ATLC-107-895-106
Issue 2, February 1982

TRAINING MANUAL FOR INTERVIEW® 4500

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NOTICE

This training manual was prepared for use with the Series A INTERVIEW 4500. Issue 1 applied only to units with Software Version 10.06, while the present revision, Issue 2, covers Versions 10.06 and 10.08. Two training tapes are required, the 4500 Interactive BISYNC Training Tape, TAP-895-106-1.0, and the 4500 X.25-SDLC Training Tape, TAP-895-106-2.0, as well as the blank tapes furnished with the unit.

Programs in the manual and on the training tapes are intended only for learning to operate the 4500. However, they do present techniques that may be adapted for use in specific data environments.

Atlantic Research Corporation reserves the right to improve this manual or the tapes without prior notice. Further software releases or tape revisions will not necessarily affect correlation with this manual.

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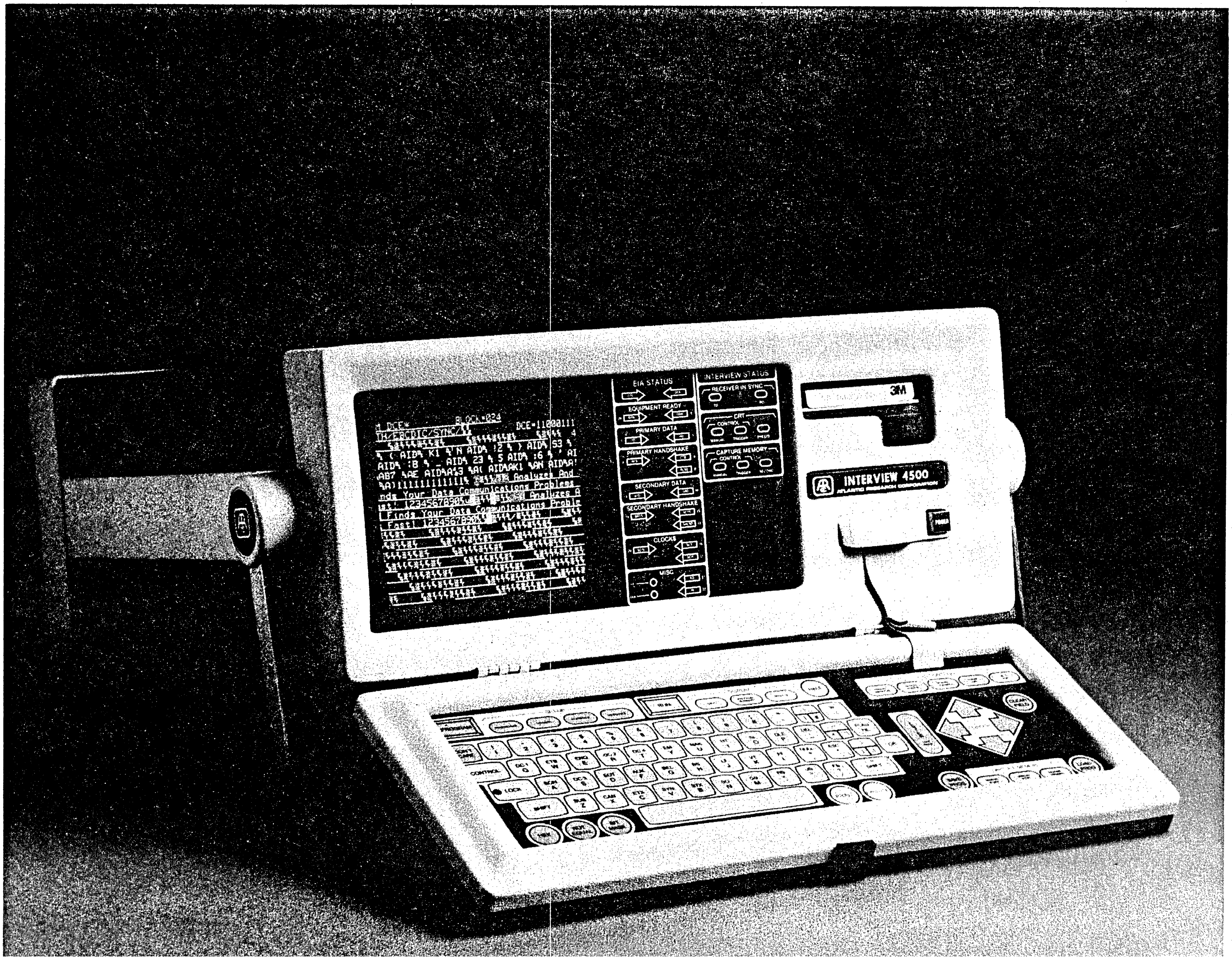
CONTENTS (CONTINUED)

1 WHAT CAN THE INTERVIEW 4500 DO?


INTERVIEW 4500
ATLANTIC RESEARCH CORPORATION
3M
EIA STATUS
INTERVIEW STATUS
RECEIVER IN SYNC
EQUIPMENT READY
PRIMARY DATA
PRIMARY HANDSHAKE
SECONDARY DATA
SECONDARY HANDSHAKE
CLOCKS
MISC
CRT
CAPTURE MEMORY

The INTERVIEW 4500 is suitable for a wide range of operator skills and knowledge. You need no programming skills to use it effectively, but you must be familiar with your own protocol and system characteristics.

The 4500 is really four independent instruments in one:

(1) A simple real-time data display that you can control from the keyboard. Selected data can be highlighted or suppressed from the display. More sophisticated CRT control can be programmed as you wish.

(2) A programmable diagnostic analyzer for network performance measurements. Eight counters and two timers are under program control of 16 nonsequential triggers.

(3) An automatically controlled program and data recorder. Self-documenting integral tapes store the program in a protected area and record data as well as RS-232/V.24 interface lead status. A high-speed memory option is available to augment the tape. Programs and data may be printed out on most asynchronous ASCII printers. There is also a Program-Only Tape option that allows you to record up to 100 programs on a single tape.

(4) An Emulator. When the 4500 transmits, it controls EIA interface leads. Thus, it can emulate a terminal transmitting via either DCE (modem) or DTE, or a CPU transmitting through either DCE or DTE.

The 4500 is programmed with self-prompting menus. When you power up the unit, it leads you through all the necessary steps to monitor data in any one of eight codes and six data formats, offering at any point in the process only selections relevant to your previous choices.

The INTERVIEW 4500 contains three Z-80 microprocessors. Each microprocessor operates independently and is supported with its own ROM, RAM, and input-output interfaces.

Most of the firmware is dedicated to the human interface tasks associated with the keyboard, CRT menus, and status indicators.

Operation has been further simplified by assigning each microprocessor independent tasks: One controls the CRT display and keyboard; the second is actively looking for triggers and handling the real-time statistical performance monitoring operations; and the third controls the tape and the optional high-speed memory.

Although the logical power of the three microprocessors controls the CRT, counters and timers, and data recording, you can override the trigger program from the keyboard without stopping the test or entering program mode, and just as easily restore trigger control.

2 HOW TO TRAIN YOURSELF WITH THIS MANUAL

There are two manuals for the INTERVIEW 4500, this Training Manual and the Technical Manual (ATLC-107-895-105). The Training Manual gives the basic information you need to operate the 4500, and it is much the easiest way to get started. It will give you enough familiarity with the operation of the 4500 so you will know what to ask of the Technical Manual.

Two training tapes and two blank tapes are furnished with your unit, and you will use all of them with this manual. The interactive BISYNC tape contains BISYNC data to be monitored and also includes an interactive demonstration program. The X.25-SDLC tape has three types of data, 7E-framed X.25, BISYNC-framed X.25, and SDLC-SNA. It also has a program for analyzing the 7E/X.25 data on the tape.

Since a self-teaching format is used, you should proceed through the manual in the given sequence, no matter what protocol you use in your own system.

All readers will use Sections 1 through 7. You will use the Interactive BISYNC Training Tape to learn the elementary use of the keyboard, how to monitor data, obtain and fill out program menus, and set triggers. Then you will use the blank tape to learn to emulate a terminal or modem.

All readers who plan to use the 4500 for bit-oriented protocols, whether X.25 (including BISYNC-framed X.25), X.75, or SDLC, should read Section 8 in its entirety. For BISYNC-framed X.25, you should also read Section 9.

Figures show typical CRT displays. Negative reproductions of the displays have been used because they offer better definition in print than do positives. The tape or RAM block numbers may vary between the training tape and reproductions in this manual because of the buffering and operator response time; however, the content of each figure will still illustrate the point.

For this section, all readers will use the program and data on the 4500 Interactive BISYNC Training Tape, TAP-895-106-1.0.

3 MONITORING TAPED DATA

The 4500's keys are grouped by function and color-coded. The two most important groups are program keys (red), and run keys (green). The factory 4500 keyboard is slightly different from that of a converted 3500 unit.

3.1 USING THE 4500'S KEYBOARD

Familiarize yourself with the INTERVIEW 4500's keyboard. If you have a factory-built unit your keyboard will look like the diagram in Figure 3.1-1; if you have a converted 3500, it will look like Figure 3.1-2. On the factory unit, there is an oval red MESSAGE key just to the left of the RUN key. On the converted 3500 unit the same function is served by the ENTER MSG key to the right of the space bar.

The blue and gray keys are alphanumeric characters. The blue keys are those used for hexadecimal entries and the most frequently used control characters.

Red keys are active in Program Mode; some of them also have uses in Run Mode. The large rectangular red PROGRAM key enables all the other red Program Mode keys.

Green keys are active only in Run Mode. The large rectangular green RUN key enables all the green Run Mode keys.

The two yellow keys, PRINT and EXECUTE, have limited, specific functions.

A single audible "beep" confirms each proper key action. If you use an illegal key, you will be warned by a displayed message, KEY ERROR, accompanied by a series of beeps.

Keyboard translation tables for the eight codes standard in the INTERVIEW 4500 may be found in the Technical Manual.

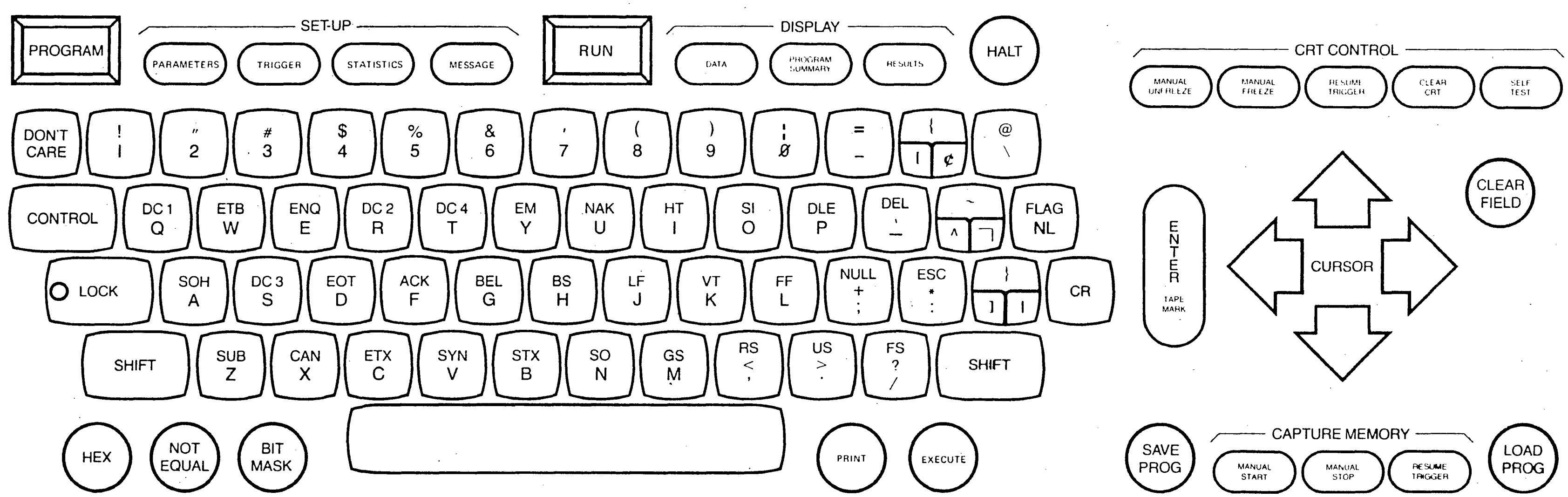


Figure 3.1-1 Factory 4500 Keyboard

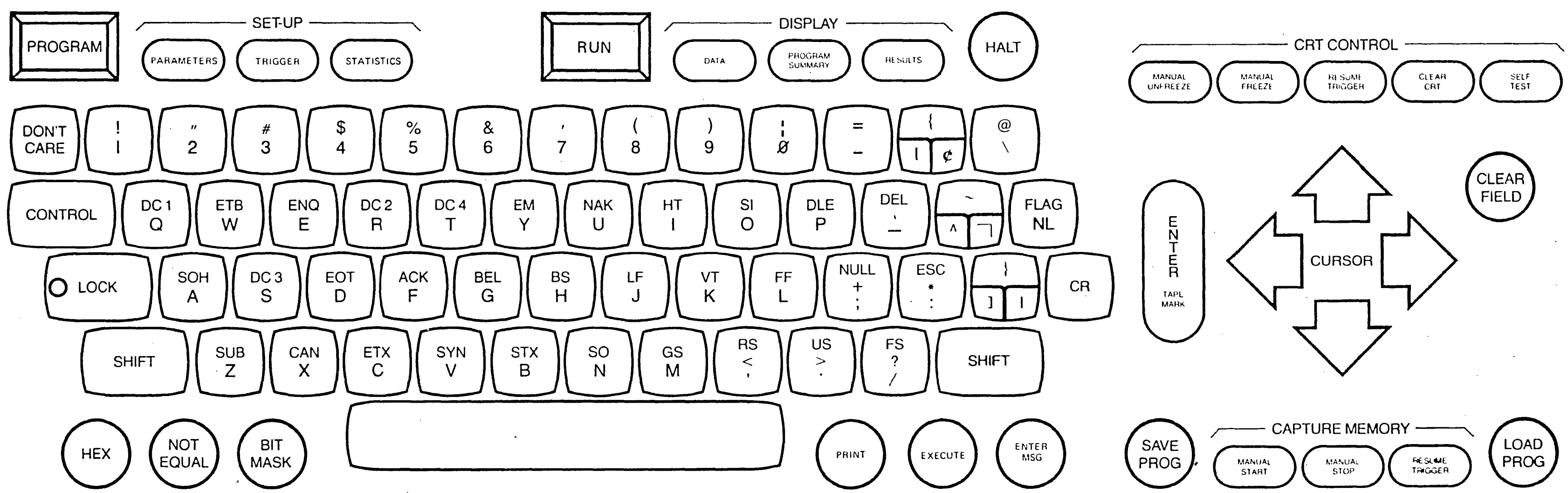


Figure 3.1-2 Converted 3500 Keyboard

```
** INTERVIEW 4500 **

RS-232 / V.24 INTERFACE

TAPE:

SELF TEST: IN PROCESS




                SOFTWARE VERSION: 10.08A
                OPTIONS: 05
```

Figure 3.2-1

```
** INTERVIEW 4500 **

RS-232 / V.24 INTERFACE

TAPE: TAPE NOT INSTALLED (41)

SELF TEST: GOOD


PRESS PROGRAM KEY FOR MENU PAGE

PRESS  RUN  KEY TO START PROGRAM

                SOFTWARE VERSION: 10.08A
                OPTIONS: 05
```

Figure 3.2-2

```
*MON/LINE*      BLOCK=
BOTH/EBCDIC/SYNC/
```

Figure 3.2-3

```
** PROGRAM SELECTION **

KEY SEQUENCE      MENU SELECTED

PARAMETER / 1     BASIC SETUP MENU
PARAMETER / 2     CRT & CAPTURE MEM MENU
PARAMETER / 3     RAM/TAPE XFER AND
                     PRINTER MENU
PARAMETER / 4     I/F CONTROL MENU
PARAMETER / 5     TAPE UTILITY MENU

TRIGGER           TRIGGER MENUS
STATISTICS        COUNTER/TIMER MENU
MESSAGE  OR       MESSAGE ENTRY MENUS
ENTER MSG~
```

Figure 3.2-4 (Version 10.08)

With a taped program, you may monitor any data simply by powering up the INTERVIEW 4500. You can load the program by inserting the tape before or after power-up.

3.2 POWERING UP THE 4500

3.2.1 Power-up Without a Tape

(1) Operate the red power switch to power up the 4500. The display of Figure 3.2-1 will appear on the CRT screen while power-up interactive diagnostics are conducted between the internal microprocessors. If your unit has the high-speed memory option, these self-tests may take several seconds. If an error is found, a code will be displayed on the SELF TEST line. In the Technical Manual you will find a list of error codes identifying the faulty modules and component types.

When the diagnostic tests are completed, the display will appear as in Figure 3.2-2. You may use only the PROGRAM key or the RUN key. Any other key will cause a KEY ERROR response on line 2 of the display and an audible signal. KEY ERROR clears after 3 seconds or when you operate a correct key.

(2) Verify the KEY ERROR response by operating a numeric key.

(3) Operate the green RUN key and observe the display (Figure 3.2-3). On the top line are the mode, MONitor, signal source, LINE, and tape BLOCK number. The second line shows that the monitor is expecting signals on BOTH the DCE and DTE circuits and that the signals should be EBCDIC and SYNChronous, with synchronization characters of 32 32_{16}.

On power-up without the tape inserted, the program defaults to basic BISYNC parameters. If a BISYNC signal were to be applied to the rear MONITOR connector, the data would now be displayed.

Press the red PROGRAM key. The unit will go into Program Mode and display the Program Selection menu (Figure 3.2-4). Notice that this menu permits only nine selections (eight in Version 10.06). All programming is accomplished through the Parameters, Triggers, Statistics, and Message-Entry menus, which you will learn to use in this manual.

NOTE: You may use the PROGRAM key at any time in any mode to return to a known basic starting point. It will initialize all circuits but will not affect whatever program has been entered in the unit.

3.2.2 Tape Inserted After Power-up

(1) If there is a RECORD tab on the rear of the Interactive BISYNC Training Tape cartridge check that it is in the PROTECTED position (the tab should be toward the center of the cartridge). Insert the training tape with the drive wheel to the rear and the transparent window on top. Push it gently in until you feel it lock.

NOTE: The tabs have been removed from the two training tapes containing data to prevent accidential erasure of their content, but the other tapes have tabs. You should form the habit of checking the tab whenever you use any tape.

(2) Operate the PROGRAM key.

```
** TAPE LOAD/SAVE **

PROGRAM ID: INTERACTIVE BISYNC TRAINING

STATUS: LOADED
```

Figure 3.2-5 (Version 10.06)

```
** TAPE LOAD/SAVE **

TEST ID: ______________________________

STATUS: CHECKING TAPE TYPE
```

Figure 3.2-6 (Version 10.08)

(3) Press the LOAD PROGram key located at the right of the CAPTURE MEMORY zone. A special TAPE LOAD/SAVE menu will be displayed (Figure 3.2-5). Version 10.08 displays CHECKING TAPE TYPE on the STATUS line (Figure 3.2-6) while it checks the type of tape in the unit.

NOTE: This is because an option is available for the Version 10.08 INTERVIEW 4500 that will record up to 100 programs on a single (Program-Only) tape. Version 10.06 cannot check tape type.

While the microprocessor that controls the tape automatically repositions the tape to the program area and reads the program, LOADING PROGRAM (or just LOADING) is displayed on the STATUS line. When the program has been loaded, the message is replaced by PROGRAM LOADED (or LOADED), and the tape is repositioned to Block 000 for playback. The PROGRAM ID is INTERACTIVE BISYNC TRAINING.

Press the rectangular green RUN key and watch playback of the taped data begin at tape block 40. (The taped program contains an instruction to begin playback at Block 40.) The display will be discussed in the next lesson.

Don't turn off the 4500 yet.

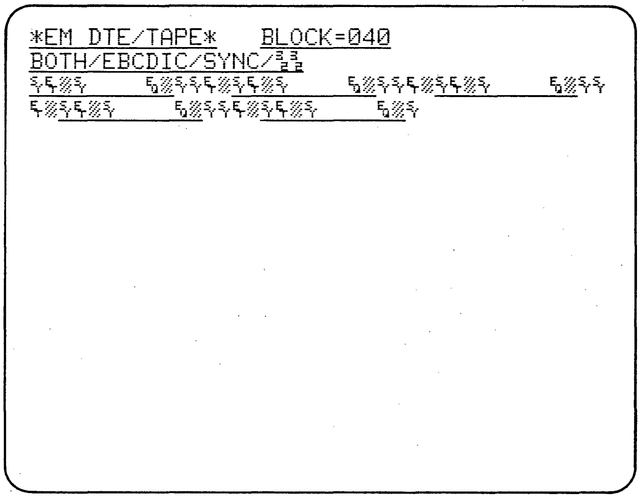


Figure 3.3-1

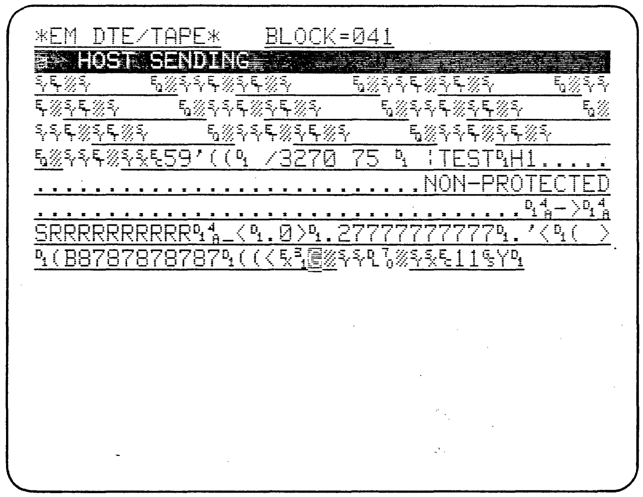


Figure 3.3-2

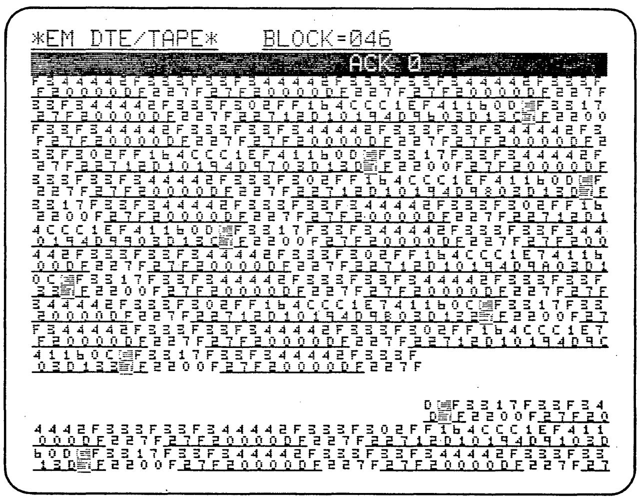


Figure 3.3-3

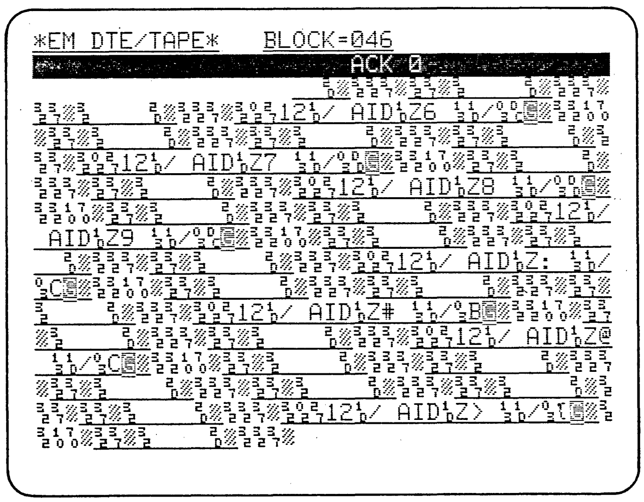


Figure 3.3-4

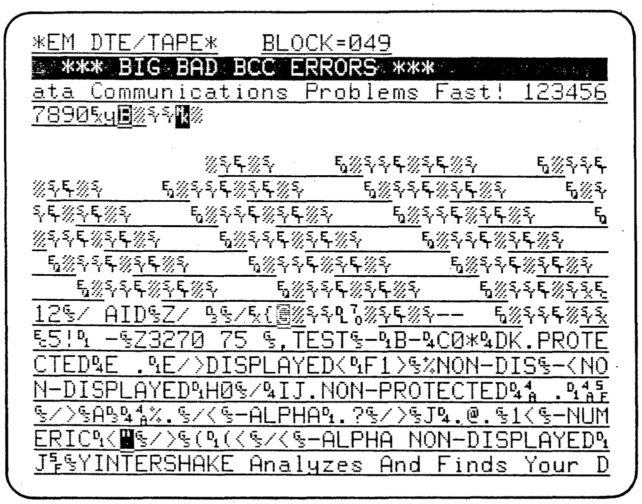


Figure 3.3-5

You can load a program by inserting the tape before power-up. While the 4500 is monitoring data, you can interact with the display from the keyboard, changing playback speed and displaying data in hexadecimal.

