.
3. List all program modules by name on a form as shown in Table A (address, size, and other details will be added later).
4. Generate a flow chart for each module such as shown in Figures B and C. Identify all flags used and define the sense 1 or 0 as to meaning, e.g., ERROR = 1. Add the flag information to Table A.

As the modules are developed, be sure every flag is set to 0 and 1 and tested. A common error is to forget to re-initialize the flag after it is used (see the ACK module ACK flag set).

Make a list of module entry and exit names and add to Table A.

5. Begin writing the module programs by writing only the function NAME on the program sheets, beginning each module at step 10. When learning to program, the writer usually omits some necessary startup step that can be later added as step 9, 8, 7, etc. Leave room at the start.

## SI 842-2A

Each module should be written on a separate program sheet. Do not be concerned about the DATA. Only write the function numbers for the functions that are related to other steps or functions, e.g., Preset.

Be sure to use *arrows* and *names* for all *jump destinations*. Circle the address for all points at which other program operations will *enter* each module. An example is step 2E in Appendix A: "MSG".

6. Transfer the number of steps to the Table A form and add them to determine whether a 128- or 256-step cell is required. The total number of steps should leave *at least 20%* margin for the cell size selected for the first pass.
7. List all of the DTM set-up criteria. Now review the original sequence of operation and compare it to all the exit and entry points of the modules.
8. This is the first time the program is to be written as a consecutive listing.
  - a. Always start with a NO-OP for the first step of any program.
  - b. Select the module(s) requiring operator editing near the front of the program, e.g., terminal address entry.
  - c. On the first writing, leave several spare steps between each program module.
  - d. First fill in all program steps only with the functional description.
  - e. Next fill in all entry and exit (JUMP) destinations with the names given.
  - f. Next connect all the Jumps together by *NAME*.
  - g. Next add the address (HEX) starting location for all start locations or entry points to Table A.
  - h. Enter the Hex jump address to all Function 40, 41 steps. Check for completeness, e.g., all Jumps go to the proper place, etc.
  - i. Add all other function numbers.
  - j. Add all other non-character data.
  - k. Add all other character data (observing parity if required).
9. Display the program on the INTERVIEW as shown in Figure D.
10. Operate the program.
11. Debug of the program is assisted by observing the INTERVIEW and using the REVERSE image at various program locations to show the progress. HALT and beeps can be also used quite effectively to status the progress of the program.

## 2.0 RECEIVE SORT

A generally accepted good practice is to use a common receive program to “sort” each receive transmission to classify it for action by DTM. The REC, ACK, S&S, AID modules show in detail an example of this capability. See Figures A and B-1.

## 3.0 TRANSMIT

Since all synchronous transmissions require several SYNC characters plus dynamic operation of the control leads, these repeated operations can be made into a subroutine common to all transmit sequences. Refer to the START TX subroutine Figure C-1 and Paragraph 11, Section III and Figure F.

## 4.0 EDIT

An effective technique to make it easy for the operator to find the step to be edited is to precede the step with a NO-OP. The operator can then scroll search to the NO-OP, then step one more to the step to be edited. Refer to Section I, Paragraph 5 and Table 5-1.

## 5.0 ALTERNATE BCC ERRORS

Forcing the BCC error is an important test of the error recovery routine of the device being tested. A flag can be used as a one-bit counter to divide by 2. This permits alternating between a Good and Bad BCC by testing the flag. The MSG module Figure C-3 depicts this technique. Two flags will divide by 4, etc.

## 6.0 MESSAGE GENERATION

Functions 60 through 67 permit 8 messages to be canned in the DTM firmware. There are certain characteristics of special messages that should be considered:

- There are two classes of messages: those that must be the first part of the transmit text, and those that can be used anywhere in the text.
- No message should include STX or SOH. This will permit generation of BCC by the DTM.
- No message should include ETX. This will permit another message to be added onto the end to make a longer message.
- When two or more messages are to be used as a sequence, one always follows the other. *NO* multiple character control function, such as (set buffer address) should bridge across from one message into the next. All control sequences must complete within a message. This allows intermixing of messages.
- Messages should contain as many exercises of the terminal attributes as possible. The displayed format should be symmetrical and readable (in clear sentence structure if possible).
- All messages should include both upper and lower case in a prominent way to ascertain the features of the terminal/device under test.

## 7.0 TRANSMIT TIMING

The DTM permits precise determination of transmit timing. The time relationship between the last transmit character and turning off RTS may be critical to some systems. This delay can be accurately defined in 1 ms increments or in terms of Bits (which of course remains constant as the bit rate changes). Paragraph 5.7 of Section I describes the transmit timing criteria used here.

## 8.0 SAVINGS PROGRAM STEPS

As with any programmable test system, conservation of program memory permits more comprehensive programs to be used for a given program memory cell size. Economy can be achieved by using these techniques:

- Use of Subroutines
- Commonality of program modules to share common program steps. Refer to Figures B-3, C-2 and C-3.

## 9.0 CLEAR RESULTS MEMORY

Whenever the results memory is used to record in a test, it is good practice to clear it at the start of each program execution. A three-step sequence performs this in about 9 ms. This sequence is contained in Steps 06, 07 and 08 of the program. Basically, Function 07 writes 00 into the RM and then the RM is tested to jump, when RM is *NOT* full, back to write 00 again. This process repeats until the RM is full and the program does not jump but falls through to the next program step.

## 10.0 PROGRAM PATCH

Usually every program at some time or other is used in a special case! Some change is usually required in the middle of a program module.

A patch is obtained by placing in the step *after* the last valid instruction a JUMP to a vacant area of the program memory. The added program is written here and JUMPS back to the next valid instruction in the original program. This process "costs" two extra program steps (for the JUMPS) over the "perfect program".

## 11.0 SUBROUTINES

A subroutine is a short program module that is reused several times in a program. Instead of writing the same sequence of steps over again several times, it is only written once.

Since three steps are required to use a subroutine, the subroutine is only of value for more than three steps. However, a subroutine may also be used to permit the operator to enter a value or delay only once instead of several times in the program.

Each using program module uses a conventional JUMP (Function 40) to get to the subroutine. Therefore, any program module can get to the subroutine.

To return from the subroutine requires a conditional jump as the last step of the subroutine. The program should jump from the last step of the subroutine back into the program sequence from which it started.

DTM conditional jumps go to the address previously PRESET (Function 41). The Format for subroutines is as follows:

## SI 842-2A

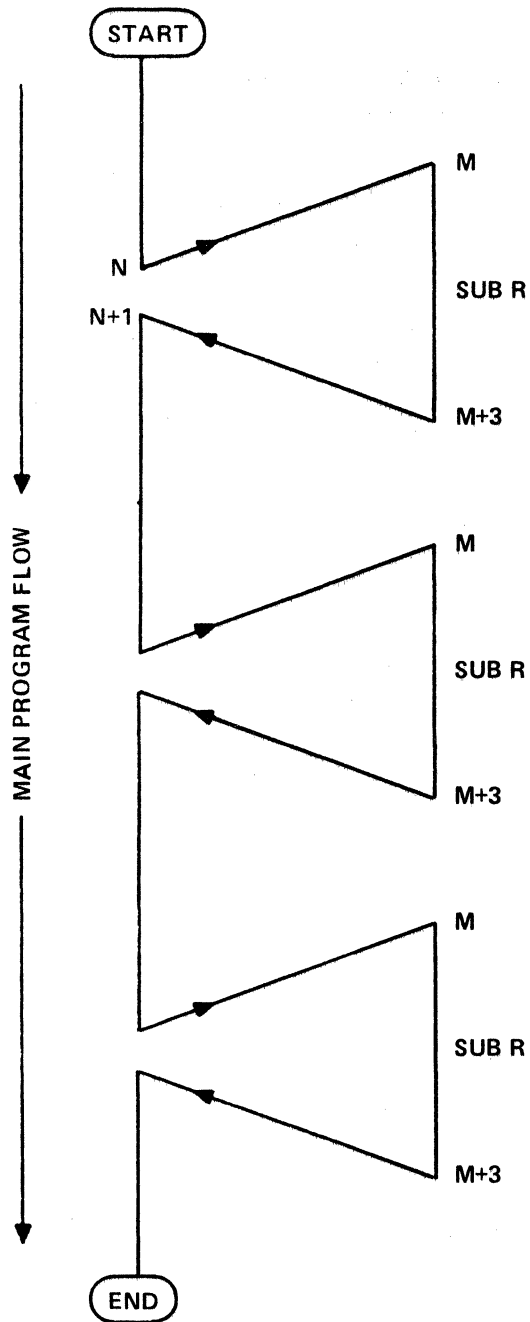
- a. Step N contains the JUMP (Function 40) to the subroutine address.
- b. Step N-1 contains the PRESET to the address which the subroutine will jump to when complete. Function 41 usually addresses step N + 1. In many cases the subroutine can be directed to return anywhere in the program thus saving instructions.
- c. The last step of the subroutine contains a known conditional JUMP. For example, START sets all flags to 0, so JUMP FLAG 0 = 0 will always jump to the most recent preset Function 41.
- d. Using this technique, a PRESET (Function 41) may NOT be used within the subroutine itself.

### NOTE

DTM Serial number Series "F" and higher contain dedicated additional subroutine functions. This permits jumps in the subroutine – or nesting (e.g., one subroutine calling another subroutine).

Function 27	Preset return address
Function 28	Return

Figure F shows graphically the use of a subroutine in a program.



Using FUN 40, 41, 47

STEP	DATA	FUN	
N-1	N+1	41	Preset Return
N	M	40	Go to S.R.
N+1	-	-	Next program step

(Subroutine)

M	-	-	Program may
M+1	-	-	NOT USE FUN 41
M+2	-	-	
M+3	02	47	JUMP FLAG 0 = 0

For Serial No. F Series and After

Using FUN 40, 27, 28

STEP	DATA	FUN	
N-1	N+1	27	Preset
N	M	40	Go to S.R.
N+1	-	-	Next program step

(Subroutine)

M	-	-	Program may
M+1	-	-	contain FUN 41
M+2	-	-	
M+3	-	28	Return

Figure F. Subroutine.

**SI 842-2A**

**APPENDIX A**

**PROGRAM LISTING**

**DO1 EBCDIC**



SI 842-2A

INTERSHAKE II PROGRAM

TITLE: 3270-3275 DIAGNOSTIC TEST (EBCDIC)	FILE NO. D01A
	SHEET 1 OF 4

DESCRIPTION:

- EMULATES CPU/FEP TO TEST 3270 OR 3275 TERMINAL.
- OPERATES REMOTE THRU MODEMS.\*
- SEVERAL EDIT FEATURES BUILT IN.

\*EDIT FOR TEST LOCAL TERMINAL

OBJECTIVE:

- 1) AUTO MODE PERMITS TERM OPERATOR VERIFICATION OF "OK" TERM.
- 2) INTERACTIVE MODE PERMITS DTM OPERATOR DIAGNOSTICS FOR TROUBLES.