3.3 RUN MODE; POWER-UP WITH TAPE INSERTED

Operate the PROGRAM key to stop the tape and press the red power switch to power down the 4500. Leave the tape inserted.

CAUTION: Always operate the red PROGRAM key to stop tape motion before you power down the 4500. Never eject a tape until after tape motion has stopped or you may damage the tape-drive mechanism.

Power up the 4500. After the internal self tests are finished, Version 10.08 units check the tape type. When the tape has been searched for a test program in its protected location, the program is automatically loaded and the program ID is displayed. Then, after the tape repositions itself, data is displayed on the CRT (Figure 3.3-1).

The top two lines of the CRT display are reserved for status information for the operator. Notice that these two lines now indicate the 4500 is EMulating a DTE; the data source is TAPE at BLOCK 040; and it is looking for signals on BOTH the DTE and DCE lines in EBCDIC code and SYNChronous format with 32 32_{16} for synchronization characters. The second line of status information is soon replaced by a message to the operator initiated by the training tape program (Figure 3.3-2). Each message to the operator, or Prompt, remains on the CRT until it is replaced unless you clear it with the CLEAR FIELD key.

DCE data is always underlined because the DCE is usually connected to a transmission line.

Speed of the CRT display is 2400 bps as defined by the program on the training tape. Operate the UP cursor arrow to increase the speed. Each operation of the UP cursor arrow key doubles the playback speed to a maximum of 9.6 kbps. (The tape will record data at up to 19.2 kbps.) Each operation of the DOWN cursor halves the playback speed.

You may wish to view the display in hexadecimal. Operate the HEX key and observe that the entire display except for Lines 1 and 2 is hexadecimal as shown in Figure 3.3-3. Operate the HEX key again to restore text.

Operate CONTROL plus HEX simultaneously and observe that only the EBCDIC control (protocol) characters change to hexadecimal and the text remains (Figure 3.3-4). This feature is extremely valuable in debugging software problems. Operate CONTROL plus HEX again to restore all text. HEX and CONTROL plus HEX are alternate action operations.

The 4500 is validating each CRC received. When the CRC is good, the second block check character is replaced by a low-intensity G. If the CRC is bad, the second character is replaced by a bright reverse-image B.

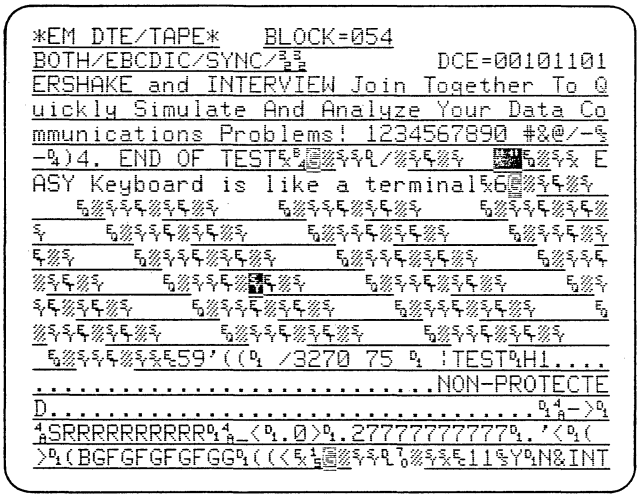


Figure 3.4-1

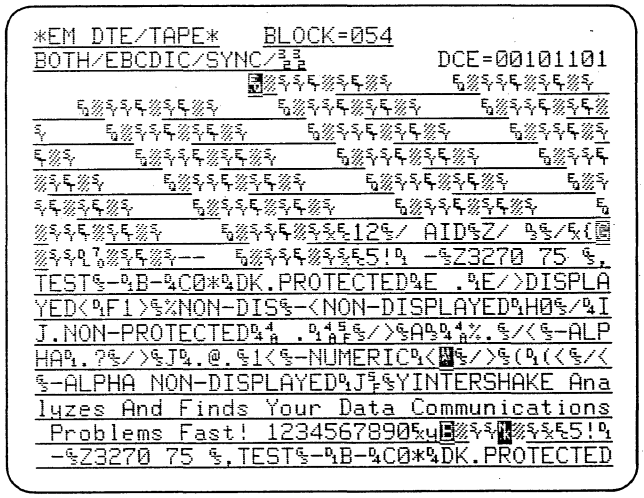


Figure 3.4-2

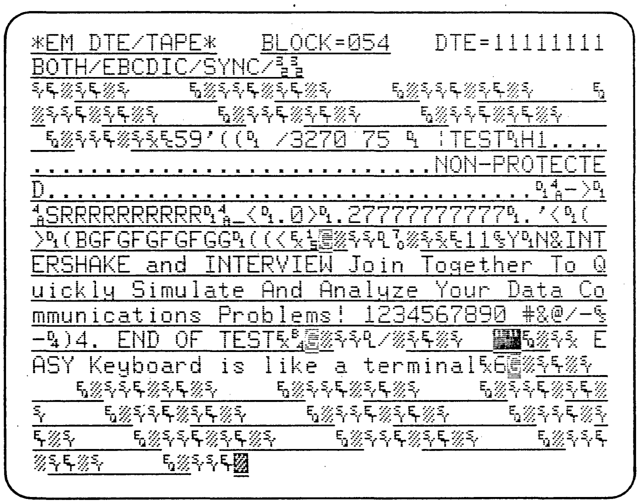


Figure 3.4-3

At Block 49 of the tape, the second line on the CRT will display a message that a Bad BCC has been received (Figure 3.3-5). The training tape program shows bad BCCs in five ways:

(1) Second block check character is replaced by reverse-image B.

(2) The NAK response is highlighted on the display.

(3) The audible alarm is sounded.

(4) Bad BCCs are being counted by the program. (You will see this later.)

(5) The PROMPT message is displayed.

For your own applications, you can choose any of these methods that you find useful.

The MANUAL FREEZE key stops entry of new data into the display buffer. The resulting frozen display has several unique characteristics that distinguish it from the Run Mode display.

3.4 MANUAL FREEZE

Operate the MANUAL FREEZE key in the CRT control zone to obtain a display similar to Figure 3.4-1.

Notice that the two lines that were blanked when the display was running real time have restored their data to give a full 640-character display. The blinking cursor is on the last character received (enhanced characters also continue to blink).

Operate the B key to display the Beginning of the buffer (Figure 3.4-2 is typical) and then the E key for the End of the buffer (Figure 3.4-3 is typical). Intermediate positioning of the 640-character CRT window in the 1920-character buffer is accomplished by holding down the UP or DOWN cursor key until, after the cursor reaches the top or bottom of the CRT, the next line is pulled onto the screen.

Notice that the RIGHT and LEFT cursor keys also position the cursor and it "wraps around" from the end (or beginning) of one line to the beginning (or end) of the next. This is a valuable time-saving feature.

At the right side of the top two lines is displayed DCE or DTE plus a pattern of 1's and 0's representing the binary pattern of the character at the cursor position. Bit 1, the low-order bit and first bit in the serial stream, is on the right. This facilitates reading the hexadecimal equivalent directly from the bit pattern.

Allow the frozen data display to remain on the screen and go to the next lesson.

The 4500 tape and CRT may be controlled either from the keyboard or by triggers. The status indicators on the front panel will always let you know which mode the unit is in.

3.5 MANUAL VS. TRIGGER CONTROL OF CRT AND TAPE

3.5.1 CRT Control Zone

Notice that both of the MANUAL indicators and the CRT FREEZE indicator on the status indicator panel (Figure 3.5-1) are ON. The MANUAL FREEZE key not only freezes the CRT display, but also stops Capture Memory (tape) playback. Hence the block number of the tape remains displayed but has stopped incrementing because tape motion has stopped.

Press MANUAL UNFREEZE. Tape playback resumes from the block at which it stopped, but notice from the status indicators that, like the CRT, it is still under manual control.

Press RESUME TRIGGER in the CRT zone. The two MANUAL indicators go out and the TRIGGER indicators go on, indicating that both CRT and tape are again under program control. It is important to remember this distinction between the MANUAL UNFREEZE and RESUME TRIGGER keys when a program is running in the 4500.

3.5.2 Capture Memory Control Zone

Verify that MANUAL STOP of the Capture Memory (below the cursor keys) also stops the tape and thus freezes the display.

If the tape were recording instead of playing back, MANUAL STOP of the Capture Memory would stop the tape without affecting the CRT, and MANUAL FREEZE of the CRT would not affect the tape motion.

As in the CRT control zone, press RESUME TRIGGER to restore program control.

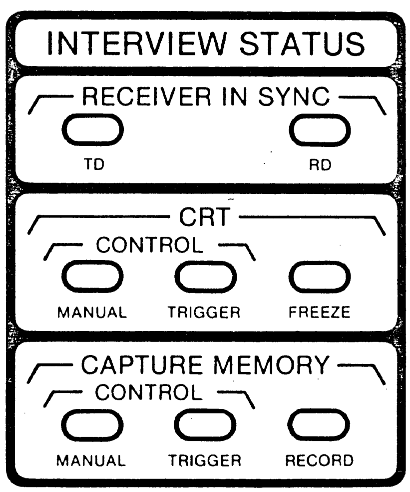


Figure 3.5-1

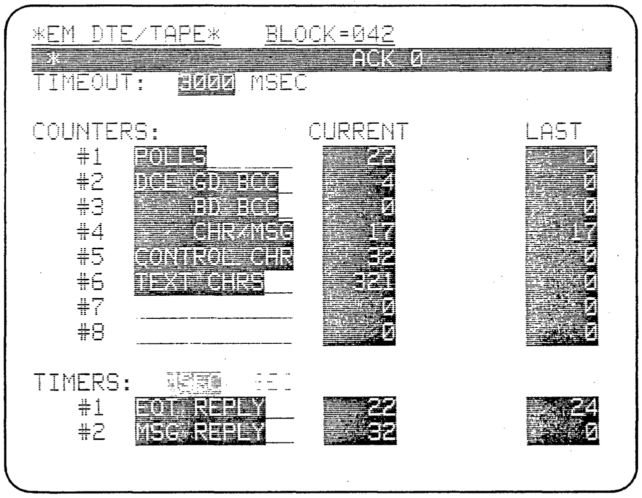


Figure 3.6-1

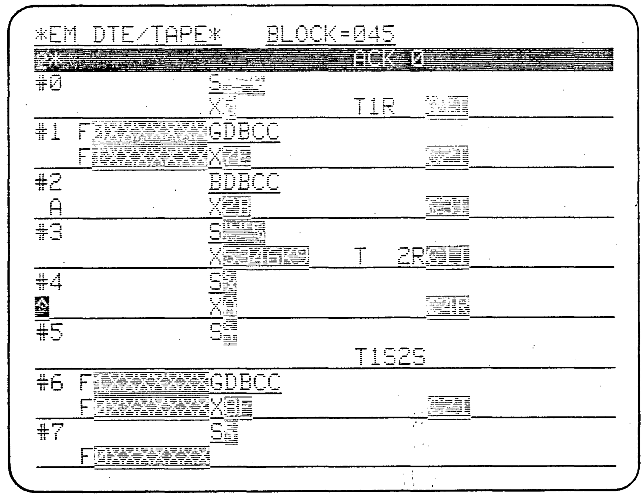


Figure 3.6-2

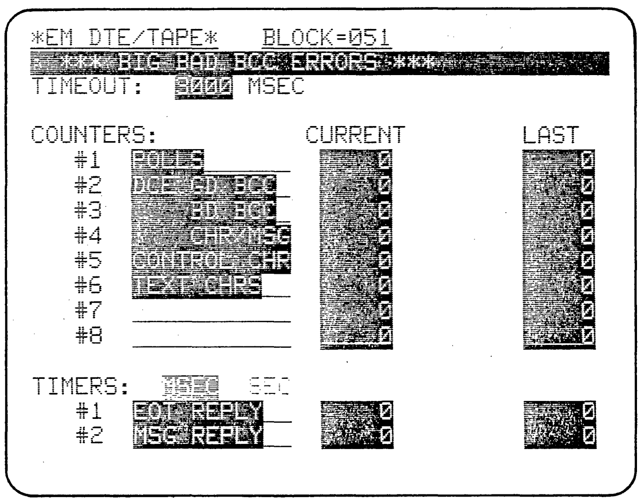


Figure 3.6-3

You can observe and reset the 4500's eight counters and two timers and check how they are programmed at any time without leaving Run Mode.

3.6 READING THE COUNTERS AND TIMERS

Press the PROGRAM key and then RUN again. This procedure initializes the tape and restarts the 4500's program. Press the green RESULTS key. This displays a counter and timer menu (Figure 3.6-1) on which you can watch the real-time counter and timer values.

The two status lines at the top of the display remain and you can observe the tape block number incrementing. Watch the display for a few blocks, to verify that the counter and timer values are changing. Press MANUAL FREEZE. Notice that the counter and timer values are static because the tape has stopped and no new data is being presented to the counters and timers. If you were monitoring line data, you would see that the counters and timers continue to operate during CRT Freeze.

Press MANUAL UNFREEZE and notice that counter and timer values start to change again. The MANUAL CRT and Capture Memory commands have no effect on the operation of Counters and Timers: they are still under trigger control.

Press the green DATA key. The data flow returns to the screen. Press the PROGRAM SUMMARY key. The display (Figure 3.6-2) is now a summary of the program that is operating the counters and timers. Later, you will be able to interpret this summary; for now, it is sufficient to know that you can obtain it in Run Mode. Notice that the status information remains on the top two lines. The program continues to run while the summary is displayed. Press DATA to return to the data display.

Press RESULTS again. Notice that six of the counters and the two timers are clearly identified. Later, in Program Mode, you will see how to name them.

Notice that there are two columns to the right of the names of the Counters and Timers labeled CURRENT and LAST. The current value is shown in the CURRENT column; the value when the counter or timer was last reset, in the LAST column. Each time a counter or timer is reset by triggers, the LAST value is also reset.

You can easily modify the RESULTS display manually while a test is running to enable you to look for several criteria at the same time without going back into the Program Mode.

Operate the C key and then the numeral 4 to reset Counter 4 to zero. You can reset any counter with C followed by its number and any Timer can be reset by T followed by its number. Use the R key to reset all counters and timers. When you reset a counter or timer manually, the LAST value is not displayed.

Operate the RUN key while viewing the RESULTS display (Figure 3.6-3) and notice that all counters and timers reset. RUN, used when the unit is already in Run Mode, restarts the entire test, without initializing the tape.

Both timers increment in milliseconds or seconds as indicated on the display.

Maximum count is 65,535 for counters and timers. Overflow is indicated by a message between the Current and Last columns.

NOTE: All data received by the 4500's trigger logic is presented to the counters and timers whether or not the data or portions of it are displayed on the CRT.

For this section, all readers will use the EBCDIC data on the 4500 INTERACTIVE BISYNC Training Tape (TAP-895-106-1.0). You will learn to use the cursor to enter a basic program by editing the basic parameters on the 4500 X.25-SDLC Training Tape (TAP-895-106-2.0).

4 BASIC PARAMETERS AND CRT CONTROL

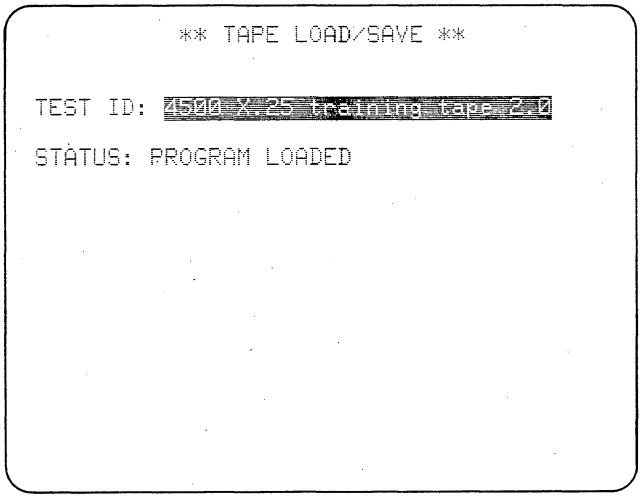


Figure 4.1-1 (Version 10.08)

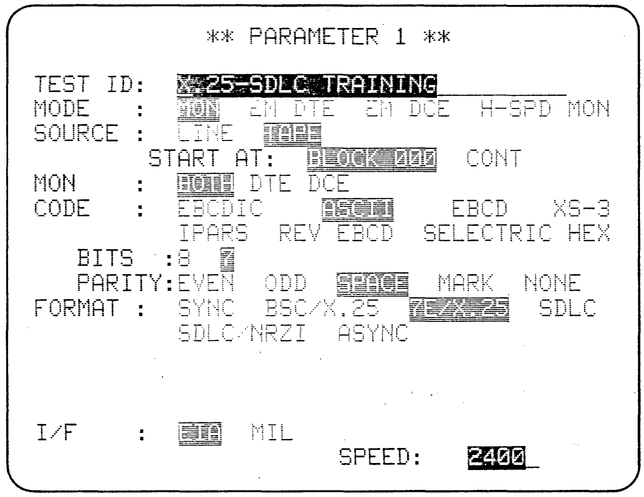


Figure 4.1-2

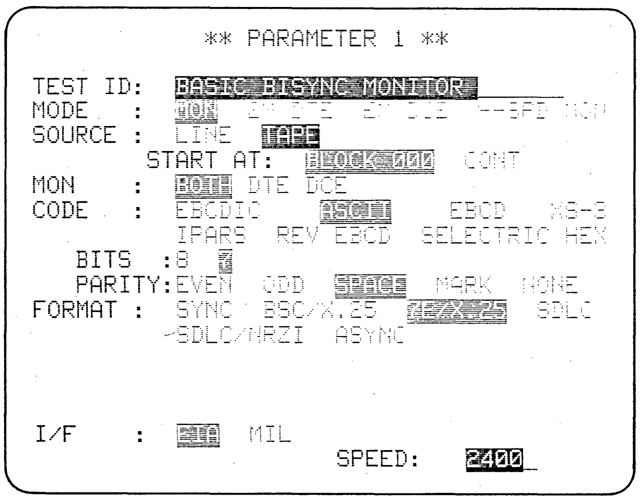


Figure 4.1-3

You can select all the parameters needed to monitor data from the Parameters 1 menu using the ENTER and the cursor ARROW keys.

4.1 SELECTING PROGRAM PARAMETERS: PARAMETERS 1 MENU

IMPORTANT: Always set up the Parameters 1 menu before you fill out any other menus--messages or triggers, for example--because your Parameters 1 choices determine what will be offered on the other menus.

Power up the 4500 without a tape; then insert the X.25-SDLC Training Tape. Press the PROGRAM key and then load the taped program by pressing the LOAD PROG key. When the program has been loaded, as shown in Figure 4.1-1, remove the tape. The program now in the 4500 is for monitoring bit-oriented X.25 data. You will modify it to a BISYNC program and in the process learn how to use the keyboard to fill out a program menu.

Press PARAMETERS followed by 1. The menu that is now displayed (Figure 4.1-2) includes all the basic parameters necessary to monitor any data.

The cursor is in the first position of the TEST ID line. This is a data-entry field that you can use to identify your program. At the right of the keyboard are grouped the red keys that you will use to control the cursor: an ENTER key, four cursor ARROWS, and the CLEAR FIELD key. Press the CLEAR FIELD key. All the characters in the field where the cursor is positioned are immediately cleared. Now enter the test ID: Press the shift LOCK key and notice that the red indicator on the key goes on. Type in BASIC BISYNC MONITOR PROGRAM.

It doesn't all fit! Use the LEFT cursor arrow to move the cursor back to the P in PROGRAM. Press SHIFT and notice that the LOCK indicator light goes off. Press SHIFT plus CLEAR FIELD simultaneously. Everything from the cursor location to the end of the field goes away and the title is now BASIC BISYNC MONITOR. If you have made a "typo" you can write over the error by positioning the cursor on it and operating the correct key.

Look at the MODE field on the next line and notice that MON is displayed in low-intensity reverse image. This means that MON is the current selection. Now press the ENTER key. The cursor goes immediately to MON. It is now displayed in blinking bright reverse image to indicate the cursor position. MON is the correct selection, since you are going to MONitor the training tape data.

Press the RIGHT cursor arrow. The cursor moves one entry to the right within the MODE FIELD, selecting EM DTE, which we, of course, don't want. Move the cursor back to MON using the LEFT cursor arrow, and this time press ENTER. This time the cursor leaves the MODE selection intact and goes immediately to the current selection in the next field, indicating that the 4500 will be expecting the data SOURCE to be TAPE. Again, this is what we want. The menu should now look like Figure 4.1-3.

To review--ENTER moves the cursor directly from a selection in one field to the current selection in the next field. ENTER never changes any of your selections. The LEFT and RIGHT cursor arrows change selections within a field. You should form the habit of always using ENTER to move to the next field, and save the RIGHT and LEFT arrows for changes within a field.

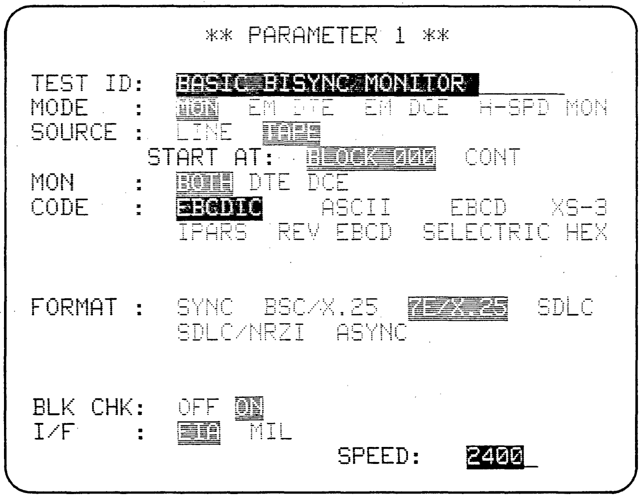


Figure 4.1-4

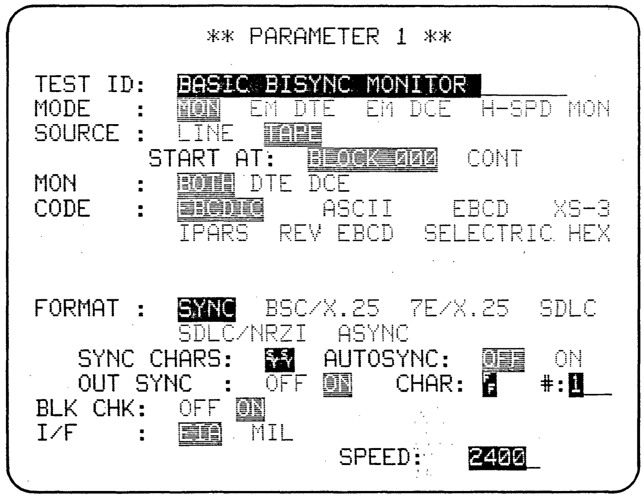


Figure 4.1-5

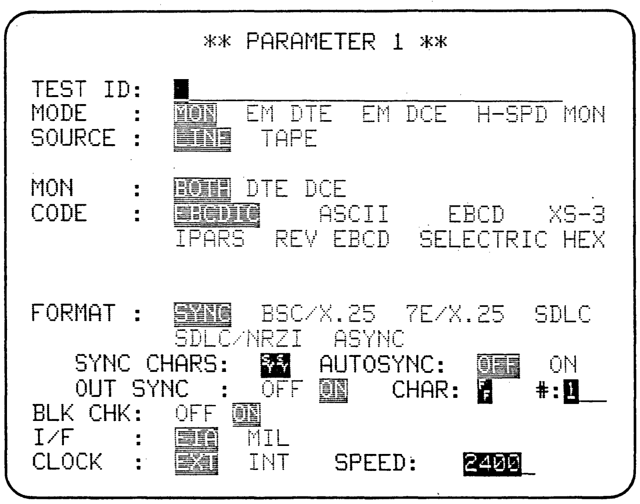


Figure 4.1-6

In the next two fields, we want the current selections, START AT BLOCK 000 and MONitor BOTH sides of the line, so use the ENTER key to go directly to the CODE field. The cursor will be on the current selection, ASCII. Watching the next few lines, press the LEFT arrow to select EBCDIC. Notice that several fields that are pertinent to ASCII but not EBCDIC go away. (Compare Figures 4.1-4 and 4.1-3.)

Go to the FORMAT field: Currently there are several blank lines following FORMAT. Watch the menu as you select SYNC with the LEFT arrow. The default values in the new fields are acceptable for the BISYNC Training Tape data.

The menu is now appropriate for monitoring EBCDIC BISYNC data from the 4500's integral tape, and should look like Figure 4.1-5.

Since this menu is almost the same as the 4500's default program (Figure 4.1-6), you could have powered up the unit without loading the taped program, and achieved the same thing more easily without learning as much.

The UP or DOWN arrow moves the cursor to the first current selection in the preceding or following line, respectively. This means that the cursor will skip fields if there is more than one field on a line. To move the cursor to the first line on the menu, press CONTROL plus UP simultaneously; to go directly to the last line, press CONTROL plus DOWN.

You may want to experiment with other code and format selections. If you do, be sure to return the menu to the status of Figure 4.1-5 before you go on to the next lesson.