ADDRESS PAGE (CIRCLE ONE)	ENTRY			FUNCTION DESCRIPTION/COMMENTS	JUMP	APPLICABLE INFORMATION (WRITE IN OR CIRCLE)
	STEP	DATA	FUNCTION			
0	0	0	(50) (47)	Set MSG FLAG = 0	START	CODE EBCDIC
	1	1	2D 19	INT CHAR=ENQ		SPEED ANY
	2	2	03 97			ASYNC / <u>SYN</u>
	3	3	FF 57	TX Fill Character		SYN CHARACTER 32
	4	4	32 90	RX Sync Character		STOP BIT 1.0, 1.5, 2.0
	5	5	10 95	Auto Sync Mode		INFO BITS 5, 6, 7, <u>8</u>
	6	6	00 07	Write 00	← } CLEARS RM	PARTY <u>NONE</u> ODD, EVEN
	7	7	06 41	PRE		CONTROL EIA <u>OFF</u>
	8	8	82 47	Jump Til MEMOVFL		ON-LINE TD/RD, TD, RD
0	9	9	0C 41	Preset Return	← (GEN POLL)	OFF-LINE TERM / MODEM
	A	10	01 47	SF0=1		MON SIGS <u>(NORMAL)</u>
	B	11	89 40	Go To	→ Start TX	PATCH CORDS
	C	12	02 98	No-Op (Enter SPA)	←	CONTROL EIA (V. 24) T.T. DSR ON RLSD OFF, CTS ON
	D	13	40 50	SPA	←	IM DTR ON RTS OFF
	E	14	40 50	SPA	←	COUNTER ZONE DURATION XXX MS
	F	15	7F 50	"	←	INTERRUPTS TIMER CHARACTER
1	D	9	5	1		FLAGS 0 THRU 6
	0	16	7F 50	"		LATCH CRT CONTROLS
	1	17	1A 40	Jump		
	2	18	15 41	Preset Return	← (SPECIFIC POLL)	
	3	19	01 47	Set F0=1		
	4	20	89 40	Go To	→ Start TX	
	5	21	02 98	No-Op (Enter SPA & DA)	←	
	6	22	40 50	SPA	←	
	7	23	40 50	SPA	←	
	8	24	40 50	DA	←	
	9	25	40 50	DA	←	
	A	26	2D 50	ENQ	←	
	B	27	10 47	Set ACK F = 0		
	C	28	20 47	Set S&S F = 0		
	D	29	30 47	Set RQTST F = 0		
E	30	40 47	Set ENTER F = 0			
F	31	A2 40	Jump	→ REC		

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CONTINUE ON OTHER SIDE

SI 842-2A

ADDRESS PAGE (CIRCLE ONE) 3 2 1 0	ENTRY			FUNCTION DESCRIPTION/COMMENTS	JUMP ← →	ADDITIONAL INFORMATION (WRITE IN)	
	STEP	DATA	FUNCTION				
2 E A 6 2	0	32 50	47	Set MSG F = 0	SELECT ←	3270/75 D01 A	
	1	33 24	41	Preset Return			
	2	34 01	47	Set F0 = 1			
	3	35 89	40	Go To	Start TX →		
	4	36 02	98	No-Op (Enter SSA)			
	5	37 60	50	SSA			
	6	38 60	50	SSA			
2	7	39 18	40	Jump	DA →		
2	8	40 10	82	1 Sec Delay <sup>3275 STATUS LITE</sup> ON FOR BCC ERROR	RVI ←		
	9	41 2B	41	Preset Return			
2 A B C D	42	89	40	Go To	Start TX →		
	43	10	50	DLE			
	44	7C	50	@			
	45	A2	40	Jump	REC →		
2	E	46 30	41	Preset Return	MSG ←		
	F	47 89	40	Go To	Start TX →		
3 F B 7 3	0	48 02	50	STX			
	1	49 3B	41	PRE			
	2	50 63	47	J E Flag = 1			
	3	51 61	47	S E Flag = 1			
	4	52 10	58	Start Bad BCC			
	5	53 01	66	MSG 1			
	6	54 01	67	MSG 2			
	7	55 01	63	MSG 3			
	8	56 03	50	ETX	MSG ETX ←		
	9	57 00	59	Send BCC	MSG BCC ←		
	A	58 A2	40	Jump	REC →		
	3	B	59 60	47	Set E Flag = 0		
		C	60 51	47	S MSG Flag = 1		
		D	61 00	58	Start BCC OK		
	E	62 35	40	Jump			
3	F	63 11	47	Set ACK F = 1	AID ECHO ←		

ADDITIONAL REMARKS

- 1 - REFER TO TEXT FOR OPERATIONAL INSTRUCTIONS.
- 2 - SPECIAL MESSAGE PROM 842G MUST BE USED.
- 3 - EDIT PARAMETERS-DATA-FUNCTION ARE IN (XX).

PROGRAM LOCATION

DTM S/N  
CELL G, H  
RAM  
PROM 001-B

PROGRAM WRITTEN BY:

J.L. WALLACE

DATE

6-9-77

COMPANY NAME:

ATLANTIC RESEARCH CORPORATION

TEL. NO.

ADDRESS:

INTERSHAKE II PROGRAM

TITLE: 3270-3275	FILE NO. D01 A SHEET 2 OF 4
------------------	--------------------------------

DESCRIPTION:

OBJECTIVE:

PAGE (CIRCLE ONE)	ADDRESS			ENTRY			FUNCTION DESCRIPTION/COMMENTS	JUMP	APPLICABLE INFORMATION (WRITE IN OR CIRCLE)	
	3	2	1	STEP	DATA	FUNCTION				
	8	4	0							
4	C	8	4	0	0	42	41	Preset Return		
				1	1	89	40	Go To	Start TX →	
				2	2	02	50	STX	←	
				3	3	00	58	Start BCC		
				4	4	27	50	ESC	} "WRITE"	
				5	5	F1	50	1		
				6	6	F2	50	2 KBD LOCAL		
				7	7	1D	50	GS		
				8	8	61	50	/(Prot, Modified)		
				9	9	40	50	SP		
				A	10	C1	50	A		
				B	11	C9	50	1		
				C	12	C4	50	D		
				D	13	1D	50	GS		
				E	14	E9	50	Z (Prot, Highlight, MOD)		
				F	15	00	52	Send RM		
	D	9	5	1	0	16	40	50	SP	
				1	17	13	50	Insert Cursor		
				2	18	1D	50	GS		
				3	19	C1	50	/(MOD)		
				4	20	38	40	Jump	MSG ETX →	
5				5	5	21	57	41	Preset Return	ECHO ENTER ←
				6	6	22	89	40	Go To	Start TX →
				7	7	23	02	50	STX	←
				8	8	24	00	58	Start BCC	
				9	9	25	27	50	ESC	} "ERASE/WRITE"
				A	26	F5	50	5		
				B	27	F1	50	1 KYBD Locked Out		
				C	28	03	53	Send RM Until Trap Character = ETX		
				D	29	11	47	SET ACK FLAG = 1		
				E	30	39	40	Jump	BCC MSG →	
				F	31	61	41	Preset Return	(END OF TEST) ←	

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CONTINUE ON OTHER SIDE

SI 842-2A

ADDRESS				ENTRY			FUNCTION DESCRIPTION/COMMENTS	JUMP	ADDITIONAL INFORMATION (WRITE IN)	
PAGE (CIRCLE ONE)				STEP	DATA	FUNCTION				
3	2	1	0							
E	A	6	2	0	32	90	40	Go To	Start TX	3270/75 D01 A
				1	33	02	50	STX		
				2	34	00	58	Start BCC		
				3	35	27	50	ESC	"WRITE"	
				4	36	F1	50	1		
				5	37	7D	50	' KBD Locked Out, Start Printer, Bell		
				6	38	1D	50	GS		
				7	39	E8	50	Y (Prot, Hi, UNMOD)		
				8	40	11	50	DC1	SET BUFFER ADRS	
				9	41	D5	50	Row 18		
				A	42	50	50	Col 0		
				B	43	01	64	127 CHAR MSG		
				C	44	1D	50	GS		
				D	45	60	50	— (Prot, UNMOD)		
				E	46	3C	50	DC4	"REPEAT TO ADRS"	
				F	47	5D	50	Row 24		
				0	48	F4	50	Col 69.		
				1	49	4B	50	Character Dot		
				2	50	40	50	SP		
				3	51	C5	50	E		
				4	52	D5	50	N		
				5	53	C4	50	D		
				6	54	40	50	SP		
				7	55	D6	50	O		
				8	56	C6	50	F		
				9	57	40	50	SP		
				A	58	E3	50	T		
				B	59	C5	50	E		
				C	60	E2	50	S		
				D	61	E3	50	T		
				E	62	38	40	Jump	MSG ETX	
				7	F	63	82	41	Preset	END

ADDITIONAL REMARKS

PROGRAM LOCATION

DTM S/N

CELL

RAM

PROM 001-B

PROGRAM WRITTEN BY: J.L.W.

DATE

COMPANY NAME: ATLANTIC RESEARCH CORPORATION

TEL. NO.

ADDRESS:

INTERSHAKE II PROGRAM

TITLE: 3270-3275	FILE NO. D01A SHEET 3 OF 4
------------------	-------------------------------

DESCRIPTION:

OBJECTIVE:

ADDRESS PAGE (CIRCLE ONE) 3 2 1 0	ENTRY			FUNCTION DESCRIPTION/COMMENTS	JUMP ← →	APPLICABLE INFORMATION (WRITE IN OR CIRCLE)						
	STEP	DATA	FUNCTION									
8	C	8	4	0	0	0	FF	46	RT&J = FF			CODE
					1	1	7F	40	Jump	END →		SPEED
		(8)			2	2	84	41	Preset Return ←			ASYNC / SYNC
					3	3	8E	40	Go To			SYN CHARACTER
		(8)			4	4	37	50	EOT ←			STOP BIT 1.0 , 1.5 , 2.0
					5	5	01	70	Alarm ON			INFO BITS 5 , 6 , 7 , 8
					6	6	40	81	Delay			PARITY NONE , ODD , EVEN
					7	7	01	71	Alarm OFF			CONTROL EIA / OFF
					8	8	00	99	STOP / Jump To GEN POLL			ON-LINE TD/RD , TD , RD
		(8)			9	9	01	70	Beep ON (START TX) ←			OFF-LINE TERM / MODEM
			A		10	(15)	(80)		Delay			MON SIGS / NORMAL
			B		11	01	71		Beep OFF			PATCH CORDS
			C		12	(02)	(82)		AUTO MODE = 200 ms Poll Rate			CONTROL EIA (V. 24)
			D		13	(01)	(94)		Clear ON			COUNTER ZONE
		(8)	E		14	02	80		Delay 2 ms ←			INTERRUPTS
		F		15	00	94		Clear OFF			FLAGS	
9	D	(9)	5	1	0	16	(10)	(73)	DET RLSD OFF			LATCH
					1	17	(80)	(70)	Raise RTS			
					2	18	(02)	(98)	Start Timer			
					3	19	(40)	(72)	Det CTS ON			
					4	20	02	87	Stop Timer			
					5	21	00	49	Set RM Page 0			
					6	22	61	94	CRT Low ON			
					7	23	32	50	SY			
					8	24	32	50	SY			
					9	25	32	50	SY			
			A		26	02	47		Jump FO = 0			
			B		27	37	50		EOT			
			C		28	FF	50		FF			
			D		29	32	50		SY			
			E		30	32	50		SY			
			F		31	32	50		SY			