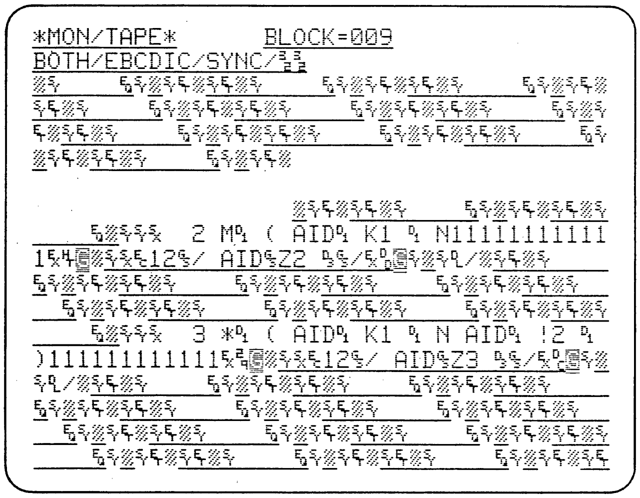


Figure 4.2-1

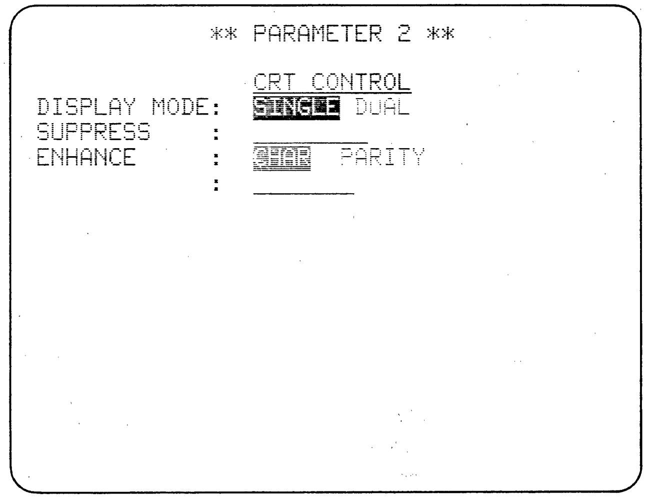


Figure 4.2-2

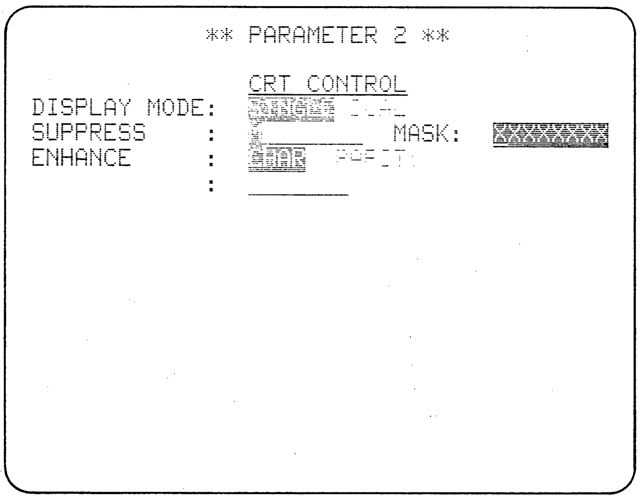


Figure 4.2-3

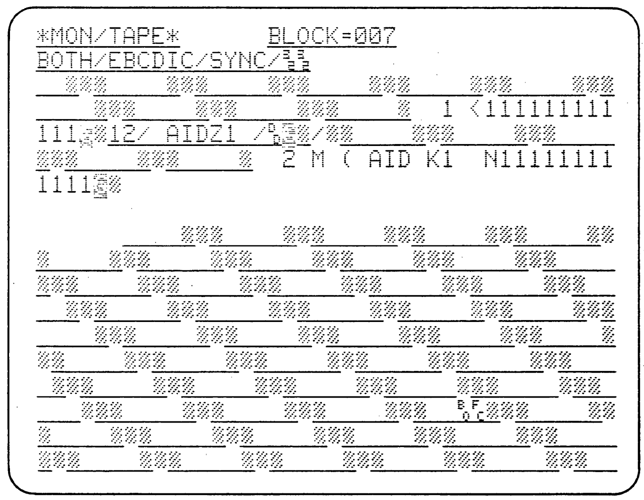


Figure 4.2-4

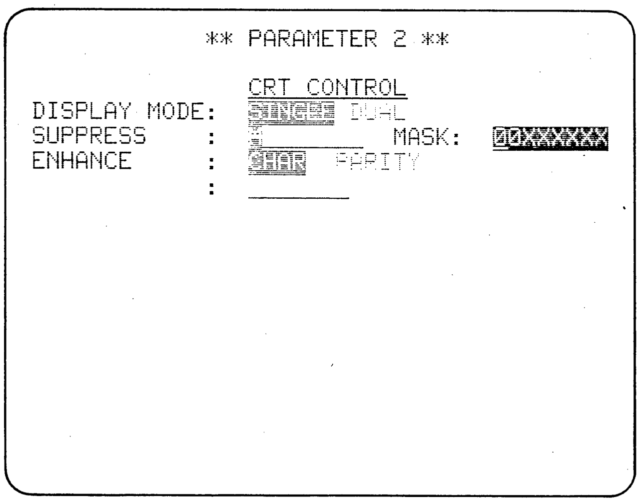


Figure 4.2-5

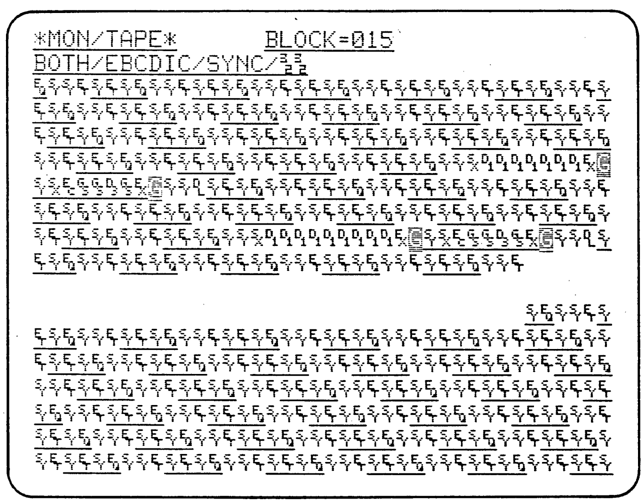


Figure 4.2-6

With the Parameters 2 menu, you may suppress from the CRT display up to eight characters, including one Bit Mask.

4.2 SELECTIVE DISPLAY: SUPPRESSING DATA FROM THE CRT

Insert the Interactive BISYNC Training Tape and press the RUN key without loading the taped program. Notice that playback begins at Block 000. All control characters are displayed and there are no Prompts or enhancements on the data (Figure 4.2-1). We shall suppress all control characters from the display.

Press PROGRAM; then PARAMETERS and 2 to obtain the Parameters 2 menu (Figure 4.2-2). The cursor is at the DISPLAY MODE field of the CRT Control section.

Use the ENTER key to move the cursor down to the SUPPRESS line. If you move the cursor past the SUPPRESS line, use the UP cursor arrow to return to the SUPPRESS field. The SUPPRESS field is a data-entry field. You may choose to suppress up to eight characters and enter them directly from the keyboard. There are more than eight protocol control characters; however, all (and only) protocol control characters in EBCDIC have bits 7 and 8 as logic 0. Therefore, if you suppress all characters with bits 7 and 8 equal 0, you will suppress all of the control characters.

The BIT MASK key is located on the lower left of the keyboard. Operate BIT MASK and observe that a low-intensity M is displayed in the SUPPRESS field (Figure 4.2-3). To the right appears MASK with the eight-position bit mask pattern XXXX XXXX.

Whenever a low-intensity alphanumeric symbol appears in a data-entry field, it represents a character other than itself. The display of the low-intensity M means that Bit Mask has been chosen.

The blinking cursor is in the Bit Mask entry field at the high-order bit on the left, Bit 8. To change Bits 8 and 7 to 0, press the number 0 key twice and observe that the pattern is now 00XX XXXX. The X's in the bit mask pattern mean Don't Care bits: the 4500 will ignore the Don't Care bits (1 through 6) and look only at Bits 7 and 8.

Note that only one Bit Mask at a time may be entered on the Parameters 2 menu.

Press the RUN key and observe that all protocol characters have been suppressed (Figure 4.2-4).

You can change the Bit Mask entry to suppress text instead of protocol characters simply by suppressing all characters with bits 7 and 8 NOT EQUAL to 0. To change the Bit Mask entry, return to the Parameters 2 menu by pressing PROGRAM and then PARAMETERS followed by 2. Reposition the cursor on the low-intensity M in the SUPPRESS field and press the NOT EQUAL key to the left of the BIT MASK key. A horizontal strike will appear at the cursor position. Press BIT MASK and notice the low-intensity M appears with the horizontal strike through it (Figure 4.2-5). The Bit Mask pattern to the right has not been changed but all characters not equal to the Bit Mask pattern will now be suppressed.

Operate RUN and notice that as in Figure 4.2-6, the text is suppressed. If you wish to condense the display even more, the strings of DC1 characters (D1) may also be suppressed. Return to the Parameters 2 menu and position the cursor to the right of the not equal bit mask (M) by using ENTER and

the RIGHT cursor arrow. Press CONTROL plus DC1 simultaneously and D1 will appear in the SUPPRESS field next to the NOT EQUAL Bit Mask. If you wish you may add six more characters to the SUPPRESS field.

Operate RUN to observe the display. Notice that the DC1 characters are suppressed as well as text.

To clear the SUPPRESS field, return to Parameters 2 and position the cursor on the SUPPRESS line. Operate the CLEAR FIELD key to the upper right of the cursor keys and all entries in the SUPPRESS field will be deleted.

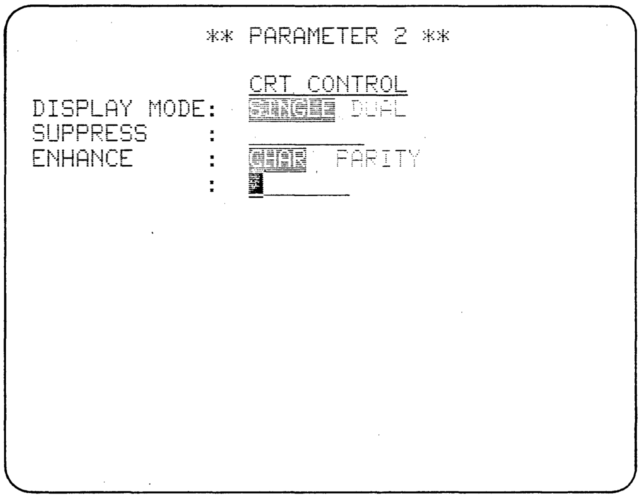


Figure 4.3-1

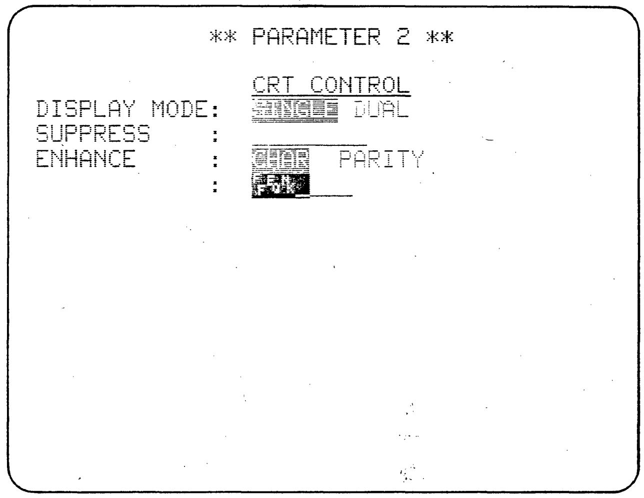


Figure 4.3-2

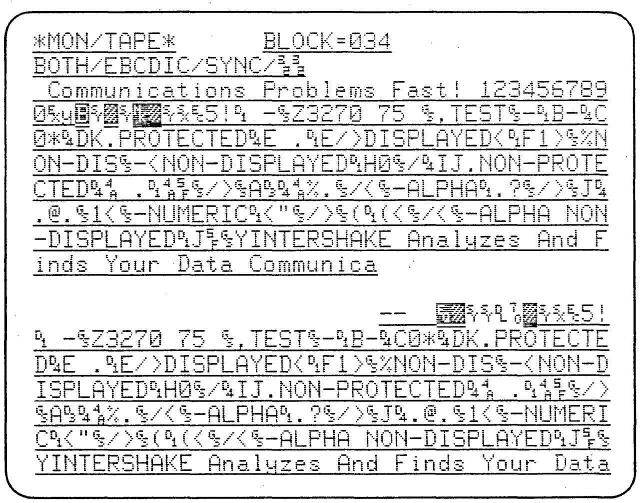


Figure 4.3-3

Using the Parameters 2 menu, you may enhance up to eight characters by displaying them on the CRT in blinking reverse image.

4.3 SELECTIVE CHARACTER ENHANCEMENT

You may choose up to eight characters to be entered in the ENHANCE field. The ENHANCED characters blink in reverse image on the CRT screen, providing you with a valuable diagnostic aid.

On the Parameters 2 menu, place the cursor on the line below ENHANCE (Figure 4.3-1).

TO ENHANCE idle pad characters (FF_{16}), press the red HEX key followed by the F key twice. This method is used to enter hexadecimal characters on most of the 4500's menus. Enter the control character ENQ by simultaneously pressing the CONTROL key plus E, and enter NAK in similar fashion (CONTROL plus U) (see Figure 4.3-2). NOTE: Control characters must be entered this way or in hexadecimal. You may enter five other characters in the ENHANCE field, if you wish. Press the RUN key and notice that the selected characters blink in reverse image (Figure 4.3-3).

Clear the ENHANCE field with the CLEAR FIELD key.

This is a good place to take a break, if you wish.

All programming in the 4500 is done with a unique, non-sequential system of 16 triggers. You simply specify what condition or conditions you want a trigger to look for, and what action or actions you want it to take.

For this section, all readers will use the data on the 4500 Interactive BISYNC Training Tape. Using the parameters configuration of Section 4, you will learn to use the 4500 triggers, and set them to operate counters and timers.

5 TRIGGERS

```
** TRIGGER Ø CONDITIONS **
________________________________________________
MON:   NEITHER DTE DCE


MON:   EIA  NO  YES

MON:   FLAGS  NO  YES

MON:   TIMEOUT                  NO   YES
```

Figure 5.1-1

```
** TRIGGER Ø ACTIONS **
________________________________________________
SET XMIT    : NO   YES
SET TMOUT   : NO   RSTRT  STOP
SET CRT     : NO   YES


SET CPT MEM: NO   ON    OFF
SET FLAG    : NO   YES


SET TIMER: TIMER1 NO  YES
           TIMER2 NO  YES
SET CNTR : CNTR1  NO  YES
           CNTR2  NO  YES
SET ALARM: NO  YES        SET OTSYNC:NO  YES
SET ALT BANK:   NO   YES
```

Figure 5.1-2

```
** TRIGGER **    Ø   *
PRESS TRIG #(Ø-F) THEN C(COND) OR A(ACT)
#Ø
________________________________________
#1
________________________________________
#2
________________________________________
#3
________________________________________
#4
________________________________________
#5
________________________________________
#6
________________________________________
#7
________________________________________
```

Figure 5.1-3

The 4500 has 16 Triggers, grouped into two banks of eight. There are two menus for each Trigger, a Conditions menu and an Actions menu. A Trigger Summary display is also available.

5.1 DISPLAYING THE TRIGGER MENUS

5.1.1 Conditions and Actions Menus

Press PROGRAM. Display the Trigger 0 Conditions menu by pressing the TRIGGER, numeral 0, and C keys in succession. Figure 5.1-1 shows this menu. To view the Actions menu of Trigger 0 (Figure 5.1-2), press TRIGGER, 0, and A. In this manner, you can see any 4500 Trigger menu whenever you wish.

When you are working on a particular trigger, though, you may want to alternate between Conditions and Actions a few times before you are finished. With the Trigger 0 Actions menu displayed, just press CONTROL plus ENTER simultaneously. You will immediately see the Conditions menu; then press CONTROL plus ENTER again to bring back the Actions menu.

5.1.2 Trigger Summary and Banks

Now press TRIGGER. You will see the Trigger Summary (Figure 5.1-3), which is the same display you saw as the Program Summary in Run Mode. Notice that there are spaces for Triggers 0 through 7. This is the "low bank" of triggers. To see the summary of the "high bank" triggers, Triggers 8 through F, press the UP or DOWN cursor arrow. To return to the low-bank summary, press the UP or DOWN cursor arrow again.

With either summary bank displayed, you can see any trigger menu by selecting its identification number followed by C or A.

Functionally, as well as for display purposes, the 16 triggers are grouped into two banks. Only one bank of eight triggers is active at a time. The low bank is always active when the 4500 enters Run Mode. We shall see later how the alternate bank is selected as a trigger action.

```
** PARAMETER 1 **

TEST ID: ____________________________________
MODE   :  MON  EM DTE  EM DCE  H-SPD MON
SOURCE :  LINE  TAPE  RAM
        START AT:  BLOCK 000  CONT
MON    :  BOTH DTE DCE
CODE   :  EBCDIC   ASCII   EBCD   XS-3
          IPARS  REV EBCD  SELECTRIC HEX


FORMAT :  SYNC  BSC/X.25  7E/X.25  SDLC
          SDLC/NRZI  ASYNC
   SYNC CHARS:     AUTOSYNC:  OFF  ON
   OUT SYNC  :  OFF  ON   CHAR:     #:1__
BLK CHK:  OFF  ON
I/F    :  EIA  MIL
                      SPEED:  2400_
```

Figure 5.2-1

```
** STATISTICS **

TIMEOUT:  3000 MSEC

COUNTERS:                CURRENT        LAST
   #1  ____________
   #2  ____________
   #3  ____________
   #4  ____________
   #5  ____________
   #6  ____________
   #7  ____________
   #8  ____________

TIMERS:  MSEC   SEC
   #1  ____________
   #2  ____________
```

Figure 5.2-2

```
** STATISTICS **

TIMEOUT:  3000 MSEC

COUNTERS:                CURRENT        LAST
   #1  ____________
   #2  ____________
   #3  ____________
   #4  ____________
   #5  ____________
   #6  ____________
   #7  ____________
   #8  ____________

TIMERS:  MSEC   SEC
   #1  HOST REPLY_
   #2  ____________
```

Figure 5.2-3

```
** TRIGGER 0 CONDITIONS **
____________________________________________
MON:  NEITHER DTE DCE


MON:  EIA  NO  YES


MON:  FLAGS  NO  YES

MON:  TIMEOUT                  NO   YES
```

Figure 5.2-4

```
** TRIGGER 0 CONDITIONS **
____________________________________________
MON:  NEITHER DTE DCE     LINK:  NO  YES
  FOR: STRG 1 OF PARER GDBCC BDBCC ABORT
______________

MON:  EIA  NO  YES


MON:  FLAGS  NO  YES

MON:  TIMEOUT              NO   YES
```

Figure 5.2-5

```
** TRIGGER 0 ACTIONS **
DTE STRG
____________________________________________
SET XMIT    :  NO   YES
SET TMOUT   :  NO   RSTRT  STOP
SET CRT     :  NO   YES


SET CPT MEM:  NO   ON    OFF
SET FLAG   :  NO   YES


SET TIMER: TIMER1  NO  YES
           TIMER2  NO  YES
SET CNTR : CNTR1   NO  YES
           CNTR2   NO  YES
SET ALARM:  NO  YES         SET OTSYNC: NO  YES
SET ALT BANK:  NO   YES
```

Figure 5.2-6

The 4500's two timers are controlled by triggers. You select the timer increment and also name the timers on the Statistics menu.

5.2 SETTING TIMERS

Power up the 4500 without a tape. Press PROGRAM, then PARAMETERS and the numeral 1 to display the Parameters 1 menu. Select TAPE as the data source (see Figure 5.2-1).

5.2.1 Filling out the Statistics Menu

You are going to set Timer 1 to measure host reply time, but first press the STATISTICS key. The display you see (Figure 5.2-2) is essentially the default version of the Results display you saw in Run Mode. Here you will select the timer increment value and give Timer 1 a name.

Use the ENTER key to tab down to the TIMERS line. The default timer increment is MSEC, which should be appropriate for measuring host response time. Go to the TIMER #1 line and type in HOST REPLY (Figure 5.2-3).

5.2.2 Measuring Host Response Time

Host reply time, for the training tape data, will start when a DTE block is completed and end when a DCE block starts. On Trigger 0, you will set Timer 1 to start incrementing and on Trigger 1, set Timer 1 to stop.

Press TRIGGER, 0, and C to display the Trigger 0 Conditions menu (Figure 5.2-4). The cursor is on NEITHER, but we want to look at DTE data, so use the RIGHT arrow to move the cursor to DTE. Three new fields appear so that you can specify precisely what you want to look for on the DTE side of the line (TD). Using ENTER, go to STRG, which is the default selection; then tab to the STRG entry line. Define the end of text by entering the control character ETX (CONTROL plus the ETX key), followed by two Don't Care characters, DC DC (use the red DON'T CARE key), to account for the two block check characters. Figure 5.2-5 shows this entry.

NOTE: Control characters may be entered with the designated control keys or in hexadecimal (using the HEX key followed by two digits). Do not, for example, use the letters E, T, X. If a control character does not appear on the keyboard, it must always be entered in hexadecimal.

To view the actions menu of this trigger (Figure 5.2-6), press CONTROL plus ENTER. Notice that the trigger conditions are summarized at the top of the Actions menu.

```
         ** TRIGGER 0 ACTIONS **
DTE STRG

SET XMIT    : NO   YES
SET TMOUT   : NO   RSTRT  STOP
SET CRT     : NO   YES


SET CPT MEM: NO   ON    OFF
SET FLAG   : NO   YES


SET TIMER: TIMER1 NO YES RSTRT CONT STOP
           TIMER2 NO YES
SET CNTR : CNTR1  NO YES
           CNTR2  NO YES
SET ALARM: NO YES       SET OTSYNC:NO YES
SET ALT BANK:   NO   YES
```

Figure 5.2-7

```
        ** TRIGGER 0 CONDITIONS **

T1R
MON:  NEITHER DTE DCE     LINK:  NO YES
  FOR: STRG 1 OF PARER GDBCC BDBCC ABORT


MON:  EIA  NO  YES


MON:  FLAGS  NO  YES

MON:  TIMEOUT                  NO  YES
```

Figure 5.2-8

```
        ** TRIGGER 1 CONDITIONS **

MON:  NEITHER DTE DCE     LINK:  NO YES
  FOR: STRG 1 OF PARER GDBCC BDBCC ABORT


MON:  EIA  NO  YES


MON:  FLAGS  NO  YES

MON:  TIMEOUT                  NO  YES
```

Figure 5.2-9

```
         ** TRIGGER 1 ACTIONS **
DCE 1 OF

SET XMIT    : NO   YES
SET TMOUT   : NO   RSTRT  STOP
SET CRT     : NO   YES


SET CPT MEM: NO   ON    OFF
SET FLAG   : NO   YES


SET TIMER: TIMER1 NO YES RSTRT CONT STOP
           TIMER2 NO YES
SET CNTR : CNTR1  NO YES
           CNTR2  NO YES
SET ALARM: NO YES       SET OTSYNC:NO YES
SET ALT BANK:   NO   YES
```

Figure 5.2-10

```
              ** TRIGGER **    1   
PRESS TRIG #(0-F) THEN C(COND) OR A(ACT)
#0           S
                       T1R
#1           1
                       T1S
#2

#3

#4

#5

#6

#7

```

Figure 5.2-11

```
*MON/TAPE*       BLOCK=007
BOTH/EBCDIC/SYNC/
TIMEOUT:  3000 MSEC

COUNTERS:            CURRENT        LAST
   #1  __________          0           0
   #2  __________          0           0
   #3  __________          0           0
   #4  __________          0           0
   #5  __________          0           0
   #6  __________          0           0
   #7  __________          0           0
   #8  __________          0           0

TIMERS:  MSEC  SEC
   #1  HOST REPLY        248         245
   #2  __________          0           0
```

Figure 5.2-12

Select TIMER 1 and YES (Figure 5.2-7). Since you want the timer to ReSTaRT (the default selection) no other selections are needed. Press CONTROL plus ENTER again and notice that the trigger actions are now summarized at the top of the Conditions menu (Figure 5.2-8).

Display the Trigger 1 Conditions menu. You want to look for the beginning of a host reply; that is, of a text block from DCE, so select DCE. In BISYNC, there are several ways to begin a transmission, so select "1 OF" this time; then tab to the data-entry line. While you hold down the CONTROL key, use the control character keys to enter a list of possible opening characters: DLE SOH NAK STX (Figure 5.2-9). The trigger condition will become true as soon as any ONE OF the characters (or functions) on the list is found. On the Trigger 1 Actions menu, go to TIMER 1 again, and select YES and STOP (Figure 5.2-10).

Now press TRIGGER and consider the Trigger Summary of your program to measure Host Reply time (Figure 5.2-11). Notice that an underline is used to denote DCE data, just as in Run Mode. You will probably learn most of the Trigger Summary abbreviations through use, but you will find a complete list in the Technical Manual if you need it.

Insert the Interactive BISYNC Training Tape and press RUN to monitor the data. Press the RESULTS key. You should see the CURRENT value incrementing and resetting and the LAST value changing each time the current value resets (Figure 5.2-12). Remember that if you change data playback speed, either with the cursor arrows or by changing the SPEED entry on the Parameters 1 menu, the timer readings will not be valid.

NOTE: It is a good idea to give your program a test run each time you add a new segment to it. If at any point in its development the program doesn't run, you will know approximately where you went wrong.

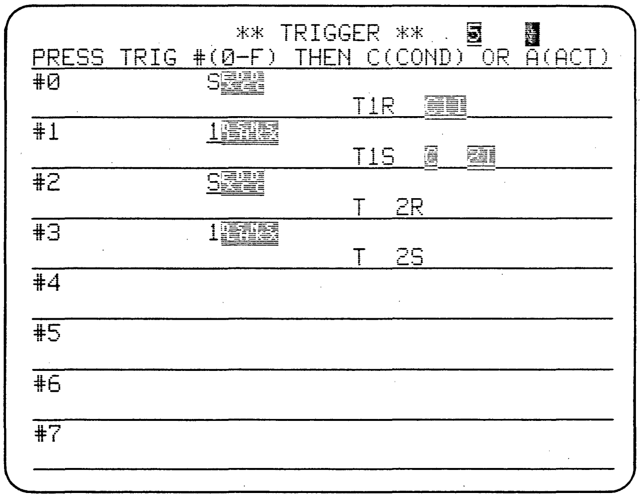


Figure 5.2-13

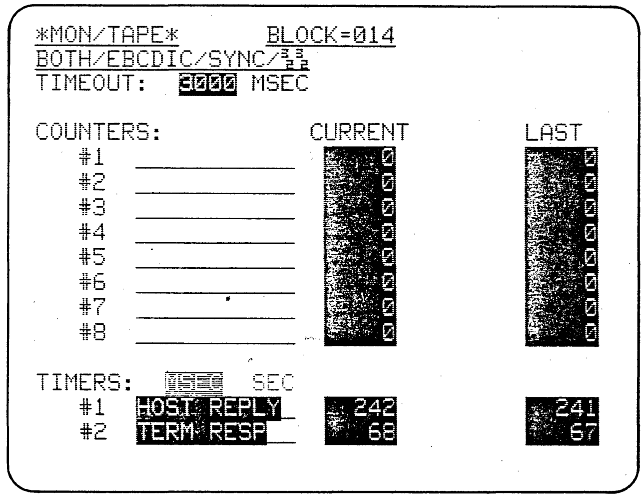


Figure 5.2-14

5.2.3 Measuring Terminal Response Time

To measure terminal response time, the procedure is essentially the same, but this time you will monitor the DCE line for end of transmission and the DTE line for beginning of transmission. Try filling out Triggers 2 and 3 to measure terminal response time on Timer 2. (Figure 5.2-13 shows the Trigger Summary.) Check the operation of Timer 2 in Run Mode (Figure 5.2-14).

Don't turn off the 4500. You will add more segments to this program in the next lesson.

```
** TRIGGER 0 CONDITIONS **

T1R
MON:  NEITHER DTE DCE       LINK:  NO  YES
  FOR: STRG 1 OF PARER

MON:  EIA  NO  YES

MON:  FLAGS  NO  YES

MON:  TIMEOUT                       NO  YES
```

Figure 5.3-1

```
          ** TRIGGER 0 ACTIONS **
DTE STRG

SET XMIT    :  NO   YES
SET TMOUT   :  NO   RSTRT  STOP
SET CRT     :  NO   YES

SET CPT MEM:  NO   ON    OFF
SET FLAG    :  NO   YES

SET TIMER:  TIMER1  NO  YES  RSTRT  CONT  STOP
            TIMER2  NO  YES
SET CNTR :  CNTR1   NO  YES    INC   DEC   RES
            CNTR2   NO  YES
SET ALARM:  NO  YES         SET OTSYNC: NO  YES
SET ALT BANK:   NO   YES
```

Figure 5.3-2

```
          ** TRIGGER 4 ACTIONS **
DCE STRG

SET XMIT    :  NO   YES
SET TMOUT   :  NO   RSTRT  STOP
SET CRT     :  NO   YES

SET CPT MEM:  NO   ON    OFF
SET FLAG    :  NO   YES

SET TIMER:  TIMER1  NO  YES
            TIMER2  NO  YES
SET CNTR :  CNTR3   NO  YES    INC   DEC   RES
            CNTR2   NO  YES
SET ALARM:  NO  YES         SET OTSYNC: NO  YES
SET ALT BANK:   NO   YES
```

Figure 5.3-3

```
          ** TRIGGER 5 ACTIONS **
DTE STRG

SET XMIT    :  NO   YES
SET TMOUT   :  NO   RSTRT  STOP
SET CRT     :  NO   YES

SET CPT MEM:  NO   ON    OFF
SET FLAG    :  NO   YES

SET TIMER:  TIMER1  NO  YES
            TIMER2  NO  YES
SET CNTR :  CNTR1   NO  YES
            CNTR4   NO  YES    INC   DEC   RES
SET ALARM:  NO  YES         SET OTSYNC: NO  YES
SET ALT BANK:   NO   YES
```

Figure 5.3-4

```
            ** TRIGGER **    7    0
PRESS TRIG #(0-F) THEN C(COND) OR A(ACT)
#0          S
                      T1R
#1          1
                      T1S
#2          S
                      T  2R
#3          1
                      T  2S
#4          S

#5          S
 A
#6

#7
```

Figure 5.3-5

```
*MON/TAPE*        BLOCK=022
BOTH/EBCDIC/SYNC/
TIMEOUT:  3000 MSEC

COUNTERS:                CURRENT        LAST
    #1  TERM MSGs             13           0
    #2  HOST TXs              15           0
    #3  HOST MSGs             15           0
    #4  NAKs                   1           0
    #5                         0           0
    #6                         0           0
    #7                         0           0
    #8                         0           0

TIMERS:  MSEC   SEC
    #1  HOST REPLY           245         245
    #2  TERM RESP            956         956
```

Figure 5.3-6

Like the Timers, the 4500's eight counters are set by Triggers and named on the Statistics menu.

5.3 SETTING COUNTERS

5.3.1 Count Terminal Messages

Trigger 0 is already set to look for a DTE string of ETX DC DC (Figure 5.3-1). Display the Trigger 0 Actions menu and tab the cursor to CNTR 1. Select YES. The default selection in the new selection field is INCrement (Figure 5.3-2). On the Statistics menu, label Counter 1 TERM MSGs. Of course, you will not catch messages ending in ETB or ITB, but this serves as an example of how you can use the same trigger for several purposes. Go to Run Mode and check the operation of Counter 1 on the Results display.

5.3.2 Count Host Transmissions

To count host transmissions, you can use the "ONE OF" condition already entered on Trigger 1. Display the Trigger 1 Actions menu; select CNTR 2: YES; and accept the default selection INCrement. On the Statistics menu, name Counter 2 HOST TXs.

5.3.3 Count Host Messages

You may want to know how many host transmissions are actually messages. On the Trigger 4 Conditions menu, enter a DCE string of STX DC DC DC. The three Don't Care characters ensure that the string is long enough to be a message. You could easily modify the string to specify counting messages to a specific address.

Display the Trigger 4 Actions menu and set CNTR 3 to increment as follows: Select CNTR 1. The cursor will be on the 1. Write over the 1 with a 3 and then select YES and INC (Figure 5.3-3). Name Counter 3 HOST MSGs on the Statistics menu. Check for operation of Counters 2 and 3.

5.3.4 Count NAKs and Sound Alarm

Set Trigger 5 to monitor DTE for the string NAK PAD (to enter the pad, type in HEX, F, F). Putting the pad in the string prevents counting block check characters.

NOTE: When the 4500 is set to go out of synchronization on one pad, only one pad character can be used as a trigger condition.

On the Trigger 5 Actions menu, set CNTR 4 to INCrement. Tab down to the ALARM line and select YES (Figure 5.3-4). On the Statistics menu name Counter 4, NAKs. The 4500's audible alarm will sound whenever a NAK is received on TD. Check for operation of Counter 4 and the alarm.

Figures 5.3-5 and 5.3-6 show your counter-and-timer program to this point.

```
         ** TRIGGER 6 ACTIONS **
DCE STRG
SET XMIT    : NO   YES
SET TMOUT   : NO   RSTRT   STOP
SET CRT     : NO   YES

SET CPT MEM: NO   ON    OFF
SET FLAG   : NO   YES   INC

SET TIMER: TIMER1 NO YES
           TIMER2 NO YES
SET CNTR : CNTR1  NO YES
           CNTR2  NO YES
SET ALARM: NO YES       SET OTSYNC:NO YES
SET ALT BANK:  NO   YES
```

Figure 5.3-7

```
         ** TRIGGER 7 CONDITIONS **

MON:  NEITHER DTE DCE


MON:  EIA  NO   YES


MON:  FLAGS  NO   YES    87654321
                         XXXX1010
MON:  TIMEOUT                NO  YES
```

Figure 5.3-8

```
         ** TRIGGER 7 ACTIONS **
                           FLG:XXXX1010
SET XMIT    : NO   YES
SET TMOUT   : NO   RSTRT   STOP
SET CRT     : NO   YES

SET CPT MEM: NO   ON    OFF     87654321
SET FLAG   : NO   YES   INC     00000000

SET TIMER: TIMER1 NO YES
           TIMER2 NO YES
SET CNTR : CNTR5  NO YES    INC   DEC   RES
           CNTR2  NO YES
SET ALARM: NO YES       SET OTSYNC:NO YES
SET ALT BANK:  NO   YES
```

Figure 5.3-9

```
              ** TRIGGER **   6
PRESS TRIG #(0-F) THEN C(COND) OR A(ACT)
#0            S
                         T1R   C1I
#1            1
                         T1S   C   2I
#2            S
                         T   2R
#3            1
                         T   2S
#4            S
                               C3I
#5            S
 A                             C   4I
#6            S
  F INC                        C   6I
#7  FXXXX1010
    F00000000                  C5I
```

Figure 5.3-10

```
*MON/TAPE*        BLOCK=002
BOTH/EBCDIC/SYNC/
TIMEOUT:  3000 MSEC

COUNTERS:           CURRENT          LAST
   #1  TERM MSGs         0              0
   #2  HOST TXs          0              0
   #3  HOST MSGs         0              0
   #4  NAKs              0              0
   #5  ENQs X10          4              0
   #6  ENQs X1          40              0
   #7                    0              0
   #8                    0              0

TIMERS:  MSEC  SEC
   #1  HOST REPLY        0              0
   #2  TERM RESP         0              0
```

Figure 5.3-11

5.3.5 Increment a Counter by a Number Greater than 1

If you expect to be counting data over a long period, the possibility of the counter overflowing will increase. To prevent this, you can instruct a counter to increment by any number up to 255. We shall count ENQs by 10's as an example.

Instruct Trigger 6 to look for a DCE string of the control character ENQ followed by a pad (FF_{16}). On the Trigger 6 Actions menu, select FLAG INCrement (see Figure 5.3-7). The 4500's eight flags will behave like a binary counter, with Flag 8 the highest-order bit and Flag 1 the lowest-order bit. Each time the trigger conditions become true, the binary counter will increment by 1.

Set Trigger 7 to look for a flag mask having the value by which you want the counts to increment, that is, 10: binary number 0000 1010 (see Figure 5.3-8).

Since the initial flag status in the unit is always 0000 0000, the flag mask will increment each time an ENQ is received on RD, as follows:

0000 0001
0000 0010
0000 0011
0000 0100
0000 0101
0000 0110
0000 0111
0000 1000
0000 1001
0000 1010

At this point the Trigger 7 conditions will be true. To stop the flag mask counter, select the Trigger 7 Actions menu and reinitialize the flags by setting them to 0000 0000. To count ENQs by 10's, set Counter 5 to increment (Figure 5.3-9). Label Counter 5 on the Statistics menu, ENQs x10. To verify that Counter 5 is really counting by 10's, set Counter 6 to increment on the Trigger 6 Actions menu and name it ENQs x1 on the Statistics menu. Now monitor the Interactive BISYNC Training Tape data, look at the Results display, and compare the real-time readings for Counters 5 and 6.

Figure 5.3-10 shows the program; Figure 5.3-11, the Results display.

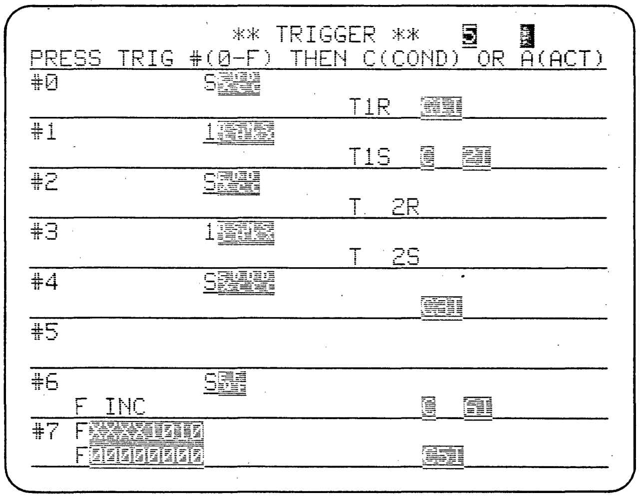


Figure 5.4-1

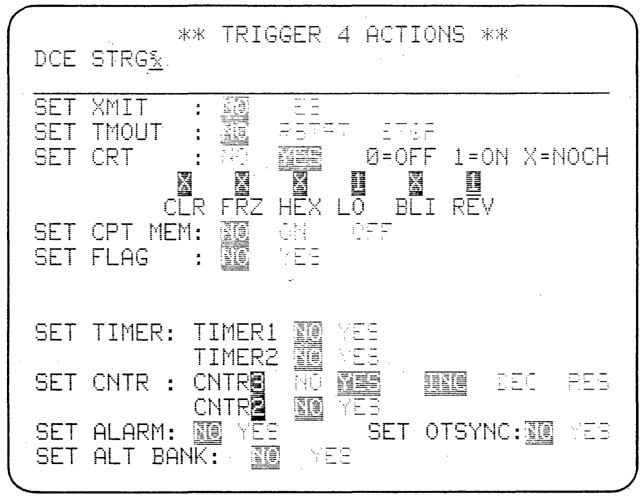


Figure 5.4-2

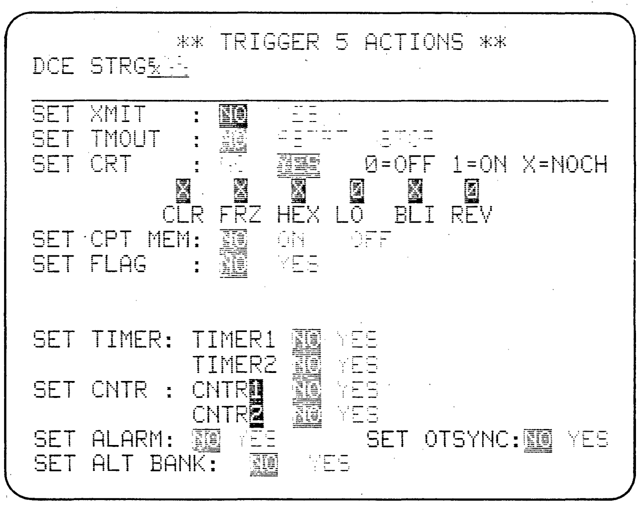


Figure 5.4-3

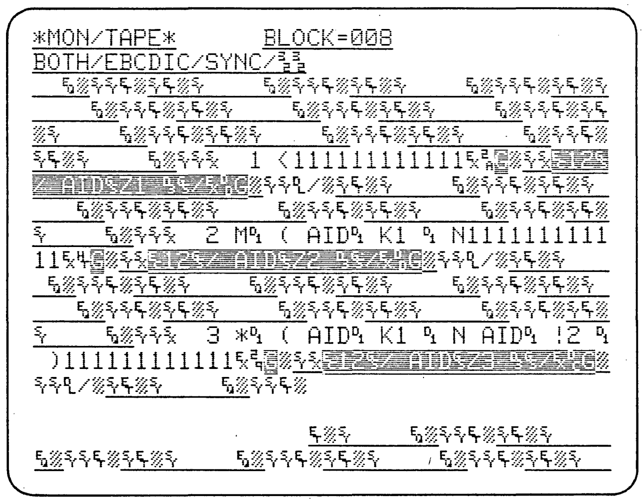


Figure 5.4-4

You have seen how to control the CRT display both manually and by parameters selection. In this section you will become familiar with several ways in which triggers can control the display.

5.4 CRT CONTROL WITH TRIGGERS

5.4.1 Data Highlights

Let's arbitrarily assume that we are only interested in seeing messages on RD (Host messages). In a half-duplex system, one way to do this is to display the data in reverse image.

We shall need another trigger, so clear Trigger 5 to default condition; that is, display the Trigger 5 Conditions menu and press CONTROL plus CLEAR FIELD; then display the Actions menu and clear that. The Trigger Summary will now appear as in Figure 5.4-1.

Notice that Trigger 4 is already programmed to look for an STX from DCE. On the Trigger 4 Conditions menu, use SHIFT plus CLEAR FIELD to delete the Don't Care Characters from the DCE string. On the Actions menu, select CRT:YES and turn on low-intensity reverse image by entering 1 in the LO and REV boxes (Figure 5.4-2).

On the Trigger 5 Conditions menu, select DCE, STRG, and enter a string to identify the end of the Host message, that is, ETX DC DC. On the Trigger 5 Actions menu, turn LOw-intensity REVerse image off (0) (see Figure 5.4-3). Figure 5.4-4 shows the Host messages displayed in reverse image.

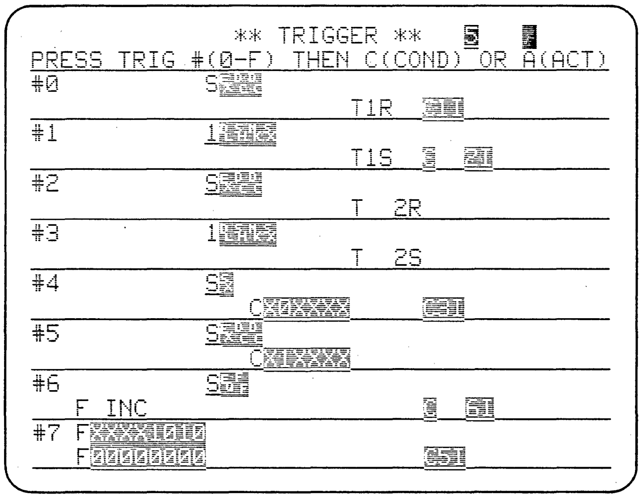


Figure 5.4-5

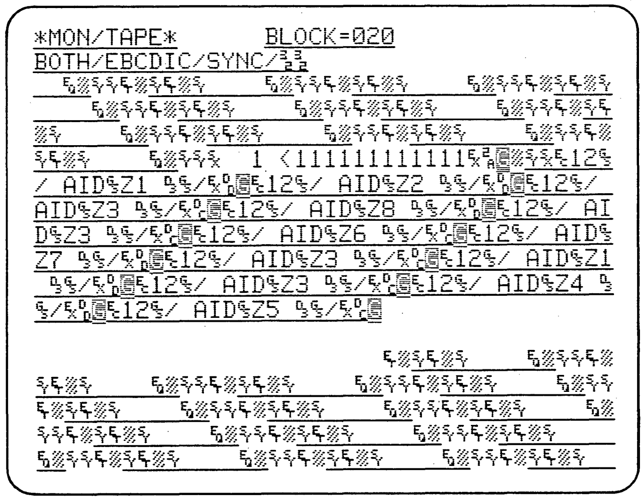


Figure 5.4-6

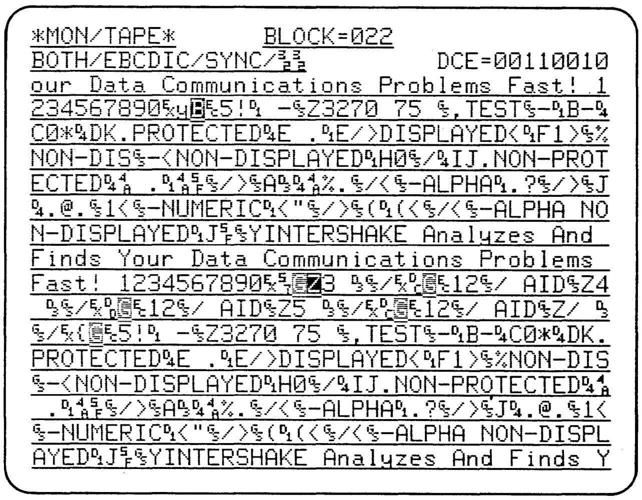


Figure 5.4-7

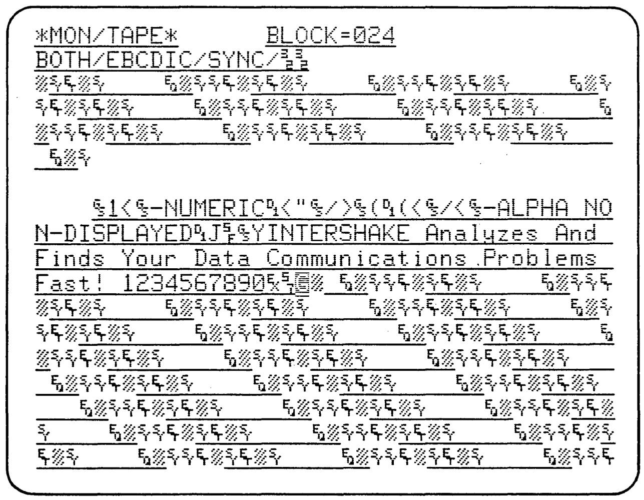


Figure 5.4-8

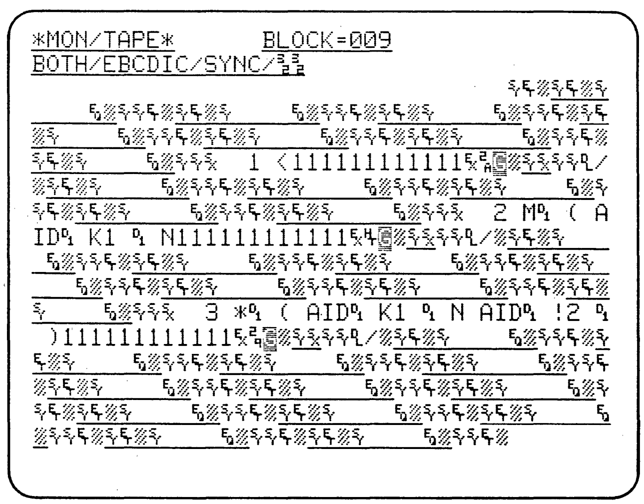


Figure 5.4-9

5.4.2 Trigger Freeze

We can also limit the display to only the data of interest by using the CRT Freeze Action.

On the Trigger 4 Actions menu, change the LO and REV entries to X and enter a zero in the FRZ box to turn CRT Freeze OFF at the beginning of a DCE message. On the Trigger 5 Actions menu, turn the CRT Freeze on and set LO and REV to X (Figure 5.4-5).

In Run Mode at first all data will be displayed. At the end of the first DCE message, the CRT will be frozen and no new data will be added to the CRT until the next DCE message is received. From here on only DCE messages will be displayed (see Figure 5.4-6).

Press the MANUAL FREEZE key (Figure 5.4-7); then MANUAL UNFREEZE. All received data is once again displayed (see Figure 5.4-8) because MANUAL FREEZE and MANUAL UNFREEZE override the triggers. While the 4500 is in Run Mode, only the RESUME TRIGGER key can restore program control of the CRT.

5.4.3 OUTSYNC

The Trigger Freeze Action prevents display of data from both sides of the line. If you want to suppress display of data in only one direction, you can use the OUTSYNC action to force the trigger logic receiver for the side of the line selected on the Conditions menu out of synchronization.

On the Trigger 4 Actions menu, select CRT:NO; then OTSYNC:YES. On the Trigger 5 Actions menu, change the CRT selection to NO. When an STX is detected on RD, the RD trigger logic receiver will go out of synchronization until the next synchronization pattern is detected. The resultant data display is shown in Figure 5.4-9 (compare this with Figure 5.4-4).