CONTINUE ON OTHER SIDE

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CONTINUE ON OTHER SIDE

SI 842-2A

ADDRESS		ENTRY			FUNCTION DESCRIPTION/COMMENTS	JUMP	ADDITIONAL INFORMATION (WRITE IN)			
PAGE (CIRCLE ONE)		STEP	DATA	FUNCTION						
3	A	6	2	0	32	10	47	S ACK F = 0		3270/75 D01 A
		1		33	20	41	PRE			
		2		34	33	47	J TQST F = 1	SELECT	→	
		3		35	12	41	PRE			
		4		36	52	47	J MSG = 0	SPEC POLL	→	
		5		37	42	47	J Enter = 0	SPEC POLL	→	
		6		38	5F	40	JUMP	END OF TEST	→	
E	A	7	39	00	38	Start BCC	AID	←		
		8	40	02	14	Wait 2 Characters				
		9	41	51	94	Rev ON CRT				
		A	42	ED	41	PRE				
		B	43	7D	44	J = Enter				
		C	44	C4	40	Jump	X S&S	→		
		D	45	41	47	Set Enter F = 1				
		E	46	C4	40	Jump	X S&S	→		
		F	47							
		F	B	7	3	0	48			
1	49									
2	50									
3	51									
4	52									
5	53									
6	54									
7	55									
8	56									
9	57									
A	58									
B	59									
C	60									
D	61			FF		40	Time OUT INT (3 Sec)			
E	62	09	40	Character INT (ENQ)	GEN POLL	→				
F	63	08	97	Disable INT Timer	START/GEN POLL	→				
ADDITIONAL REMARKS							PROGRAM LOCATION			
							DTM S/N			
							CELL			
							RAM			
							PROM 001-B			
PROGRAM WRITTEN BY: J.L.W.					DATE					
COMPANY NAME: ATLANTIC RESEARCH CORPORATION					TEL. NO.					
ADDRESS:										

SI 842-2A

INTERSHAKE II PROGRAM

TITLE: 3270-3275 FILE NO. 001A  
SHEET 4 OF 4

DESCRIPTION:

OBJECTIVE:

ADDRESS PAGE (CIRCLE ONE) 3 2 1 0	ENTRY			FUNCTION DESCRIPTION/COMMENTS	JUMP ← →	APPLICABLE INFORMATION (WRITE IN OR CIRCLE)
	STEP	DATA	FUNCTION			
(C) 8 4 0 0	0	00	41	PRE		CODE
	1	D9	46	RT&J = R		SPEED
	2	7F	40	Jump	END →	ASYNC / SYNC
(C) 3	3	31	47	Set RQTST F = 1	SET TST ←	SYN CHARACTER
(C) 4	4	00	36	Record Current Character	X S&S ←	STOP BIT 1.0 , 1.5 , 2.0
	5	50	94	CRT REV OFF		INFO BITS 5 , 6 , 7 , 8
	6	03	25	Record Until ETX		PARITY NONE , ODD , EVEN
	7	7F	41	PRE		CONTROL EIA / OFF
	8	00	39	J = BCCE	END →	ON-LINE TD/RD , TD , RD
	9	28	41	PRE		OFF-LINE TERM / MODEM
A	10	23	47	J S&S F = 1	RVI →	MON SIGS / NORMAL
B	11	CF	40	Jump		PATCH CORDS
(C) C	12	21	47	Set S&S F = 1		CONTROL EIA (V. 24)
	D	05	14	Wait 5 Characters		COUNTER ZONE
	E	C4	40	Jump		INTERRUPTS
(C) F	15	3F	41	PRE		FLAGS
D 9 5 1	0	42	47	J Enter = 0	AID ECHO →	LATCH
	1	52	47	J MSG = 0	AID ECHO →	
	2	55	40	Jump	ECHO ENTER →	
(D) 3	19	D8	41	PRE	ACK ←	
	4	70	44	J = 70 ACK 0		
	5	DE	41	PRE		
	6	61	46	RT&J = 61 ACK 1		
	7	7F	40	Jump	END →	
(D) 8	24	7F	41	PRE		
	9	13	47	J ACK F = 1	END →	
A	26	11	47	S ACK F = 1		
B	27	(00)	41	PRE		
C	28	53	47	J MSG F = 1	START →	
D	29	2E	40	Jump	MSG →	
(D) E	30	7F	41	PRE		
F	31	12	47	J ACK F = 0	END →	

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CONTINUE ON OTHER SIDE





**SI 842-2A**

**APPENDIX B**

**PROGRAM LISTING**

**DO2 ASCII**

SI 842-2A

INTERSHAKE II PROGRAM

TITLE: 3270-3275 DIAGNOSTIC TEST (ASCII) FILE NO. D02 SHEET 1 OF 4

DESCRIPTION:  
 - EMULATES CPU/FEP TO TEST 3270 OR 3275 TERMINAL.  
 - OPERATES LOCAL AT TERMINAL OR REMOTE THRU MODEMS.  
 - SEVERAL EDIT FEATURES BUILT IN.

OBJECTIVE:  
 1) AUTO MODE PERMITS TERM OPERATOR VERIFICATION OF "OK" TERM.  
 2) INTERACTIVE MODE PERMITS DTM OPERATOR DIAGNOSTICS FOR TROUBLES.