While the receiver is out of synchronization, no data will be received by the counters or timers, but recording will continue because the separate Capture Memory receivers are not affected.

```
         ** TRIGGER 1 ACTIONS **
DCE STRG%                 LNK
--------------------------------------------
SET XMIT    : NO   YES
SET TMOUT   : NO   RSTRT  STOP
SET CRT     : NO   YES    0=OFF 1=ON X=NOCH
           X    0    X    X    X    X
          CLR  FRZ  HEX  LO   BLI  REV
SET CPT MEM: NO   ON    OFF
SET FLAG    : NO   YES


SET TIMER: TIMER1 NO YES
           TIMER2 NO YES
SET CNTR : CNTR1  NO YES
           CNTR2  NO YES
SET ALARM: NO YES        SET OTSYNC:NO YES
SET ALT BANK:   NO   YES
```

Figure 5.5-1

```
         ** TRIGGER 2 ACTIONS **
DCE STRG%-MXMMXM          LNK
--------------------------------------------
SET XMIT    : NO   YES
SET TMOUT   : NO   RSTRT  STOP
SET CRT     : NO   YES    0=OFF 1=ON X=NOCH
           X    X    X    X    X    1
          CLR  FRZ  HEX  LO   BLI  REV
SET CPT MEM: NO   ON    OFF
SET FLAG    : NO   YES


SET TIMER: TIMER1 NO YES
           TIMER2 NO YES
SET CNTR : CNTR1  NO YES
           CNTR2  NO YES
SET ALARM: NO YES        SET OTSYNC:NO YES
SET ALT BANK:   NO   YES
```

Figure 5.5-2

```
         ** TRIGGER 3 ACTIONS **
DCE 1 OFABCD              LNK
--------------------------------------------
SET XMIT    : NO   YES
SET TMOUT   : NO   RSTRT  STOP
SET CRT     : NO   YES    0=OFF 1=ON X=NOCH
           X    X    X    X    1    X
          CLR  FRZ  HEX  LO   BLI  REV
SET CPT MEM: NO   ON    OFF
SET FLAG    : NO   YES


SET TIMER: TIMER1 NO YES
           TIMER2 NO YES
SET CNTR : CNTR1  NO YES
           CNTR2  NO YES
SET ALARM: NO YES        SET OTSYNC:NO YES
SET ALT BANK:   NO   YES
```

Figure 5.5-3

```
               ** TRIGGER **   4   #
PRESS TRIG #(0-F) THEN C(COND) OR A(ACT)
#0
--------------------------------------------
#1             S%                 L
                 CX0XXXX
--------------------------------------------
#2             S%-MXMMXM          L
                 CXXXXX1
--------------------------------------------
#3             1ABCD              L
                 CXXXX1X
--------------------------------------------
#4             SMMAB
                 CX1XX00
--------------------------------------------
#5
--------------------------------------------
#6
--------------------------------------------
#7
--------------------------------------------
```

Figure 5.5-4

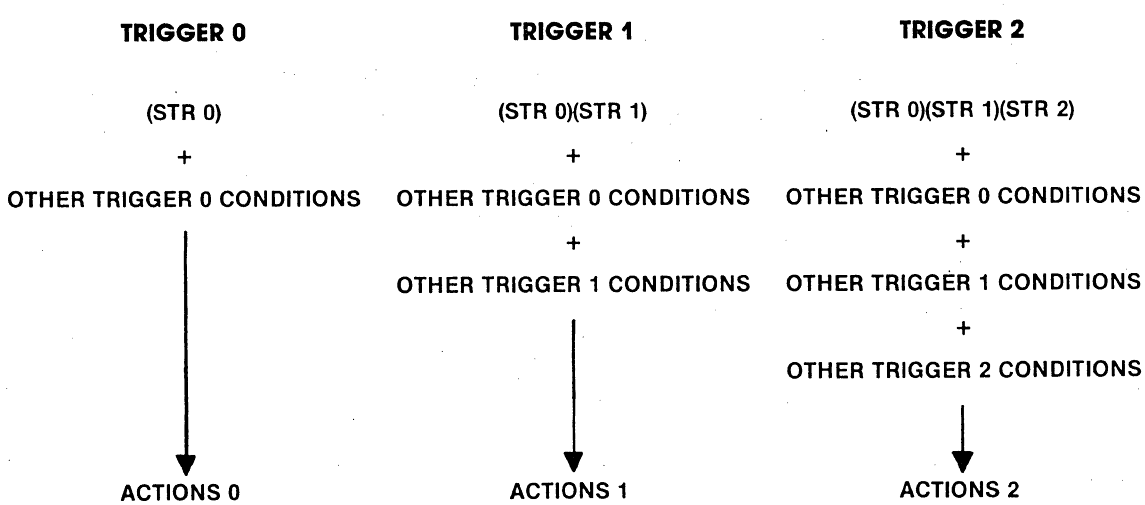


Figure 5.5-5

You may link up to eight triggers together to obtain longer strings with more bit masks and include "1 OF" characters in the string.

5.5 LINKING TRIGGERS

Up to eight of the 4500's triggers may be linked together so that you can look for--

(1) strings of more than 16 characters;
(2) strings with more than four bit masks;
(3) strings in which one or more character positions may be satisfied by any character from a list of up to 16 characters.

When triggers are linked, you may set actions on any of the linked triggers and the actions will be taken sequentially as the accumulated subset of conditions for each trigger comes true.

5.5.1 Linking Strings and Actions

The following fantastic example will clarify this even if it does nothing for the data communications world. We shall use four triggers to illustrate each of the above three string configurations in one string.

To clear the trigger menus, press TRIGGER to display the Trigger Summary. Then press CONTROL plus CLEAR FIELD. Verify that this has cleared all trigger menus to their default condition.

On Trigger 1, select DCE, LINK YES, STRG, and enter the control character STX on the string-entry line. On the Actions menu, turn CRT Freeze OFF (Figure 5.5-1). Trigger 1 will begin to display data when it sees an STX on RD.

On Trigger 2, select DCE, LINK YES, STRG and enter the next eight characters in the string: (DC) (DC) M X M M X M. This uses all four bit masks available on the trigger. On the Actions menu, turn Reverse Image ON (Figure 5.5-2). Trigger 2 will turn Reverse Image on when it sees the nine-character string (STX) (DC) (DC) M X M M X M.

On Trigger 3, select DCE, LINK YES, and 1 OF. Enter a list of characters in the "1 OF" field: A B C D. On the Trigger 3 Actions menu, turn Blink ON (Figure 5.5-3). Trigger 3 will turn Blink on when it sees the 10-character string (STX) (DC) (DC) M X M M X M (1 OF A B C D).

On Trigger 4, select DCE, LINK NO, STRG and enter the end of our string: X M M A B. On the Actions menu, turn CRT Freeze ON and turn Reverse Image and Blink OFF. After the 15-character string (STX) (DC) (DC) M X M M X M (1 OF A B C D) X M M A B is received, no data will be displayed on the CRT until Trigger 1 again sees an STX on RD.

Figure 5.5-4 shows the Trigger Summary. Notice that for each trigger that is linked to the following trigger, the Conditions entry is followed by an L for link.

You may include other trigger conditions (EIA status, Flag status, and so on) on any linked trigger. These other conditions will be checked when the accumulated string segment comes true.

Figure 5.5-5 illustrates this process.

5.5.2 Reminders

Be sure to select the same side of the line on each linked Conditions menu.

Triggers in one bank cannot be linked with those in the other bank.

Notice that it does not matter whether or not you fill all 16 positions of a string entry line with characters: The first character in the string on the next linked trigger will immediately follow the last one on the preceding trigger.

5.5.3 Trigger String Capacity

Maximum string use for the 4500, whether or not triggers are linked, is determined by number of string sets: A string set consists of the first eight or the second eight string positions on a trigger or a single "1 OF" position. The maximum that may be used in a unit is 20 eight-character string sets. Therefore, if you use either ten 16-character strings or nine 16-character strings and two "1 of" characters, you have used the unit's full string capacity. If you use twelve 8-character strings, you still have eight 8-character string sets available. If you use four string positions on one trigger and 12 on another, you have used not two but three string sets because using four characters on one trigger uses an entire string set.

In the example of Figures 5.5-1 and 5.5-4, we have used four string sets, one on Trigger 1, one on Trigger 2, one on Trigger 3, and one on Trigger 4.

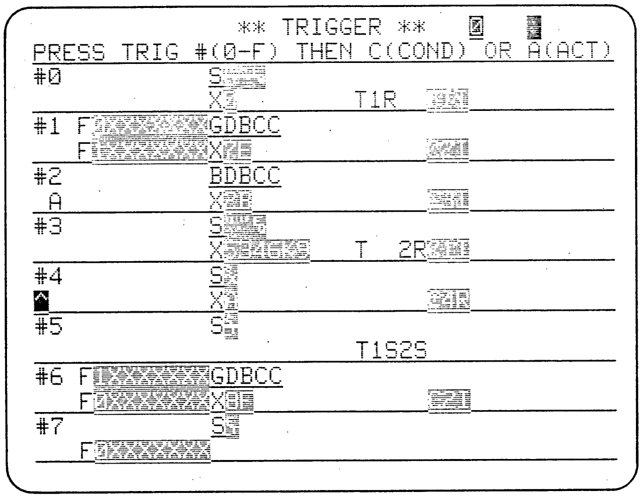


Figure 5.6-1

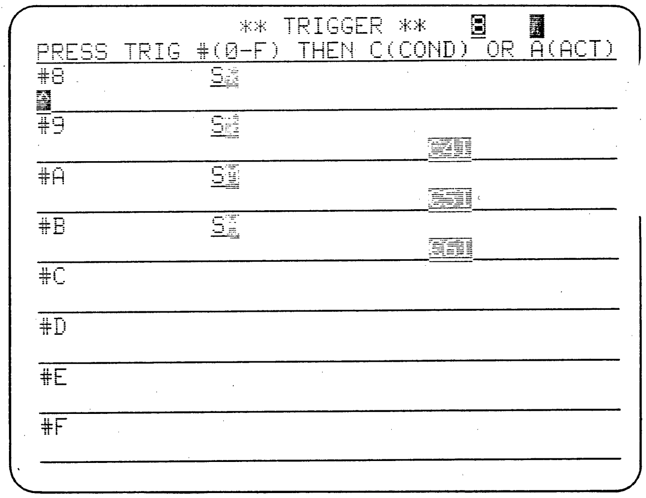


Figure 5.6-2

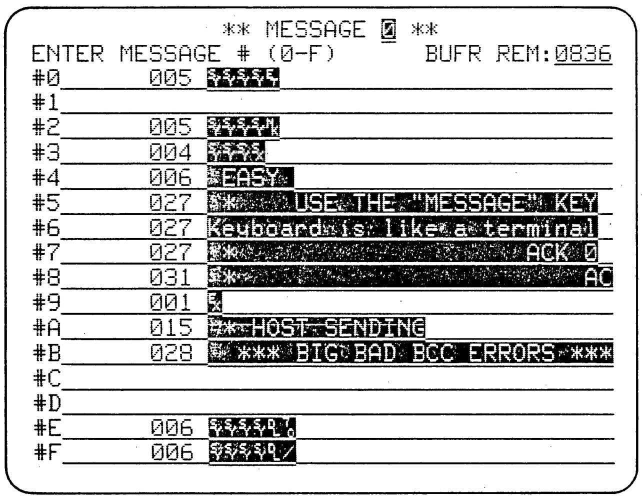


Figure 5.6-3

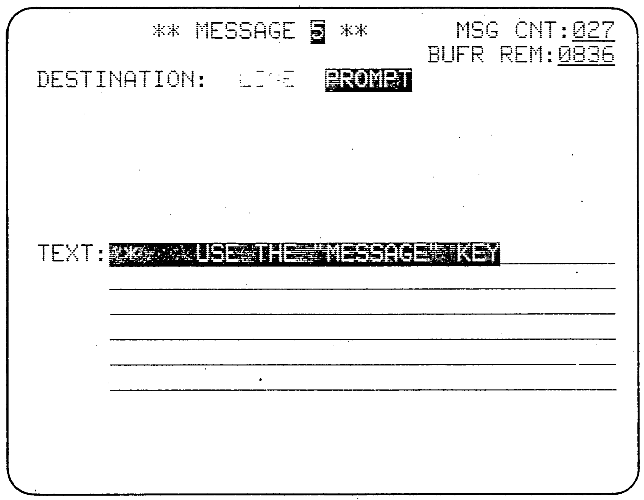


Figure 5.6-4

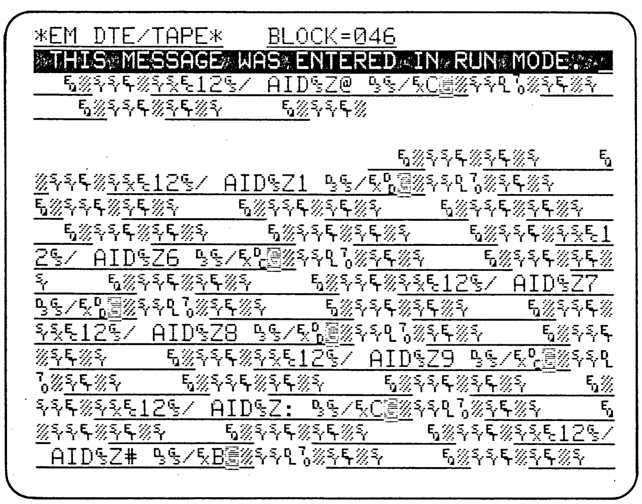


Figure 5.6-5

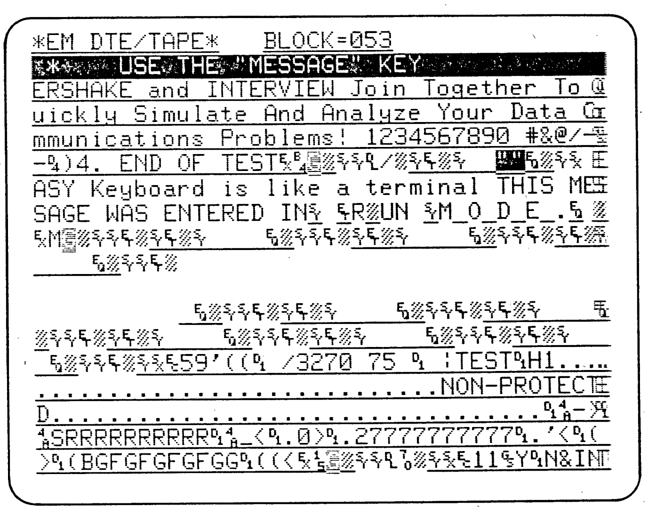


Figure 5.6-6

The Interactive BISYNC Training Tape program demonstrates use of the counters and timers, alternate banks, and some of the 4500's interactive capabilities.

5.6 THE 4500 INTERACTIVE BISYNC TRAINING PROGRAM

In the training tape program (summarized in Figures 5.6-1 and 5.6-2) the 4500 emulates a terminal, transmitting on TD in response to the Host's transmissions being played back from the tape on RD. The low bank of triggers is used for all transmissions and messages to the operator (Prompts). Characters in host messages are counted on the high bank; other counts and response time measurements are done by the low bank.

5.6.1 Transmitting

To demonstrate trigger control of the 4500's transmissions, we have used the training tape data rather arbitrarily, so the training tape should not be used as a model of BISYNC protocol. Trigger 3 sends a message (see Figure 5.6-3 to identify messages) in response to each general poll (""ENQ), and Trigger 0 sends an EOT in response to any other poll.

Notice from the Trigger Summary (Figure 5.6-1) that six messages are being sent by Trigger 3. One of these (Message 5) is a Prompt, or message to the operator (Figure 5.6-4), which you will see on Line 2 in Run Mode. The K in the list of Trigger 3 messages stands for Keyboard Buffer. In Run Mode, when the Prompt message USE THE "MESSAGE" KEY appears on Line 2, press the MESSAGE (or ENTER MSG) key. The Prompt line will clear and you can type in a message to be transmitted on Line 2 (Figure 5.6-5). Press MESSAGE again, and you will see your message transmitted every time Trigger 3 is true (Figure 5.6-6).

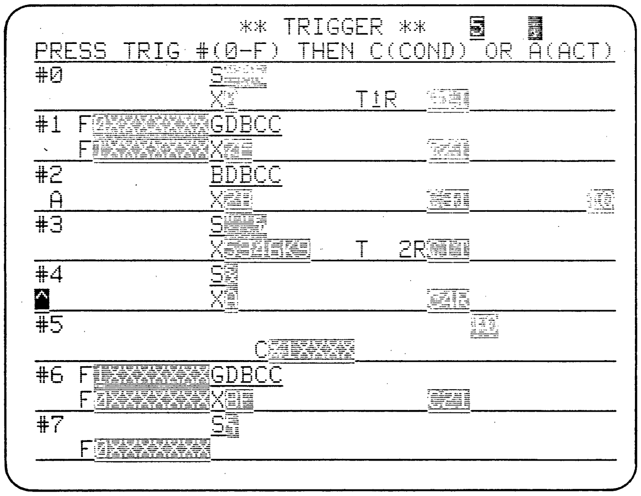


Figure 5.6-7

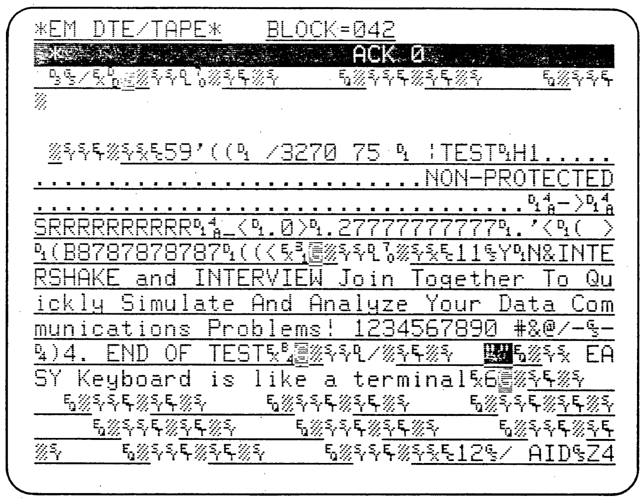


Figure 5.6-8

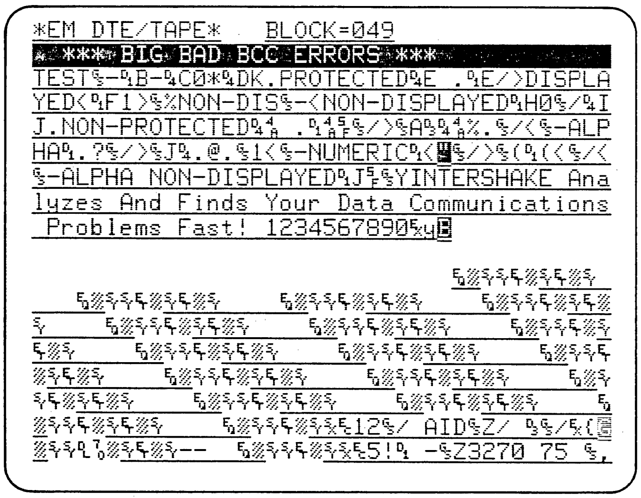


Figure 5.6-9

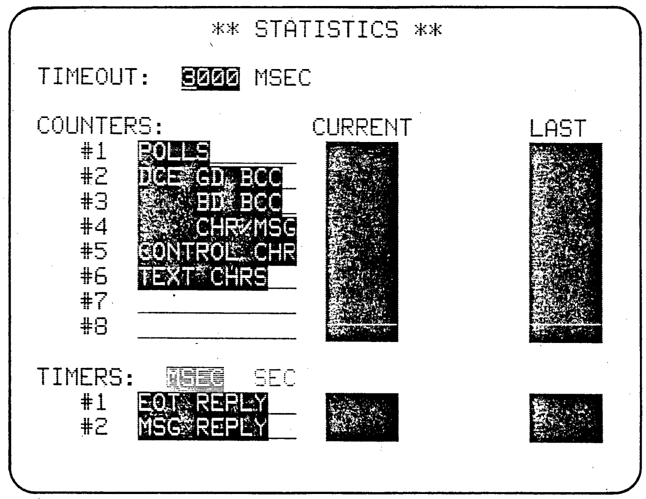


Figure 5.6-10

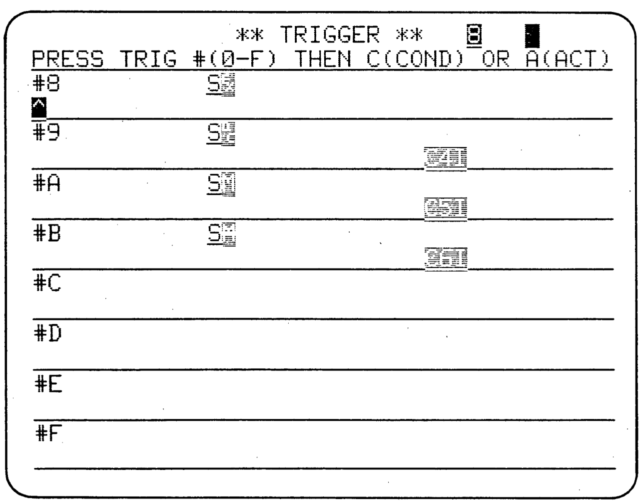


Figure 5.6-11

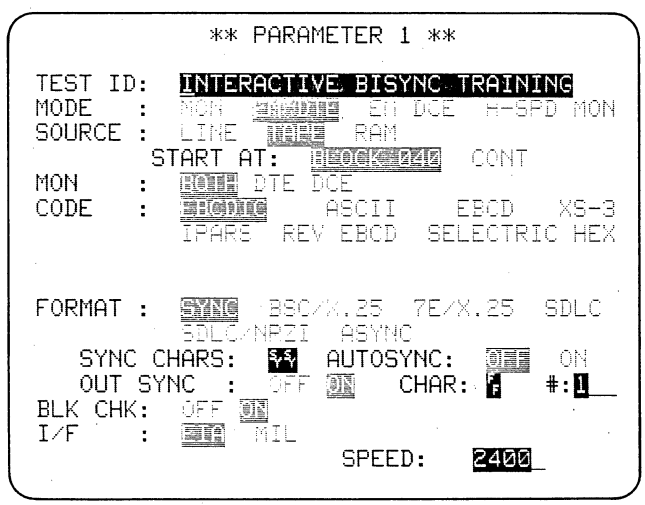


Figure 5.6-12

On Triggers 1 and 6 (Figure 5.6-7), transmission of ACK 0 and ACK 1 is controlled with flags. Trigger 1 looks for good block checks from the DCE and Flag 8 OFF; then responds with ACK 0, and turns Flag 8 ON to prevent ACK 0 from being sent twice in succession. When the next good block check is received on RD, only Trigger 6 can respond. It sends ACK 1 and turns Flag 8 off to permit Trigger 1 to respond to the next good BCC with ACK 0 again. Each time a trigger sends an ACK it announces it by a Prompt on the second line of the CRT display (Messages 7 and 8; see Figure 5.6-8).

Each Prompt remains on Line 2 until triggers replace it with another Prompt or you clear it with the CLEAR FIELD key.

Whenever the 4500 receives a bad Block Check, Trigger 2 announces it with a Prompt (Message B; Figure 5.6-9) and an audible alarm and sends a NAK on RD. All NAKs are displayed in blinking bright reverse image by the Parameters 2 ENHANCE selection.

5.6.2 Counters

Polls are counted by Counter 1 (Figures 5.6-7 and 5.6-10). Since Trigger 3 is already looking for general polls, and Trigger 0 is looking for all other polls, total polls can be counted by setting Counter 1 to increment on the Actions menu of each of these triggers. Similarly, Counter 2 counts good block checks.

Host message characters are counted by the High Bank triggers. When Trigger 4 sees an STX from DCE it puts up a prompt announcing that the HOST is SENDING (Message A) and activates the alternate trigger bank. On the high bank (Figure 5.6-11), Trigger 9 sets Counter 4 to count total characters received through ETX; Trigger A sets Counter 5 to count all control characters received through ETX, and Trigger B sets Counter 6 to count all noncontrol characters received until ETX.

The control character count is performed by looking for a bit mask in which Bits 8 and 7 are 0. Since in EBCDIC, all--and only--control characters have bits 8 and 7 = 0, this is the simplest way to count control characters. Noncontrol characters are counted by looking for characters Not Equal to the control character bit mask.

Counters 5 and 6 keep cumulative counts of all control and noncontrol characters in DCE (host) messages. Counter 4, however, counts characters for each message, because it is reset each time Trigger 4 sees a DCE STX.

Notice from the Program Summary (see Trigger 4) that Counters 4 and 5 are not counting the STX at the beginning of each Host message.

5.6.3 Timers

The timers measure response times. Timer 1 resets and begins measuring on receipt of any poll but a general poll (Trigger 0); then stops on receipt of the next non-SYNC character from DTE (Trigger 5). Timer 2 measures response time to general polls in similar fashion.

5.6.4 Interactive Modes

The BISYNC Training Tape program introduces some of the 4500's interactive capability. In the following sections you will see more of what you can do when you select an Emulate Mode on the Parameters 1 menu (Figure 5.6-12).

The INTERVIEW 4500 can emulate a CPU or a terminal: it is thus much more than a simple transmitter.

6 TRANSMITTING: THE EMULATE MODES

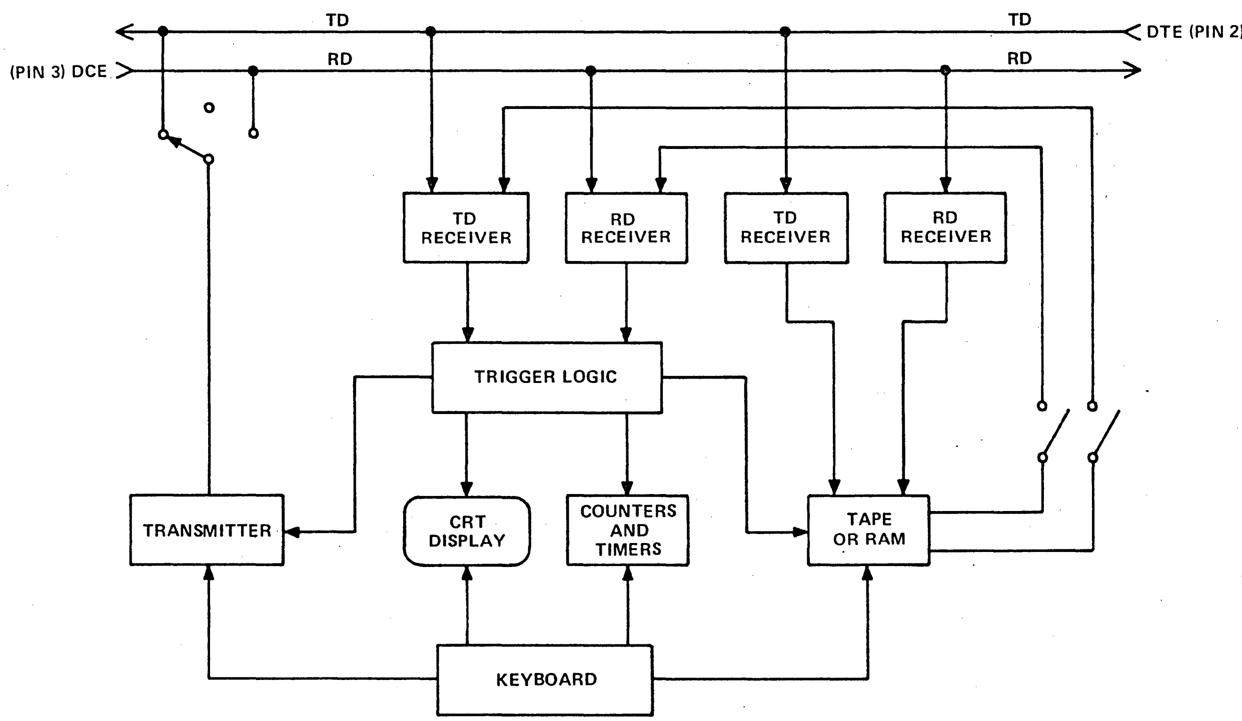

TD
TD
DTE (PIN 2)
(PIN 3) DCE
RD
RD
TD
RECEIVER
RD
RECEIVER
TD
RECEIVER
RD
RECEIVER
TRIGGER LOGIC
TRANSMITTER
CRT
DISPLAY
COUNTERS
AND
TIMERS
TAPE
OR RAM
KEYBOARD

Figure 6.1-1

Figure 6.1-1 is a simplified block flow diagram of the INTERVIEW 4500. You should be familiar with this in order to understand interactive operation.

6.1 THE INTERVIEW 4500 BLOCK DIAGRAM

As shown in Figure 6.1-1, the 4500 has separate RD and TD receivers for the Capture Memory (tape and RAM option) and for the trigger logic.

When the tape is played back, it sends its data directly to the trigger logic receivers and hence to the CRT buffer and counters and timers.

The transmitter sends data to the line. Both the trigger logic receivers and the Capture Memory receivers receive the 4500's own transmissions directly from the line, so what you see on the 4500 CRT is what the 4500 sends out on the line.

The transmitter is switched between RD and TD by moving the line data connectors between the EM DCE (TO TERMINAL) connector and the EM DTE (TO MODEM) connector on the rear of the unit (see Figure 6.1-2). When the data line is connected to the EM DCE connector, the 4500 transmits on RD, receives its own transmissions at the RD receivers, and receives line data at the TD receivers. When the data line is connected to the EM DTE connector, the 4500 transmits on TD, receives its own transmissions at the TD receivers, and receives the line data at the RD receivers.

When you select EMulate DCE on the Parameters 1 menu, the 4500 assumes it is transmitting on RD, expects to receive its own transmissions at the RD receivers, and expects any other data (from tape or RAM, as well as line) to arrive on TD. If you choose EMulate DTE, the 4500 assumes it is transmitting on TD, expects to receive its own transmissions at the TD receivers, and expects any other data to come in on RD.

Therefore, you must be careful that the Emulate mode you select on the Parameters 1 menu is correct for the data connections established at the rear of the unit.

Connecting the data line to the MONITOR port disconnects the transmitter and ensures that the 4500 cannot affect the monitored line. In this case, you should select MONitor Mode on the Parameters 1 menu.

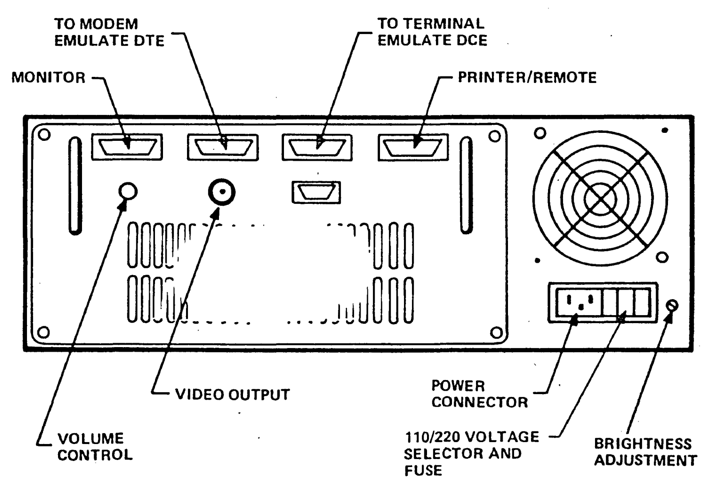


Figure 6.1-2

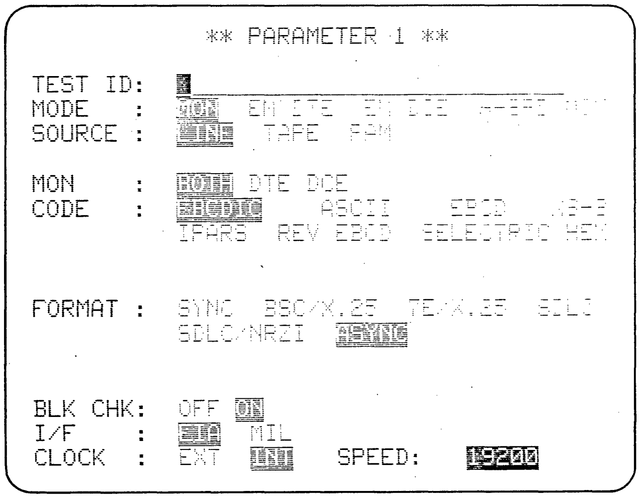


Figure 6.2-1

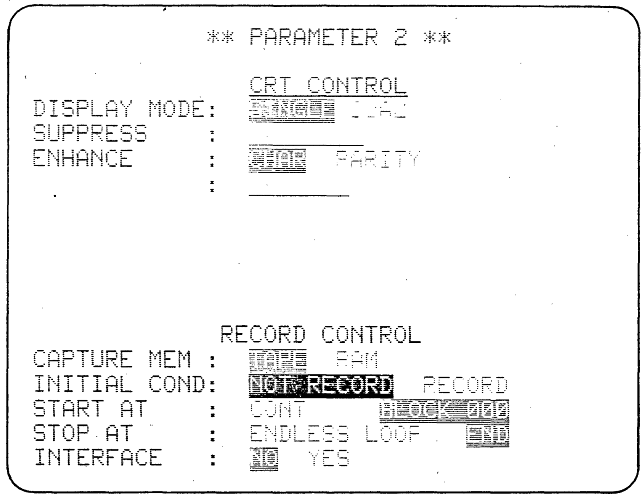


Figure 6.2-2

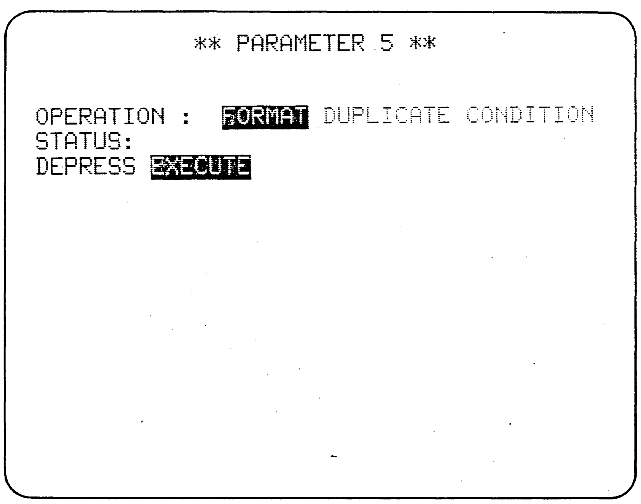


Figure 6.2-3

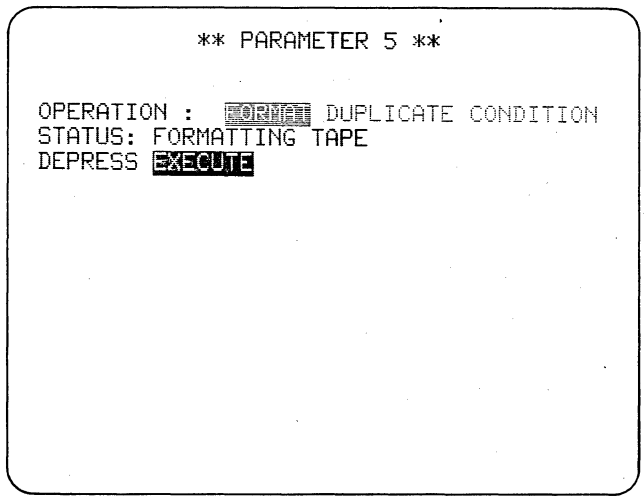


Figure 6.2-4

New blank tapes should not be used in the 4500 without being preformatted.

6.2 PREFORMATTING TAPES

All new blank tapes should be formatted prior to use in the 4500, for two reasons.

(1) When tapes are exposed to temperature changes or vibration, they may lose their tension. This results in faulty operation. Running a tape through one cycle, forward and reverse, will readjust the tension to its proper value.

(2) Unless block numbers have been recorded on the entire tape, the 4500 cannot find any tape block numbers past 000 in order to start recording or playback. Preformatting all new blank tapes ensures you of all the convenience and flexibility that the tapes can offer.

Since you will need a blank tape for some of the following exercises, you should format a blank tape now. The procedures for formatting are different in Software Versions 10.06 and 10.08.

6.2.1 Version 10.06

Be sure no signals are connected at the rear of the unit. The PRIMARY DATA TD and RD indicators in the EIA STATUS indicator zone must be OFF.

Power up the 4500 without a tape so that all menus are in default condition. On the Parameters 1 menu select FORMAT: ASYNC and SPEED: 19200. All other fields should be in default condition. The menu should now appear as in Figure 6.2-1.

On the RECORD CONTROL section of the Parameters 2 menu select CAPTURE MEM: TAPE; INITIAL COND: NOT RECORD; START AT: BLOCK 000; and STOP AT: END (see Figure 6.2-2).

Position the tab on the new tape to the RECORD position, that is, toward the outside edge of the case, and insert the tape in the 4500. Press the RUN key, and watch the CRT.

As soon as BLOCK 000 appears, press the MANUAL START key in the CAPTURE MEMORY zone. After about 3 minutes the block counter will stop incrementing near 250.

6.2.2 Version 10.08

In this version of the 4500, tapes may be formatted without changing the program in the unit. Display the Tape Utility menu (Parameters 5; see Figure 6.2-3). Insert the tape to be formatted in the unit with the tab in the RECORD position (toward the outside of the case). Select FORMAT and press the EXECUTE key. The STATUS line will display FORMATTING TAPE (Figure 6.2-4) while the tape is automatically formatted; then, when formatting is finished, TAPE FORMATTED.

Tapes are automatically tensioned while they are being formatted, but they may be tensioned without affecting the formatting by selecting CONDITION on this menu.

6.2.3 Labeling

The tape is now formatted with all 250 blocks. Press PROGRAM to ensure that tape motion has stopped and remove the tape. Label the tape FORMATTED and keep it until you need it.

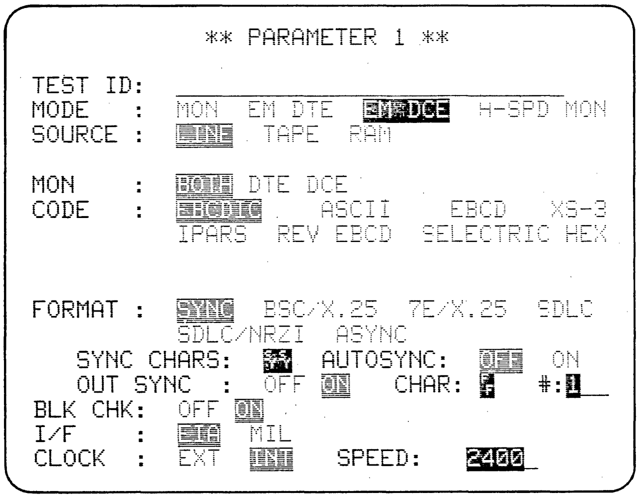


Figure 6.3-1

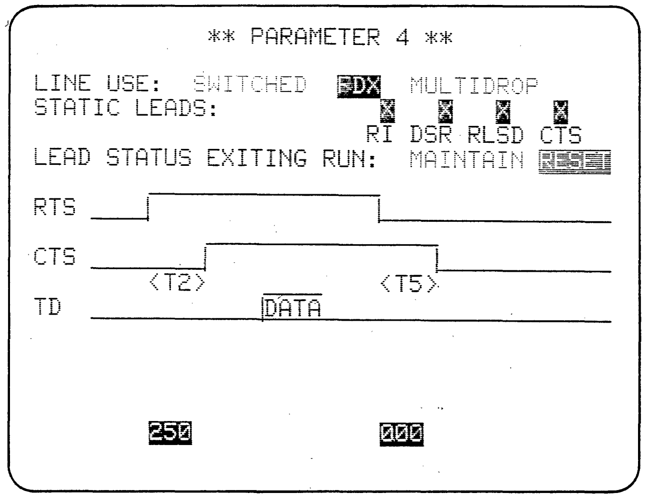


Figure 6.3-2

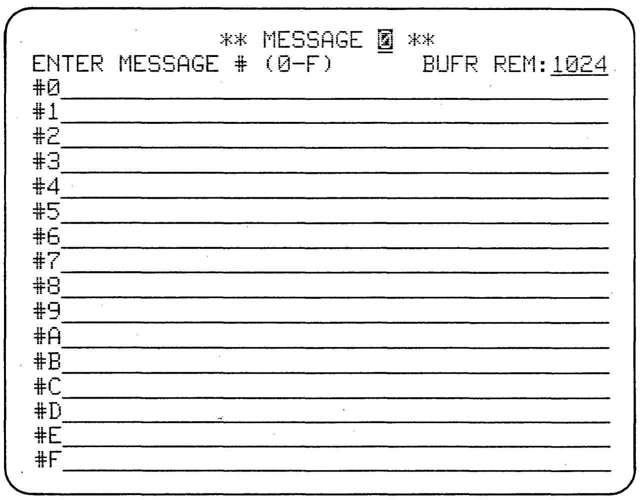


Figure 6.3-3

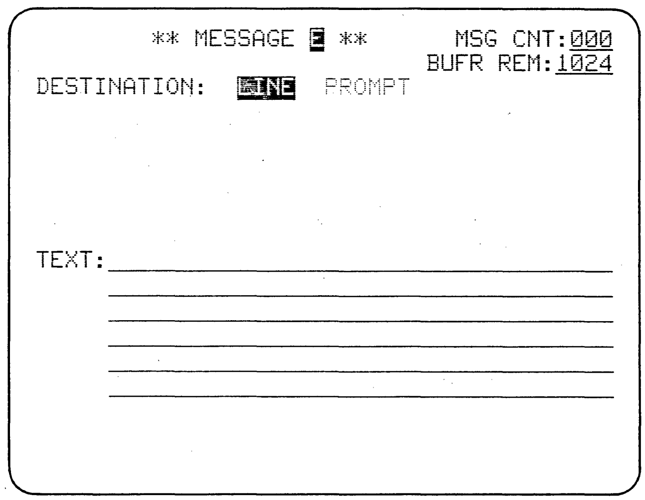


Figure 6.3-4

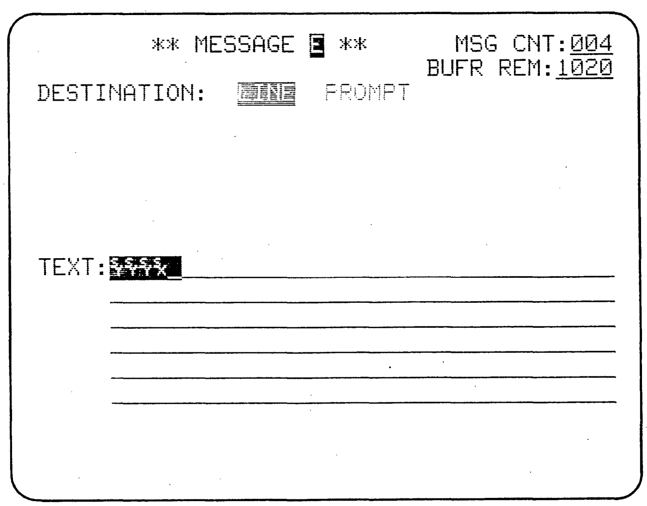


Figure 6.3-5

In the 4500's Emulate Modes, before messages can be transmitted you fill out the Parameters 4 menu, which controls the EIA leads, and then enter the text of your message on a message-entry menu.

6.3 ENTERING MESSAGES

6.3.1 Choose an Emulate Mode

Power up the 4500 without installing a tape or connecting any data line. Press PROGRAM and display the Parameters 1 menu. Since we are going to use the BISYNC format, we can accept most of the menu's default parameters.

On the Mode line, select EM DCE. The 4500 will emulate a DCE, or modem, transmitting on RD. Notice that CLOCK automatically changes from EXT to INT.

The source will be LINE, but since there is no external data connected, we will only see the 4500's own transmissions looped back to its RD receiver. The Parameters 1 menu should now look like Figure 6.3-1.

6.3.2 Choose a Message Transmission Envelope

In Program Mode, press PARAMETERS and then the numeral 4. You will see the display of Figure 6.3-2, which is the Interface Control menu. This menu is used to specify a message transmission envelope to control activity and delay times of the EIA interface leads. It will be used automatically every time a transmission is triggered.

The default selection for LINE USE is FDX, which selects continuous carrier use. This is what we need just now. Later, we shall look at this Interface Control menu in detail.

6.3.3 Obtain a Message-Entry Menu

Press the red MESSAGE key, or--if you have a converted 3500 unit--the ENTER MSG key. The display (Figure 6.3-3) will be a Message Summary, showing that you can enter 16 messages. We shall consider the summary in more detail later. For now, it is just your gateway to a Message-Entry Menu.

To see Message-Entry Menu E (Figure 6.3-4), press the E key while the Message Summary is displayed.

6.3.4 Fill in the Message-Entry Menu

(1) Choose a DESTINATION. We want the default choice, LINE. If you choose PROMPT, then your text will not be transmitted on RD but will be displayed as a message to the operator on the second line of the 4500's CRT.

(2) Press ENTER to move the cursor to the first message-entry line. For your BISYNC message to be received properly, synchronization characters and a header must be sent. Hold down the CONTROL key and enter SYN SYN SYN STX (see Figure 6.3-5).

As on other menus, you may back up with a cursor arrow and write over any character or characters. Each of the message-entry lines is a separate field from the cursor's point of view. Therefore, CLEAR FIELD clears the line where the cursor is and SHIFT plus CLEAR FIELD clears that line from the cursor position to the end.

(3) You could add your Text followed by an End of Text character on this menu, but if you should want to combine a number of messages in one transmission it will be more convenient to have your protocol characters

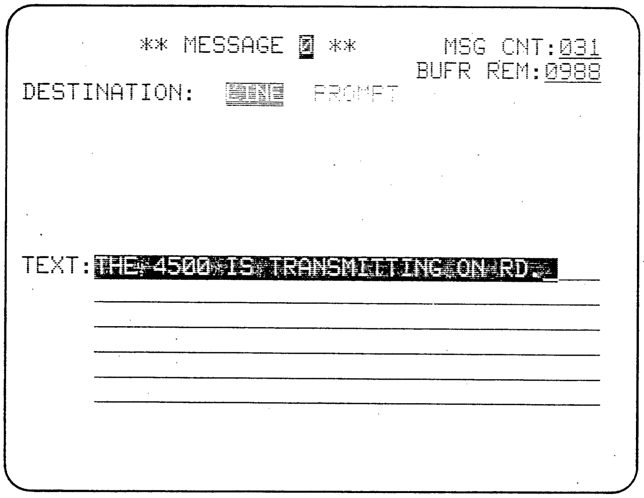


Figure 6.3-6

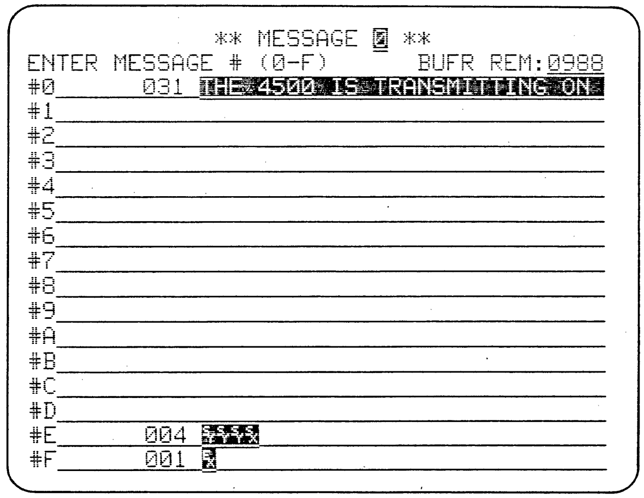


Figure 6.3-7

available separately. So, press MESSAGE (or ENTER MSG) again, followed by F to obtain Message-Entry menu F. There, enter ETX.

(4) On Message-Entry menu 0, enter the text of your message, as in Figure 6.3-6, for example. Notice that at the upper right-hand corner of the menu are displayed the total number of characters in your message (MSG CNT) and the total message buffer (in characters) currently remaining (BFR REM). The 4500 allows a total of 1024 characters, or bytes, for the 16 messages. The maximum number of message characters that can be accepted on one Message-Entry Menu is 210.

6.3.5 Look at the Message Summary

Press MESSAGE, and take a good look at the Message Summary (Figure 6.3-7). On line 2, it tells you the total remaining message buffer space. It tells you the number of characters in each message and shows you the first 28 characters in each message.

Don't turn off the 4500.

```
        ** TRIGGER 0 CONDITIONS **

MON:   NEITHER DTE DCE


MON:   EIA   NO   YES


MON:   FLAGS   NO   YES   87654321
                          0XXXXXXX
MON:   TIMEOUT                      NO   YES
MON:   XMT CMPLT                    NO   YES
```

Figure 6.4-1

```
          ** TRIGGER 0 ACTIONS **
                                  FLG:0XXXXXXX
SET XMIT    :  NO   YES  EOF       BCC:GD  BD  NO
SET TMOUT   :  NO   RSTRT   STOP
SET CRT     :  NO   YES


SET CPT MEM:  NO    ON    OFF      87654321
SET FLAG    :  NO   YES   INC      1XXXXXXX
SET XMT VAR:  NO    INC   00
SET RECBUF :  NO    RESTART   STOP
SET TIMER:  TIMER1  NO  YES
            TIMER2  NO  YES
SET CNTR :  CNTR1   NO  YES
            CNTR2   NO  YES
SET ALARM:  NO  YES         SET OTSYNC:NO  YES
SET ALT BANK:   NO    YES
```

Figure 6.4-2

```
*EM DCE/LINE*   BLOCK=000
BOTH/EBCDIC/SYNC/
THE 4500 IS TRANSMITTING ON RD.
```

Figure 6.4-3

```
*EM DCE/LINE*   BLOCK=000
BOTH/EBCDIC/SYNC/
THE 4500 IS TRANSMITTING ON RD.
```

Figure 6.4-4

You can program the 4500 to talk to itself. Thus you do not need a data line to learn how to transmit.

6.4 LOOPBACK

6.4.1 Set Up the Triggers

All 4500 transmissions are controlled by triggers (although, as you will see later, there is a way for you to obtain manual control of the triggers).

(1) First, we need a way to get transmission started, and give us something to use as a trigger source. Select the Trigger 0 Conditions menu (TRIGGER, 0, C). Select FLAGS YES. On the next line, test for Flag 8 off by entering 0 (zero) (compare Figure 6.4-1). Since all flags in the unit are initially OFF, the trigger must find this first condition true.

(2) Press CONTROL plus ENTER to display the Trigger 0 Actions menu. On line 4, select XMIT YES. This brings up a data-entry line for entering the IDs of the messages you want to transmit. Enter the three characters E 0 F, which instructs the trigger to combine the three messages into one transmission.

(3) Since Flag 8 is constantly off, the trigger will be constantly trying to retransmit the message even though the first transmission is not complete. This would cause Transmit Buffer overflow and stop the program. To avoid this, select FLAG YES and set Flag 8 to 1 (on). The trigger Actions menu should now look like Figure 6.4-2.