ADDRESS PAGE (CIRCLE ONE) 3 2 1 0	ENTRY			FUNCTION DESCRIPTION/COMMENTS	JUMP ← →	APPLICABLE INFORMATION (WRITE IN OR CIRCLE)
	STEP	DATA	FUNCTION			
0	0	02	98			CODE ASCII
	1	85	19	INT CHAR=ENQ		SPEED ANY
	2	03	97			ASYNC / SYNC
	3	02	98	No-Op		SYN CHARACTER 16
	4	32	90	RX Sync Character		STOP BIT 1.0, 1.5, 2.0
	5	10	95	Auto Sync Mode		INFO BITS 5, 6, 7, 8
	6	00	07	Write 00 ← CLEARS		PARITY NONE (ODD), EVEN
	7	06	41	PRE ← RM		CONTROL EIA (OFF)
	8	82	47	Jump Til MEMOVFL ←		ON-LINE TD/RD, TD, RD
	9	0C	41	Preset Return ← GEN POLL		OFF-LINE TERM / MODEM
	A	01	47	SF0=1		MON SIGS (NORMAL)
	B	89	40	Go To → Start TX		PATCH CORDS T.T. = CTS TO +12V
	C	02	98	No-Op (Enter SPA) ←		CONTROL EIA (V. 24) T.T. DSR ON, RLSD OFF
	D	20	50	SPA ←		TM DTR ON RTS OFF
	E	20	50	SPA ←		COUNTER ZONE DURATION XXX MS
	F	A2	50	" ←		INTERRUPTS TIMER CHARACTER
1	0	A2	50	"		FLAGS 0 THRU 6
	1	1A	40	Jump		LATCH CRT CONTROLS
	2	15	41	Preset Return ← SPECIFIC POLL		
	3	01	47	Set F0=1		
	4	89	40	Go To → Start TX		
	5	02	98	No-Op (Enter SPA & DA) ←		
	6	20	50	SPA ←		
	7	20	50	SPA ←		
	8	20	50	DA ← DA		
	9	20	50	DA ←		
	A	85	50	ENQ ←		
	B	10	47	Set ACK F = 0		
	C	20	47	Set S&S F = 0		
	D	30	47	Set ROTST F = 0		
	E	40	47	Set ENTER F = 0		
F	A2	40	Jump → REC			

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CONTINUE ON OTHER SIDE

ADDRESS PAGE (CIRCLE ONE) 3 2 1 0	ENTRY			FUNCTION DESCRIPTION/COMMENTS	JUMP ← →	ADDITIONAL INFORMATION (WRITE IN)
	STEP	DATA	FUNCTION			
E A 6 2	0	32 50	47	Set MSG F = 0 (SELECT)	←	3270/75 D02
	1	33 24	41	Preset Return		
	2	34 01	47	Set F0 = 1		
	3	35 89	40	Go To Start TX	→	
	4	36 02	98	No-Op (Enter SSA)		
	5	37 2D	50	SSA		
	6	38 2D	50	SSA		
2	7	39 18	40	Jump DA	→	
	8	40 10	82	1 Sec Delay 5275 STATUS LITE ON FOR BCC ERROR (RVI)	←	
	9	41 2B	41	Preset Return		
	A	42 89	40	Go To Start TX	→	
	B	43 10	50	DLE		
2	C	44 BC	50	@		
	D	45 A2	40	Jump REC	→	
2	E	46 30	41	Preset Return (MSG)	←	
	F	47 89	40	Go To Start TX	→	
F B 7 3	0	48 02	50	STX		
	1	49 3B	41	PRE		
	2	50 63	47	I E Flag = 1		
	3	51 61	47	S E Flag = 1		
	4	52 78	58	Start Bad BCC		
	5	53 01	66	MSG 1		
	6	54 01	67	MSG 2		
	7	55 01	61	MSG 3		
	8	56 85	50	ETX MSG ETX	←	
	9	57 00	59	Send BCC MSG BCC	←	
	A	58 A2	40	Jump REC	→	
	B	59 60	47	Set E Flag = 0		
	C	60 51	47	S MSG Flag = 1		
	D	61 08	58	Start BCC OK		
E	62 35	40	Jump			
3	F	63 11	47	Set ACK F = 1 (AID ECHO)	←	
ADDITIONAL REMARKS					PROGRAM LOCATION	
1 - REFER TO TEXT FOR OPERATIONAL INSTRUCTIONS.					DTM 5/N	
2 - SPECIAL MESSAGE FROM 842G MUST BE USED.					CELL G, H	
PROGRAM WRITTEN BY: J. L. WALLACE					DATE 6-9-77	
COMPANY NAME: ATLANTIC RESEARCH CORPORATION					TEL. NO.	
ADDRESS:						

INTERSHAKE II PROGRAM

TITLE: 3270-3275										FILE NO. D02 SHEET 2 OF 4	
DESCRIPTION:											
OBJECTIVE:											
ADDRESS			ENTRY			FUNCTION DESCRIPTION/COMMENTS	JUMP	APPLICABLE INFORMATION (WRITE IN OR CIRCLE)			
PAGE (CIRCLE ONE)			STEP	DATA	FUNCTION						
C	8	(4)	0	0	42	41	Preset Return				
			1	1	89	40	Go To	Start TX	→		
		(4)	2	2	02	50	STX		←		
			3	3	08	58	Start BCC				
			4	4	9B	50	ESC	"WRITE"			
			5	5	31	50	1				
4			6	6	32	50	2 KBD LOCAL				
			7	7	9D	50	GS				
			8	8	2F	50	/ (Prot, Modified)				
			9	9	20	50	SP				
			A	10	C1	50	A				
			B	11	49	50	1				
			C	12	C4	50	D				
			D	13	9D	50	GS				
			E	14	DA	50	Z				
			F	15	00	52	Send RM				
D	9	5	1	0	16	20	50	SP			
			1	1	17	13	50	Insert Cursor			
			2	2	18	9D	50	GS			
			3	3	19	2F	50	/ (Prot, Mod)			
			4	4	20	38	40	Jump	MSG ETX	→	
(5)	(5)		5	5	21	57	41	Preset Return	ECHO ENTER	←	
			6	6	22	89	40	Go To	Start TX	→	
(5)	(7)		7	7	23	02	50	STX		←	
			8	8	24	08	58	Start BCC			
			9	9	25	9B	50	ESC	"ERASE/WRITE"		
			A	26	B5	50	5				
			B	27	B9	50		1 KYBD Locked Out & Printer ON			
			C	28	03	53		Send RM Until Trap Character = ETX			
			D	29	11	47		SET ACK FLAG = 1			
			E	30	39	40		Jump	BCC MSG		
(5)	(F)		F	31	61	41		Preset Return	END OF TEST	←	