(4) Press RUN. The data display should appear as in Figure 6.4-3.

6.4.2 Emulate Mode Data Display

Notice (Figure 6.4-3) the first two lines of the Run Mode display. The interactive mode is EMulate DCE. The data source is LINE and the unit is monitoring BOTH DTE and DCE. The only data you see on the screen is what the 4500 is actually transmitting on RD. If a data line were connected you would see received line data from DTE as well as your transmission.

Because Received BLOCK CHECK is on in the unit (Parameters 1 menu) and the default BCC selection on the SET XMIT line of the trigger is GD, the second block check character is replaced by G on the display.

Return to the Trigger 0 Actions menu, and select BD on the XMIT line. Press RUN and notice that a BD block check has been sent.

In non-BOP modes, you can see what block check characters are actually being transmitted by returning to the Parameters 1 menu and selecting BLOCK CHECK OFF. This time, though, you won't know whether the block check (Figure 6.4-4) is good or bad unless you check the BCC entry on the SET XMIT line of the trigger Actions menu.

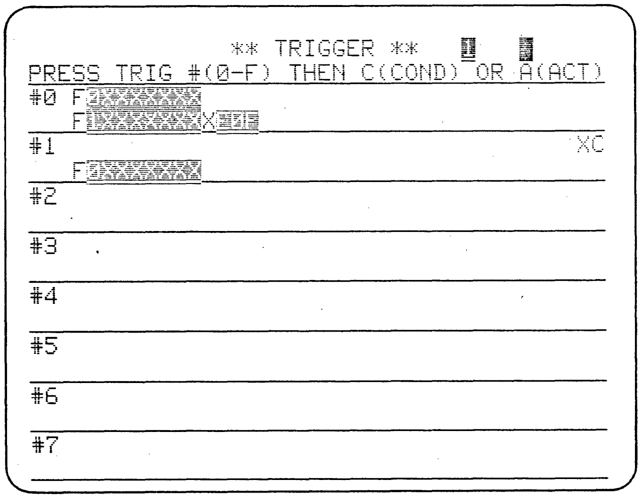


Figure 6.4-5

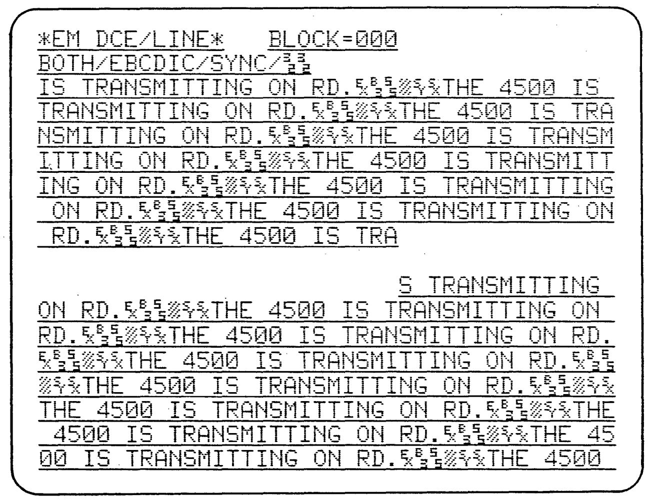


Figure 6.4-6

6.4.3 Repeating the Transmission

The transmission is being sent only once, because Flag 8 is turned on when it is sent. To repeat the transmission an indefinite number of times, (1) display the Trigger 1 Conditions menu, and select XMIT CMPLT YES. (2) On the Actions menu for this trigger, set Flag 8 off (0). The Trigger Summary is shown in Figure 6.4-5; and the data display in Figure 6.4-6.

Do not turn off the 4500. You will use this program again.

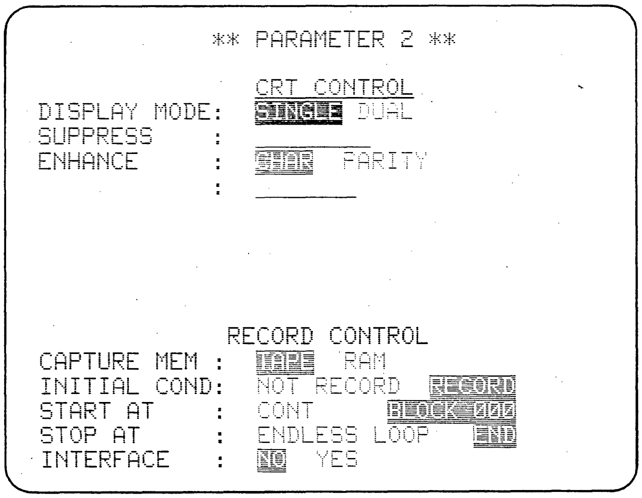


Figure 6.5-1 (Version 10.06)

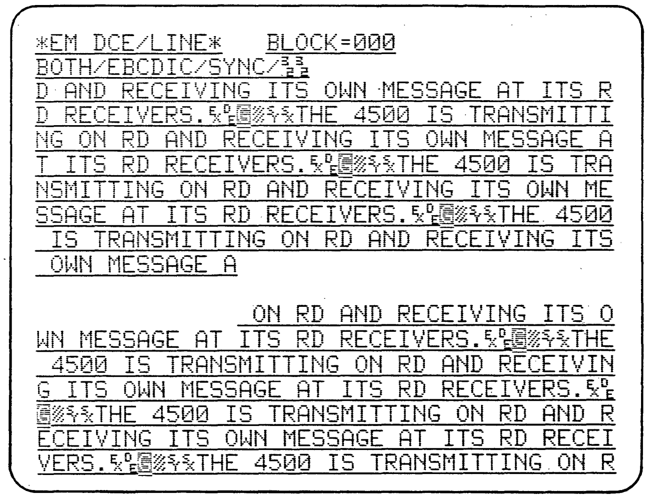


Figure 6.5-2

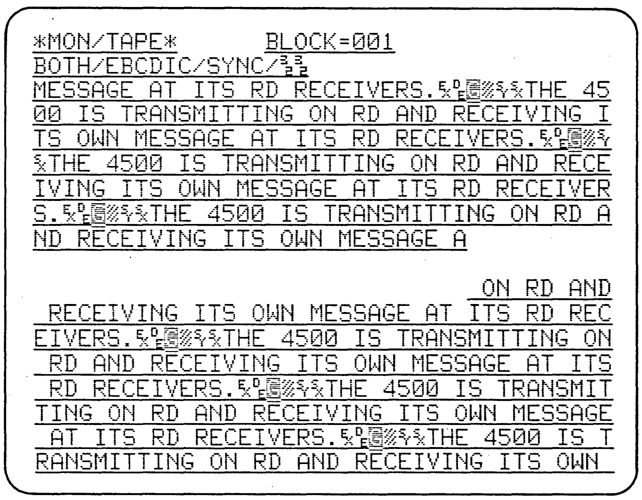


Figure 6.5-3

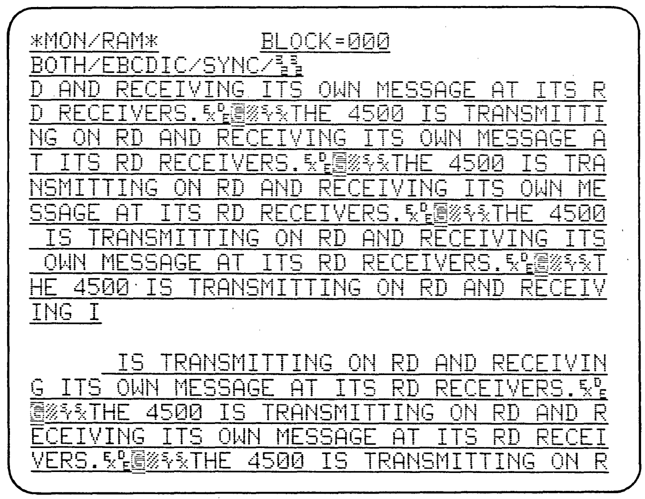


Figure 6.5-4

You can record all data received and transmitted by the 4500 on tape and, if your unit has the high-speed memory option, in RAM.

6.5 RECORDING DATA

6.5.1 Recording Transmitted Data on Tape

(1) Press PROGRAM. This stops tape motion. Select a blank formatted tape and set the tab to RECORD position (tab toward outside edge of cartridge). Install the blank tape in the unit.

(2) Display the Parameters 2 menu. Under Record Control the default CAPTURE MEMORY selection is RAM. (This line will be absent if your unit does not have the high-speed memory option.) Select TAPE and use the ENTER key to tab to INITIAL COND. Select RECORD; then START AT BLOCK 000 (see Figure 6.5-1). The STOP AT selection automatically changes to END. When it enters Run Mode, the 4500 will start to record data on tape beginning at the first block (Block 000) of the tape.

If you have Software Version 10.08, there is also a CLOCK field on the last line of the menu. Select INT clock, since there is no external source connected to the 4500.

(3) Press RUN to start transmission and recording on tape (Figure 6.5-2). Notice the tape block number incrementing on the first line. Allow recording to continue to Block 15; then press PROGRAM to stop it.

(4) To verify that the transmissions have been recorded, press PROGRAM, then PARAMETERS and 1. Select MON MODE; then tab down to the SOURCE line and select TAPE. The Record Control section will automatically disappear from the Parameters 2 menu.

(5) Press RUN and view the playback of your recorded data (Figure 6.5-3). Notice that the unit is now in MONitor mode and the data source is TAPE. Since the tape has recorded data that was being transmitted in EM DCE mode, it is playing back on RD.

6.5.2 Recording Transmitted Data in RAM

If your unit has the high-speed memory option (RAM), you will find it very convenient to record in and play back from RAM as you proceed through the remainder of this manual.

(1) Change the MODE selection on the Parameters 1 menu back to EM DCE and change the SOURCE back to LINE. On the Parameters 2 Record Control menu, change the CAPTURE MEMORY selection to RAM. Press RUN and observe the block numbers incrementing on the first line of the display. There are 54 blocks of RAM: if you try to record more than this, a message MEMORY FULL will be displayed (unless you have selected ENDLESS LOOP).

(2) Return to the Parameters 1 menu and change MODE to MON and SOURCE to RAM. Check that your data has actually been recorded in RAM by playing it back (Figure 6.5-4).

Do not turn off the 4500.

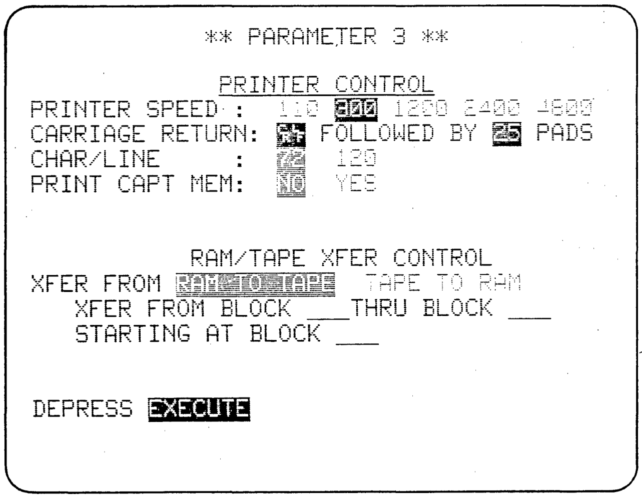


Figure 6.6-1

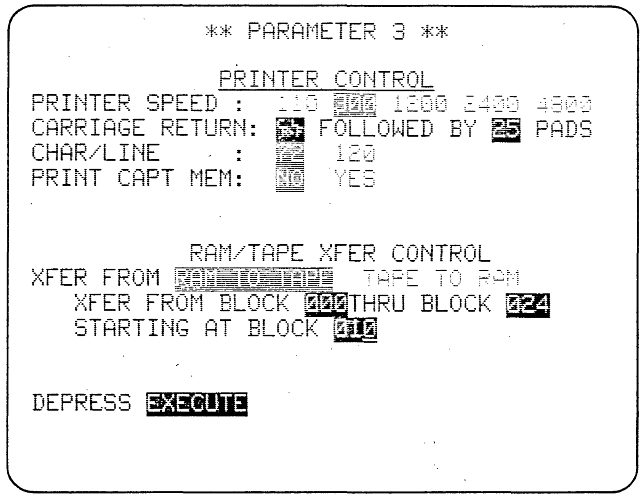


Figure 6.6-2

If the high-speed memory option is installed in your unit, you may transfer any portion of the data in RAM to any block of the tape, or vice versa.

6.6 TRANSFERRING DATA FROM RAM TO TAPE

(1) Press PROGRAM, PARAMETERS, and 3 to display the RAM-Tape Xfer Control menu shown in Figure 6.6-1.

(2) You are going to transfer data from RAM to tape. Since the default selection is RAM TO TAPE, use the ENTER key to go directly to the block number entry line. Enter the first and last RAM blocks from which you want data to be read. On Figure 6.6-2, we have entered Block 000 to Block 024.

(3) On the next line, enter the tape block number at which you want recording to start. We chose 010 (Figure 6.6-2). If you do the same, you can easily verify that data has actually been recorded on tape by playing the tape back from Block 010 past Block 15. (In Section 6.5.1, you recorded data on tape only as far as Block 15.)

NOTE: Remember that the 4500 will not find a tape block number past 000 unless the tape has been preformatted.

(4) Press EXECUTE. The tape will move to the selected block before transfer begins. You can verify that the transfer is in progress by watching the number of blocks increment on Line 2 in the message XFER IN PROCESS: XXX BLOCKS TRANSFERRED. A message XFER COMPLETE: XXX BLOCKS TRANSFERRED will then appear on Line 2.

(5) On the Parameters 1 menu, select SOURCE TAPE, START AT BLOCK 015. Press RUN and observe the display. The first line will give the data SOURCE as TAPE.

```
** TRIGGER 0 CONDITIONS **

MON:  NEITHER DTE DCE


MON:  EIA  NO  YES


MON:  FLAGS  NO  YES  87654321
                      0XXXXXXX
MON:  TIMEOUT           NO  YES
```

Figure 6.7-1

```
** TRIGGER 0 ACTIONS **
                                FLG:0XXXXXXX
SET XMIT   : NO   YES EOF____  BCC:GD BD NO
SET TMOUT  : NO   RSTRT  STOP
SET CRT    : NO   YES


SET CPT MEM: NO   ON   OFF      87654321
SET FLAG   : NO   YES  INC      1XXXXXXX


SET TIMER: TIMER1  NO  YES
           TIMER2  NO  YES
SET CNTR : CNTR1   NO  YES
           CNTR2   NO  YES
SET ALARM: NO  YES        SET OTSYNC:NO YES
SET ALT BANK:  NO   YES
```

Figure 6.7-2

```
** TRIGGER 1 ACTIONS **

                    XCMPL  FLG:10XXXXXX
SET XMIT   : NO   YES EOF____  BCC:GD BD NO
SET TMOUT  : NO   RSTRT  STOP
SET CRT    : NO   YES


SET CPT MEM: NO   ON   OFF     87654321
SET FLAG   : NO   YES  INC     X1XXXXXX
SET XMT VAR: NO   INC  00
SET RECBUF : NO   RESTART  STOP
SET TIMER: TIMER1 NO  YES
           TIMER2 NO  YES
SET CNTR : CNTR1  NO  YES
           CNTR2  NO  YES
SET ALARM: NO  YES      SET OTSYNC:NO  YES
SET ALT BANK:  NO   YES
```

Figure 6.7-3

```
           ** TRIGGER **   2   A
PRESS TRIG #(0-F) THEN C(COND) OR A(ACT)
#0 F0XXXXXXX
   F1XXXXXXXXEOF
#1 F10XXXXXX                          XC
   FX1XXXXXXXEOF
#2 F11XXXXXX                          XC
   F0XXXXXXX
#3

#4

#5

#6

#7

```

Figure 6.7-4

```
           ** TRIGGER **   0   A
PRESS TRIG #(0-F) THEN C(COND) OR A(ACT)
#0 F0XXXXXXX
   F10XXXXXXXEOF
#1 F10XXXXXX                          XC
   FX1XXXXXXXEOF
#2 F11XXXXXX                          XC
   F0XXXXXXX
#3

#4

#5

#6

#7

```

Figure 6.7-5

```
*EM DCE/LINE*   BLOCK=001
BOTH/EBCDIC/SYNC/
 AT ITS RD RECEIVERS.THE 4500 IS T
RANSMITTING ON RD AND RECEIVING ITS OWN
MESSAGE AT ITS RD RECEIVERS.THE 45
00 IS TRANSMITTING ON RD AND RECEIVING I
TS OWN MESSAGE AT ITS RD RECEIVERS.
THE 4500 IS TRANSMITTING ON RD AND RECE
IVING ITS OWN MESSAGE AT ITS RD RECEIVER
S.

       S OWN MESSAGE AT ITS RD RECEIVERS.
THE 4500 IS TRANSMITTING ON RD AND
 RECEIVING ITS OWN MESSAGE AT ITS RD REC
EIVERS.THE 4500 IS TRANSMITTING ON
 RD AND RECEIVING ITS OWN MESSAGE AT ITS
 RD RECEIVERS.THE 4500 IS TRANSMIT
TING ON RD AND RECEIVING ITS OWN MESSAGE
```

Figure 6.7-6

This program uses flag control to send alternate good and bad block checks.

6.7 ALTERNATING GOOD AND BAD BCC

As you have already seen, the 4500's internal flags are extremely valuable for controlling transmissions. We shall, therefore, spend some time developing the techniques of flag control. You can use the message you have already entered in the unit.

Set up the Parameters 1 menu for EM DCE and LINE source. Clear the triggers.

6.7.1 Send Good BCC: Trigger 0

Conditions Menu: To start the program, look for Flag 8 OFF (Figure 6.7-1).

Actions Menu: Send a message with a good BCC and turn Flag 8 ON to prevent transmit buffer overflow (Figure 6.7-2). The actual flag status will now be 1000 0000.

6.7.2 Send Bad BCC: Trigger 1

Conditions Menu: Look for Transmission Complete and the flag status 10XX XXXX.

Actions Menu: Send a message with a bad BCC and turn Flag 7 ON to prevent transmit buffer overflow (Figure 6.7-3). The actual flag status will now be 1100 0000.

6.7.3 Repeat Transmission of the Good BCC: Trigger 2

Conditions Menu: Look for Transmission Complete and flag status 11XX XXXX.

Actions Menu: Turn Flag 8 OFF to permit transmission of the Good BCC. The flag status is now 0100 0000 (See Figure 6.7-4.)

6.7.4 Repeat Transmission of the Bad BCC: Trigger 0

Actions Menu: Turn Flag 7 OFF so that Trigger 1 can transmit the bad BCC message the second time. Figure 6.7-5 shows the completed Trigger Summary; and Figure 6.7-6, the transmitted data.

Don't turn off the 4500.

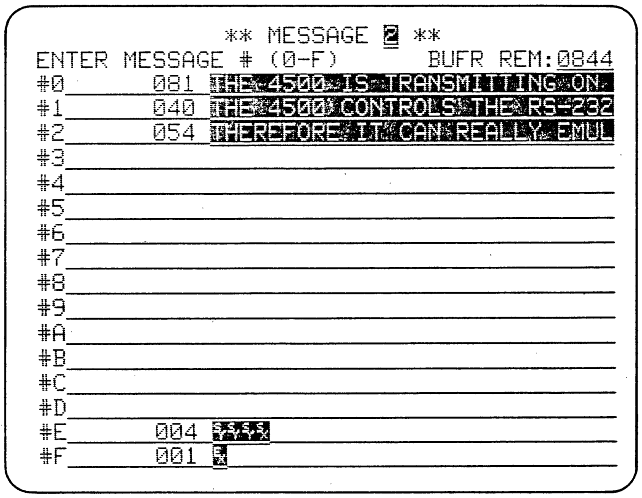


Figure 6.8-1

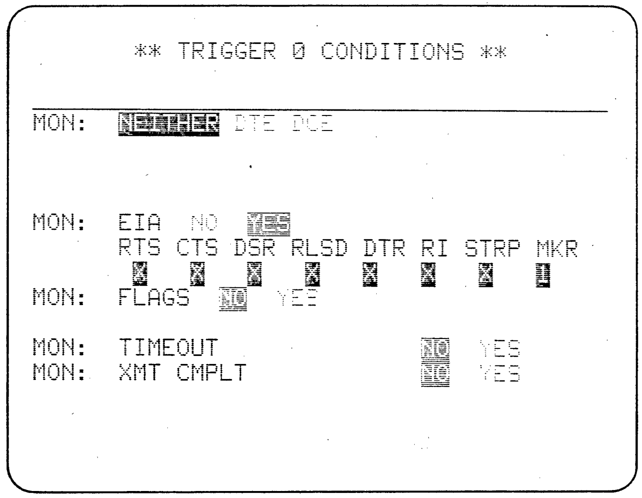


Figure 6.8-2

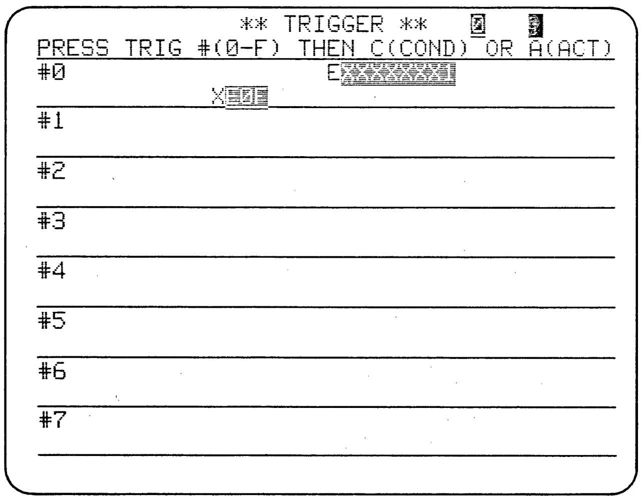


Figure 6.8-3

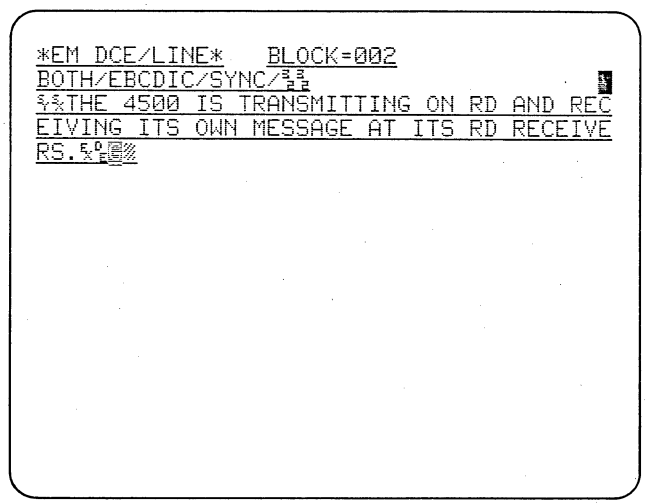


Figure 6.8-4

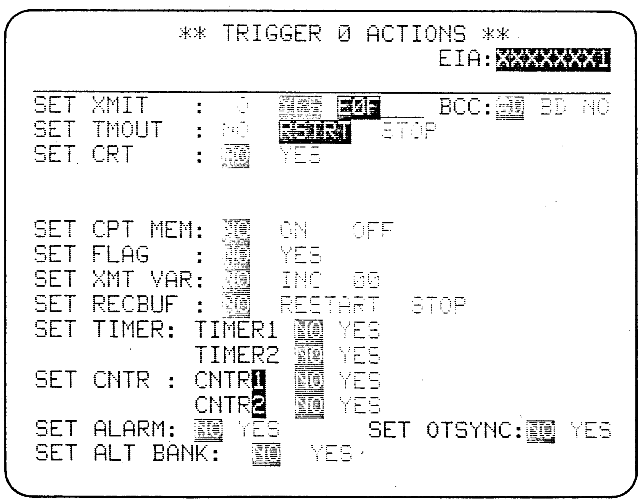


Figure 6.8-5

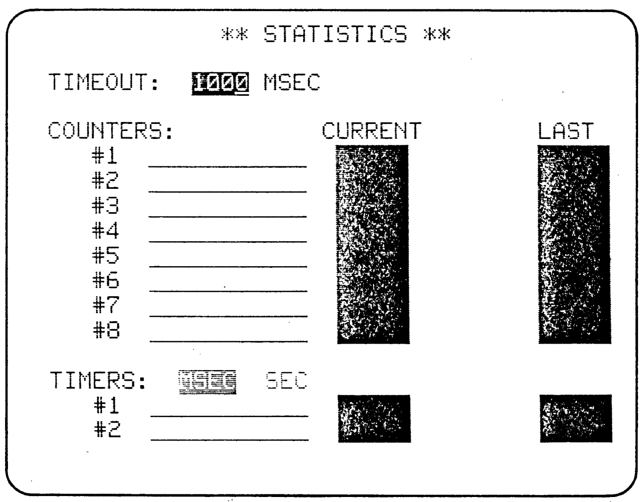


Figure 6.8-6

This program demonstrates the use of the flag increment trigger condition to count transmissions. It also employs manual control and gives a method for developing a taped training program.

6.8 USING FLAG INCREMENT TO COUNT TRANSMISSIONS

First, type in two more message texts on Message-Entry menus 1 and 2 (see Figure 6.8-1). Clear the triggers.