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CONTINUE ON OTHER SIDE

ADDRESS		ENTRY			FUNCTION DESCRIPTION/COMMENTS	JUMP	ADDITIONAL INFORMATION (WRITE IN)	
PAGE (CIRCLE ONE)		STEP	DATA	FUNCTION				
3	2	(1)	0					
E	A	(6)	2	0	32 90 40	Go To	Start TX →	
		(6)	1	1	33 02 50	STX ←		
			2		34 08 58	Start BCC		
			3		35 9B 50	ESC	"WRITE"	
			4		36 31 50	1		
			5		37 31 50	1 KBD Locked Out		
			6		38 9D 50	GS		
6			7		39 D9 50	Y (Prot, Hi, UNMOD)		
			8		40 91 50	DC1	} SET BUFFER ADRS	
			9		41 CE 50	Row 18		
			A		42 26 50	Col 0		
			B		43 01 62	127 CHAR MSG		
			C		44 9D 50	GS		
			D		45 AD 50	— (Prot, UNMOD)		
			E		46 94 50	DC4	} "REPEAT TO ADRS"	
			F		47 29 50	Row 24		
			0		48 34 50	Col 69		
			1		49 AE 50	Character Dot		
			2		50 20 50	SP		
			3		51 45 50	E		
			4		52 CE 50	N		
			5		53 C4 50	D		
			6		54 20 50	SP		
7			7		55 4F 50	0		
			8		56 46 50	F		
			9		57 20 50	SP		
			A		58 54 50	T		
			B		59 45 50	E		
			C		60 D3 50	S		
			D		61 54 50	T		
			E		62 38 40	Jump	MSG ETX →	
		(7)	F		63 82 41	Preset	(END)	
ADDITIONAL REMARKS							PROGRAM LOCATION	
							DTM S/N	
							CELL	
							RAM	
							PROM	
PROGRAM WRITTEN BY:					DATE			
COMPANY NAME: ATLANTIC RESEARCH CORPORATION					TEL. NO.			
ADDRESS:								

INTERSHAKE II PROGRAM

TITLE: 3270-3275										FILE NO. D02	
DESCRIPTION:										SHEET 3 OF 4	
OBJECTIVE:											
ADDRESS				ENTRY			FUNCTION DESCRIPTION/COMMENTS	JUMP	APPLICABLE INFORMATION (WRITE IN OR CIRCLE)		
PAGE (CIRCLE ONE)				STEP	DATA	FUNCTION					
3	2	1	0	0	0	FF	46	RT&J = FF		CODE	
				1	1	7F	40	Jump	END →	SPEED	
	8			2	2	84	41	Preset Return ←		ASYNC / SYNC	
				3	3	8E	40	Go To	START TX ●	SYN CHARACTER	
	8			4	4	04	50	EOT ←		STOP BIT	
				5	5	C1	70	Alarm ON		1.0 , 1.5 , 2.0	
				6	6	40	81	Delay		INFO BITS	
				7	7	01	71	Alarm OFF		5 , 6 , 7 , 8	
				8	8	00	99	STOP / Jump To GEN POLL		PARITY	
				9	9	01	70	Beep ON	START TX ←	NONE , ODD , EVEN	
				A	10	15	80	Delay		CONTROL EIA / OFF	
				B	11	01	71	Beep OFF		ON-LINE	
				C	12	02	82	AUTO MODE = 200 ms Poll Rate		TD/RD , TD , RD	
				D	13	01	94	Clear ON		OFF-LINE	
				E	14	02	80	Delay 2 ms	←	TERM / MODEM	
				F	15	00	94	Clear OFF		MON SIGS / NORMAL	
				0	16	10	73	DET RLSD OFF		PATCH CORDS	
				1	17	80	70	Raise RTS		CONTROL EIA (V. 24)	
				2	18	02	98	Start Timer		COUNTER ZONE	
				3	19	40	72	Det CTS ON		INTERRUPTS	
				4	20	02	87	Stop Timer		FLAGS	
				5	21	00	49	Set RM Page 0		LATCH	
				6	22	61	94	CRT Low ON			
				7	23	16	50	SY			
				8	24	16	50	SY			
				9	25	16	50	SY			
				A	26	02	47	Jump F0 = 0			
				B	27	04	50	EOT			
				C	28	FF	50	FF			
				D	29	16	50	SY			
				E	30	16	50	SY			
				F	31	16	50	SY			

CONTINUE ON OTHER SIDE

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SI 842-2

ADDRESS				ENTRY			FUNCTION DESCRIPTION/COMMENTS	JUMP	ADDITIONAL INFORMATION (WRITE IN)
PAGE (CIRCLE ONE)				STEP	DATA	FUNCTION			
3	2	1	0						
E	A	6	2	0	32	00	47	Set FO = 0	3270/75 D02
				1	33	02	47	J FO = 0 RETURN	
				(A) 2	34	00	49	Set RM Page = 0 (REC)	
				3	35	12	83	Wait N Bits	
				4	36	30	84	Set 3 Second For Int Timer	
				5	37	0C	97	Enables Int Timer	
				6	38	80	71	Drop RTS	
				7	39	60	94	CRT LOW OFF	
				8	40	01	87	Start Timer	
				9	41	32	17	Wait ≠ SYNC	
				A	42	02	87	Stop Timer	MEASURE TERMINAL RESPONSE TIME
				B	43	08	97	Int Disable	
				C	44	8A	41	Preset	
				D	45	01	46	RT&J = SOH	S&S
				E	46	E7	41	Preset	
				F	47	02	46	RT&J = STX	ATD
				F	48	D3	41	PRE	
				1	49	10	46	RT&J = DLE	ACK
				2	50	2E	41	PRE	
				3	51	15	46	RT&J = NAK	MSG
				4	52	87	41	PRE	
				5	53	04	46	RT&J = EOT	
				6	54	7F	40	Jump	END
				(B) 7	55	12	41	PRE	
				8	56	22	47	J S&S F = 0	SPEC POLL
				9	57	09	40	Jump	GEN POLL
				(B) A	58	08	38	Start BCC	(S&S)
				B	59	7F	41	PRE	
				C	60	25	45	J ≠ %	END
				D	61	51	94	CRT Rev ON	
				E	62	C3	41	PRE	
				F	63	2F	44	J = / (R/TST)	SET TST
ADDITIONAL REMARKS								PROGRAM LOCATION	
								DTM S/N	
								CELL	
								RAM	
								PROM	
PROGRAM WRITTEN BY:						DATE			
COMPANY NAME:						TEL. NO.			
ADDRESS:						ATLANTIC RESEARCH CORPORATION			

INTERSHAKE II PROGRAM

TITLE: 3270-3275	FILE NO. 002
DESCRIPTION:	
OBJECTIVE:	

ADDRESS PAGE (CIRCLE ONE)	ENTRY			FUNCTION DESCRIPTION/COMMENTS	JUMP ← →	APPLICABLE INFORMATION (WRITE IN OR CIRCLE)
	STEP	DATA	FUNCTION			
(3) 2 1 0	0	0	CC 41	PRE		CODE
(C) 8 4 0	1	1	52 46	RT&J = R		SPEED
	2	2	7F 40	Jump	END →	ASYNC / SYNC
(C) 3	3	3	31 47	Set RQTST F = 1	SET TST ←	SYN CHARACTER
(C) 4	4	4	00 36	Record Current Character	X S&S ←	STOP BIT 1.0, 1.5, 2.0
	5	5	50 94	CRT REV OFF		INFO BITS 5, 6, 7, 8
	6	6	03 25	Record Until ETX		PARITY NONE, ODD, EVEN
	7	7	7F 41	PRE		CONTROL EIA / OFF
	8	8	00 39	J = BCCE	END →	ON-LINE TD/RD, TD, RD
	9	9	28 41	PRE		OFF-LINE TERM / MODEM
	A	10	23 47	J S&S F = 1	RVI →	MON SIGS / NORMAL
	B	11	CF 40	Jump		PATCH CORDS
(C) C	12	12	21 47	Set S&S F = 1		CONTROL EIA (V. 24)
	D	13	05 14	Wait 5 Characters		COUNTER ZONE
	E	14	C4 40	Jump		INTERRUPTS
(C) F	15	15	3F 41	PRE		FLAGS
D 9 5 1	0	16	42 47	J Enter = 0	AID ECHO →	LATCH
	1	17	52 47	J MSG = 0	AID ECHO →	
	2	18	55 40	Jump	ECHO ENTER →	
(D) 3	3	19	D8 41	PRE	(ACK) ←	
	4	20	B0 44	J = 70 ACK 0		
	5	21	DE 41	PRE		
	6	22	31 46	RT&J = 61 ACK 1		
	7	23	7F 40	Jump	END →	
(D) 8	8	24	7F 41	PRE		
	9	25	13 47	J ACK F = 1	END →	
	A	26	11 47	S ACK F = 1		
	B	27	09 41	PRE		
	C	28	53 47	J MSG F = 1	GEN POLL →	
	D	29	2E 40	Jump	MSG →	
(D) E	30	30	7F 41	PRE		
	F	31	12 47	J ACK F = 0	END →	

CONTINUE ON OTHER SIDE

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SI 842-2

ADDRESS				ENTRY			FUNCTION DESCRIPTION/COMMENTS	JUMP	ADDITIONAL INFORMATION (WRITE IN)	
PAGE (CIRCLE ONE)				STEP	DATA	FUNCTION				
③	2	1	0						3270/75 D02	
(E)	A	6	2	0	32	10	47	S ACK F = 0		
				1	33	20	41	PRE		
				2	34	33	47	J TQTST F = 1		SELECT →
				3	35	12	41	PRE		
				4	36	52	47	J MSG = 0		SPEC POLL →
				5	37	42	47	J Enter = 0		SPEC POLL →
				6	38	5F	40	JUMP		END OF TEST →
	(E)	7		7	39	08	38	Start BCC		(AID) ←
				8	40	02	14	Wait 2 Characters		
				9	41	51	94	Rev ON CRT		
	A			42	ED		41	PRE		
	B			43	7D		44	J = Enter		
	C			44	C4		40	Jump		X S&S →
	D			45	41		47	Set Enter F = 1		←
	E			46	C4		40	Jump		X S&S →
	F			47						
(F)	B	7	3	0	48					
				1	49					
				2	50					
				3	51					
				4	52					
				5	53					
				6	54					
				7	55					
				8	56					
				9	57					
	A			58						
	B			59						
	C			60						
	D			61	09		40	Time OUT INT (3 Sec)	GEN POLL →	
	E			62	09		40	Character INT (ENQ)	GEN POLL →	
	F			63						
ADDITIONAL REMARKS								PROGRAM LOCATION		
								DTM S/N		
								CELL		
								RAM		
								PROM		
PROGRAM WRITTEN BY:						DATE				
COMPANY NAME: ATLANTIC RESEARCH CORPORATION						TEL. NO.				
ADDRESS:										

**SI 842-2A**

**APPENDIX C**

**USER NOTES**

SI 842-2A