6.8.1 Sending a Message Manually: Trigger 0

Although all transmissions are controlled by triggers, you can gain manual control of a trigger using the Marker condition. When Marker ON (1) is chosen in the MON EIA field of a trigger Conditions menu, the condition will come true when the ENTER key is depressed in Run Mode. This enables you to choose the moment at which a program or a transmission starts.

Conditions Menu: EIA YES; MKR 1 (ON) (Figure 6.8-2).

Actions Menu: XMIT messages E 0 F (Figure 6.8-3).

Press RUN. The two status lines appear, but there is no data on the screen. Press ENTER. This places a marker on the screen and Message 0 is sent once (Figure 6.8-4). Verify that you can send Message 0 as often as you like by pressing the ENTER key once for each transmission.

6.8.2 The Timeout Timer

The 4500 has one timer dedicated to the timeout function. It can be set to increment to any value up to 6800 milliseconds. We shall use the timeout here to leave sufficient time in the taped data for you to transmit replies in the next lesson.

On the Trigger 0 Actions menu, set the TMOUT timer to RSTRT (Figure 6.8-5). Display the Statistics menu. The default value in the timeout data-entry field is 3000 msec. Enter 1000 by writing over the 3000 (Figure 6.8-6).

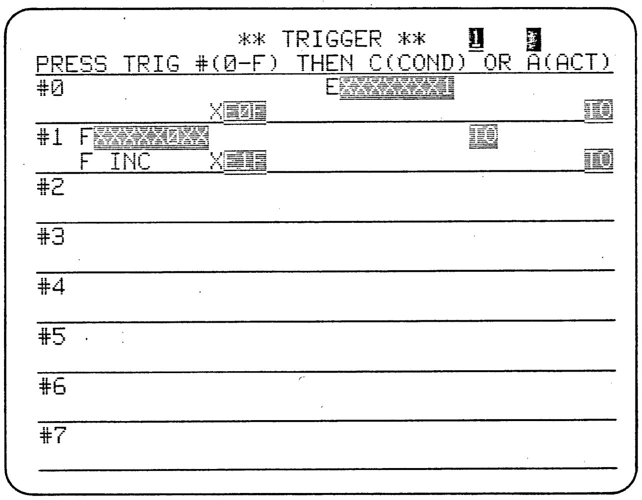


Figure 6.8-7

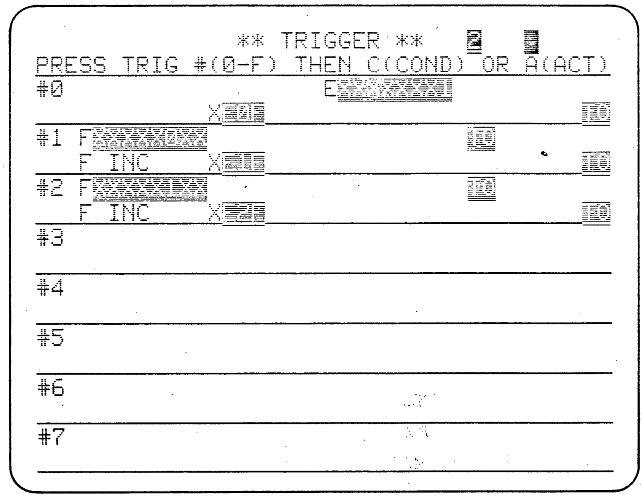


Figure 6.8-8

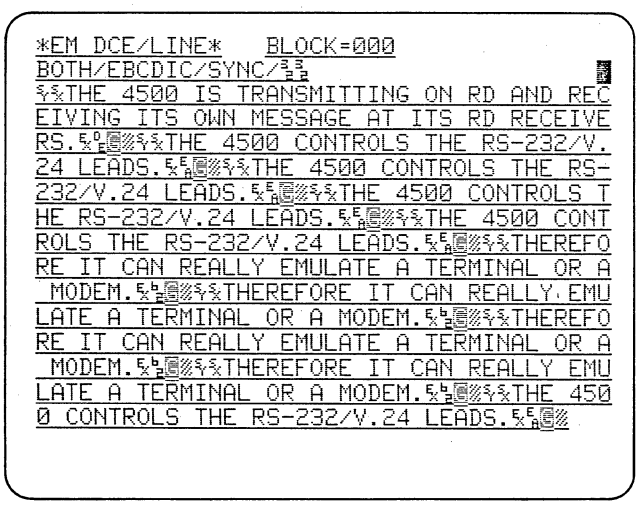


Figure 6.8-9

6.8.3 Send a Message at Timeout: Trigger 1

Conditions Menu: Look for TIMEOUT and for Flag 3 OFF (0). Flag 3 will be off initially by default, and the time-out timer will have been started by Trigger 0 at start of transmission.

Actions Menu: Set FLAGS to INCrement; XMIT messages E 1 F; RESTRT TIME-OUT. (See Figure 6.8-7.)

Whenever timeout occurs while Flag 3 is off, Trigger 1 will transmit messages E 1 F, restart the timeout timer, and increment the flag mask.

Trigger 1 sends Message 1 initially because 0 is the default condition for Flag 3. On the first transmission, the flag mask increments, but Flag 3 is not affected. The transmission repeats until Flag 3 goes to 1; that is, when the flag mask has value 4 and the message has been sent 4 times.

The timeout condition prevents transmit buffer overflow by preventing the trigger from starting a transmission before the preceding one is finished. XMIT CMPLT could also be used, but we need the timeout in the data for the next lesson.

6.8.4 Send Message 2 Four Times: Trigger 2

Message 1 can no longer be sent, because Flag 3 is now ON, but we can use the new conditions, namely timeout and Flag 3 = 1, to send Message 2.

Conditions Menu: Look for Flag 3 ON and timeout.

Actions Menu: INCrement flags; send Message 2; and RSTRT timeout. (See Figure 6.8-8.)

Now observe your transmissions in Run Mode (Figure 6.8-9). Remember that you must press ENTER to establish the Marker condition and start the transmission.

6.8.5 Record the Transmitted Data

You will use your transmitted data in the next lesson, so go to the Record Control menu (Parameters 2) and select RECORD from BLOCK 000; STOP AT END. Insert a blank tape and record the transmitted data for 10 blocks. Move the RECORD tab on the tape to the PROTECTED position and save it for the next lesson. (If you have the high-speed memory option, you may want to use RAM.)

```
           ** PARAMETER 1 **

TEST ID:
MODE   :  MON   EM DTE   EM DCE   H-SPD MON
SOURCE :  LINE  TAPE  RAM
        START AT:   BLOCK 015   CONT
MON    :  BOTH DTE DCE
CODE   :  EBCDIC    ASCII    EBCD   XS-3
          IPARS  REV EBCD  SELECTRIC HEX


FORMAT :  SYNC  BSC/X.25  7E/X.25  SDLC
          SDLC/NRZI  ASYNC
   SYNC CHARS:       AUTOSYNC:  OFF   ON
   OUT SYNC  :  OFF  ON    CHAR:     #:1
BLK CHK:  OFF  ON
I/F    :  EIA   MIL
                      SPEED:   2400
```

Figure 6.9-1

```
           ** TRIGGER **   1   
PRESS TRIG #(0-F) THEN C(COND) OR A(ACT)
#0            S REALLY
                                     RB
#1            SMODEM
                                     RB
#2

#3

#4

#5

#6

#7
```

Figure 6.9-2

```
           ** TRIGGER **   2   
PRESS TRIG #(0-F) THEN C(COND) OR A(ACT)
#0            SREALLY
                                     RB
#1            SMODEM
                                     RB
#2            SMODEM.
              XERR
#3

#4

#5

#6

#7
```

Figure 6.9-3

```
           ** TRIGGER **   3   
PRESS TRIG #(0-F) THEN C(COND) OR A(ACT)
#0            SREALLY
                                     RB
#1            SMODEM
                                     RB
#2            SMODEM.
              XERR
#3            S
                 CXXX1X1
#4            SMODEM
                 CXXX0X0
#5

#6

#7
```

Figure 6.9-4

```
*EM DTE/RAM*    BLOCK=016
BOTH/EBCDIC/SYNC/
THE 4500 CONTROLS THE RS-232/V.24 LEAD
S.THE 4500 CONTROLS THE RS-232/V.2
4 LEADS.THEREFORE IT CAN REALLY EM
ULATE A TERMINAL OR A MODEM.EMULA
TE A TERMINAL OR A MODEM&THEREFORE
IT CAN REALLY EMULATE A TERMINAL OR A MO
DEM.EMULATE A TERMINAL OR A MODEM
&THEREFORE IT CAN REALLY EMULATE A
TERMINAL OR A MODEM.EMULATE A TER
MINAL OR A MODEM&THEREFORE IT CAN R
EALLY EMULATE A TERMINAL OR A MODEM.
EMULATE A TERMINAL OR A MODEM&TH
E 4500 CONTROLS THE RS-232/V.24 LEADS.
```

Figure 6.9-5

You can instruct triggers to load up to 255 bytes of data in the 4500's Receive Buffer and transmit the contents of the Buffer.

6.9 THE RECEIVE BUFFER: SELECTIVELY ECHOING DATA

For this lesson, you will need the data that you recorded in the previous lesson. You will play back that data, load the Receive Buffer with EMULATE A TERMINAL OR MODEM each time that phrase is received, and then send it on TD.

6.9.1 Parameters Setup

Since the taped data was transmitted on RD, it will be played back on RD. Therefore, you should transmit on TD. On the Parameters 1 menu select EM DTE Mode and TAPE (or RAM) for the data source. Leave the rest of the menu in default condition. (See Figure 6.9-1.) Clear the triggers.

6.9.2 Load the Receive Buffer: Triggers 0 and 1

Trigger 0 Conditions Menu: Look for a DCE string REALLY.

Trigger 0 Actions Menu: Start Receive Buffer.

Trigger 1 Conditions Menu: Look for DCE string MODEM.

Trigger 1 Actions Menu: Stop Receive Buffer. Figure 6.9-2 shows the Trigger Summary at this point.

6.9.3 Transmit the Receive Buffer: Trigger 2

Conditions Menu: Look for the end of the block that contains EMULATE A TERMINAL OR MODEM; that is, look for the string MODEM.ETX DC DC (remember to use CONTROL plus the ETX key for ETX and use the DON'T CARE key).

Actions Menu: Transmit the Receive Buffer properly formatted, that is, transmit E R F. (See Figure 6.9-3.)

6.9.4 Enhance the Echoed Data

It will be much easier to distinguish the echoed portion of the data if we display it in low-intensity reverse image. On Trigger 3, turn on low-intensity reverse image on receipt of DTE string SYN STX; on Trigger 4, turn off low-intensity reverse-image on receipt of DTE string MODEM (see Figure 6.9-4).

Figure 6.9-5 shows the display in Run Mode.

Don't turn off the 4500.

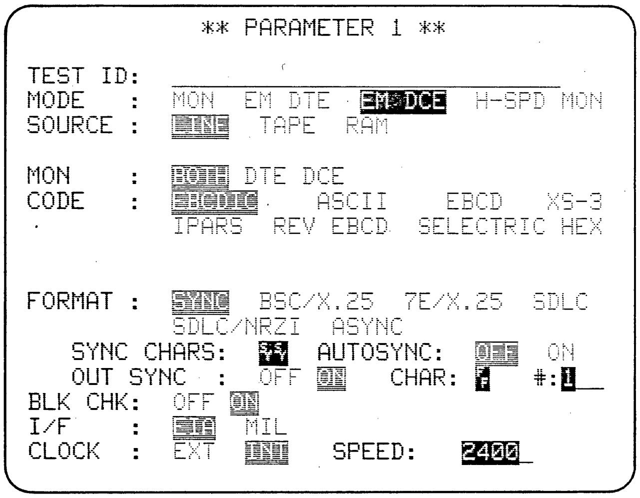


Figure 6.10-1

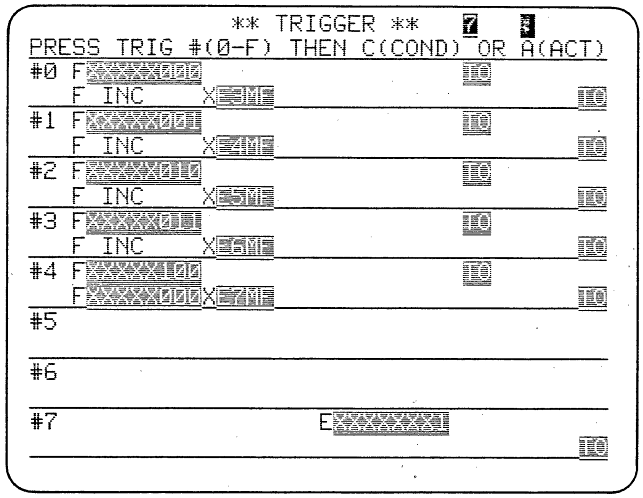


Figure 6.10-2

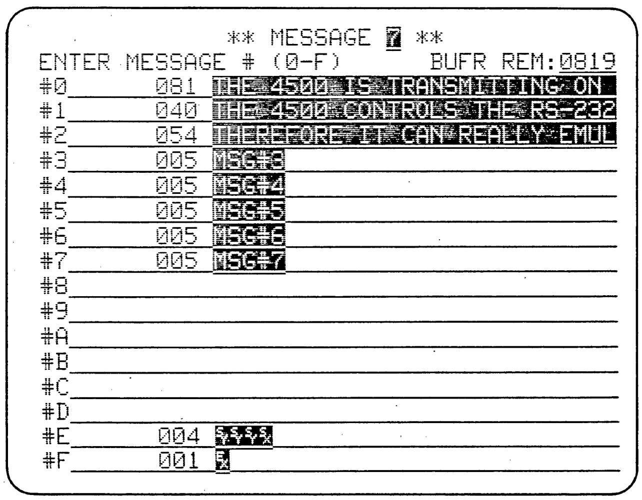


Figure 6.10-3

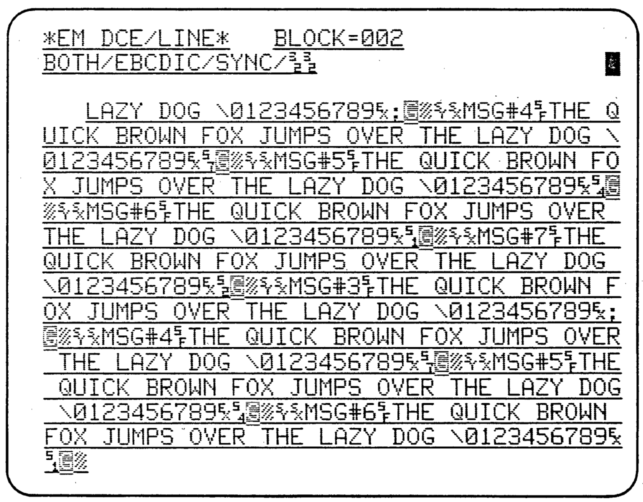


Figure 6.10-4

This program uses flag increment and the 4500's standard stored message to send each message in a series once.

6.10 THE 4500'S FACTORY-STORED MESSAGE

Set up the Parameters 1 menu for the 4500 to talk to itself (Figure 6.10-1) and enter the program shown in Figure 6.10-2. This program uses the flag increment action as the condition to send a series of messages. Since the transmitting triggers look for increments of 1, each message is sent only once. Transmission is activated by the ENTER key (Trigger 7).

Enter identifying messages on Message-Entry menus 3 through 7 as shown in Figure 6.10-3. The canned message is added in the XMIT fields of the triggers by entering an M after the Message-Entry menu number.

Figure 6.10-4 shows the transmitted data. Record this data for use in the next lesson.

```
            ** MESSAGE 9 **
ENTER MESSAGE # (0-F)          BUFR REM:0803
#0          081  THE 4500 IS TRANSMITTING ON
#1          040  THE 4500 CONTROLS THE RS-232
#2          054  THEREFORE IT CAN REALLY EMUL
#3          005  MSG#3
#4          005  MSG#4
#5          005  MSG#5
#6          005  MSG#6
#7          005  MSG#7
#8          008  ANSWER#3
#9          008  ANSWER#4
#A
#B
#C
#D
#E          004  
#F          001  
```

Figure 6.11-1

```
              ** TRIGGER **    7    
PRESS TRIG #(0-F) THEN C(COND) OR A(ACT)
#0                 SMSG#3
   FXXXXX001
#1                 SMSG#4
   FXXXXX011
#2

#3

#4

#5

#6

#7                 S
```

Figure 6.11-2

```
              ** TRIGGER **    B    
PRESS TRIG #(0-F) THEN C(COND) OR A(ACT)
#8 FXXXXX001
   FXXXXX000XE8F
#9 FXXXXX011
   FXXXXX000XE9F
#A

#B FXXXXX000

#C

#D

#E

#F
```

Figure 6.11-3

```
              ** TRIGGER **    2    
PRESS TRIG #(0-F) THEN C(COND) OR A(ACT)
#0                 SMSG#3
   FXXXXX001
#1                 SMSG#4
   FXXXXX011
#2                                       XC
                      CXXXXX0
#3

#4

#5

#6

#7                 S
```

Figure 6.11-4

```
              ** TRIGGER **    8    
PRESS TRIG #(0-F) THEN C(COND) OR A(ACT)
#8 FXXXXX001
   FXXXXX000XE8CXXXXX1
#9 FXXXXX011
   FXXXXX000XE9CXXXXX1
#A

#B FXXXXX000

#C

#D

#E

#F
```

Figure 6.11-5

```
*EM DTE/TAPE*    BLOCK=004
BOTH/EBCDIC/SYNC/
MSG#7THE QUICK BROWN FOX JUMPS OVER T
HE LAZY DOG 0123456789 ) MSG#3THE QUI
CK BROWN FOX JUMPS OVER THE LAZY DOG 012
3456789  ANSWER#3 G MSG#4THE QUIC
K BROWN FOX JUMPS OVER THE LAZY DOG 0123
456789 & ANSWER#4 E MSG#5THE QUICK
 BROWN FOX JUMPS OVER THE LAZY DOG 01234
56789  MSG#6THE QUICK BROWN FOX JUMP
S OVER THE LAZY DOG 0123456789 x MSG#
7THE QUICK BROWN FOX JUMPS OVER THE LAZY
 DOG 0123456789 ) MSG#3THE QUICK BROW
N FOX JUMPS OVER THE LAZY DOG 0123456789
  ANSWER#3 G 

                        MSG#6THE QUICK BROWN F
OX JUMPS OVER THE LAZY DOG 0123456789 x
```

Figure 6.11-6

The low bank of triggers will monitor RD for two messages from the tape and set flags to communicate with the high bank. The high bank will transmit replies.

6.11 AN ALTERNATE BANKS PROGRAM

6.11.1 Set up the Parameters and Messages

Set up the 4500 to talk to the tape you made in the preceding lesson; that is, to play back BISYNC data from tape in EM DTE mode.

Insert the data tape you made in the preceding lesson.

On Message-Entry menus 8 and 9, enter replies to MSG#3 and MSG#4 as shown in Figure 6.11-1.

6.11.2 The Receive Bank

The low bank of triggers will be used as the receive bank.

Trigger 0 Conditions Menu: Look for RD string MSG#3.

Trigger 0 Actions Menu: Set Flags to XXXX X001.

Trigger 1 Conditions Menu: Look for RD string MSG#4.

Trigger 1 Actions Menu: Set Flags to XXXX X011.

To start the program, have a trigger activate the alternate bank at the end of the first block received from the tape, as follows:

Trigger 7 Conditions Menu: Find the end of a DCE block by searching for the string ETX DC DC.

Trigger 7 Actions Menu: Go to the alternate bank.

The low-bank Trigger Summary should now look like Figure 6.11-2.

6.11.3 The Transmit Bank

On the High Bank, set Triggers 8 and 9 to transmit the replies, as follows:

Trigger 8 Conditions Menu: Look for flag status XXXX X001, which announces MSG#3 to the high bank.

Trigger 8 Actions Menu: Set flags to XXXX X000, and transmit E 8 F.

Trigger 9 Conditions Menu: Look for flag status XXXX X011, which announces MSG#4.

Trigger 9 Actions Menu: Set flags to XXXX X000 and transmit E 9 F.

Notice that there is no need to look for end of the MSG#3 or MSG#4 block, because this has already been done by the low bank (Trigger 7).

You must prevent the high bank from remaining active when the low bank should be looking for MSG#3 and MSG#4, so set up Trigger B to return activity to the low bank when the high bank isn't transmitting:

Trigger B Conditions Menu: Look for flag status XXXX X000.

Trigger B Actions Menu: Activate the low bank.

The high-bank program is shown in Figure 6.11-3.

6.11.4 CRT Enhancements

The program as shown in Figures 6.11-2 and 6.11-3 will now run, but it will be easier to distinguish your transmissions from the received data if you enhance the transmitted data. So, turn CRT reverse image on at the start of each transmission (Triggers 8 and 9 Action menus); and turn it off at end of transmission (Trigger 2; notice that the end of transmission can only be seen by the low bank in this program). Figures 6.11-4 and 6.11-5 show the completed program, and Figure 6.11-6, the data.

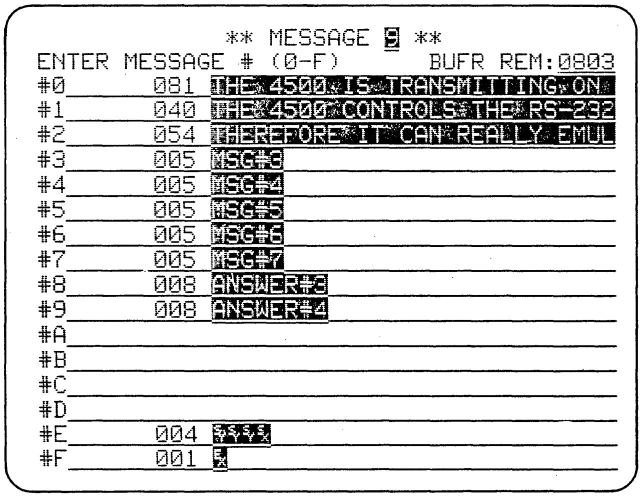


Figure 6.12-1

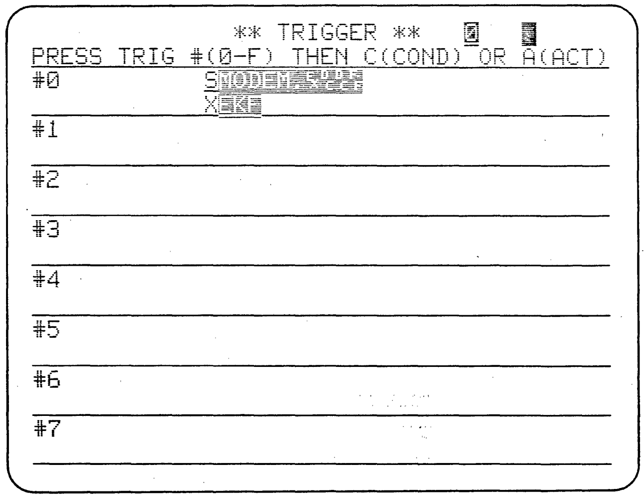


Figure 6.12-2

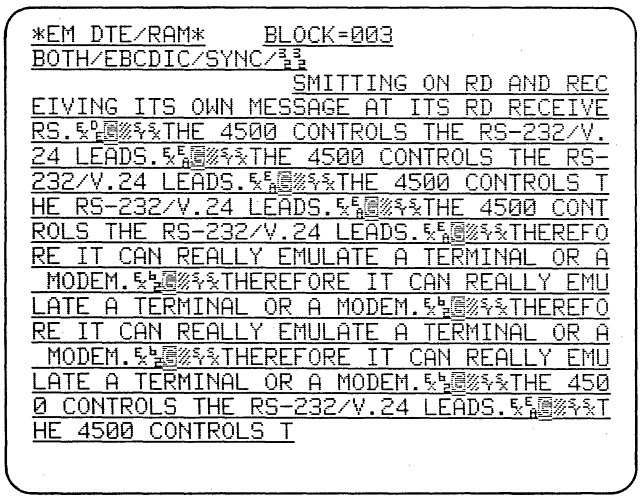


Figure 6.12-3

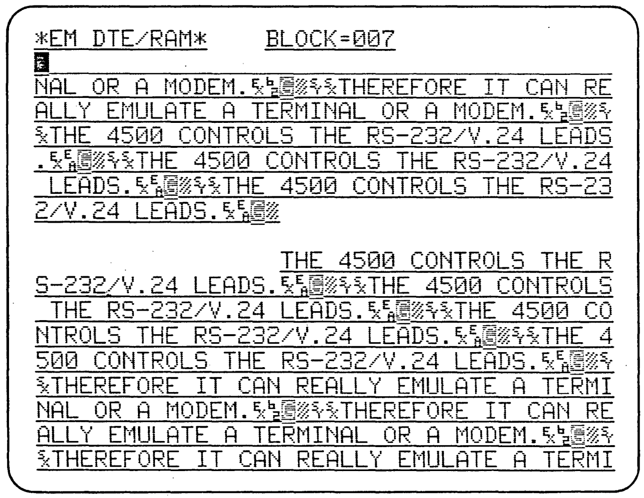


Figure 6.12-4

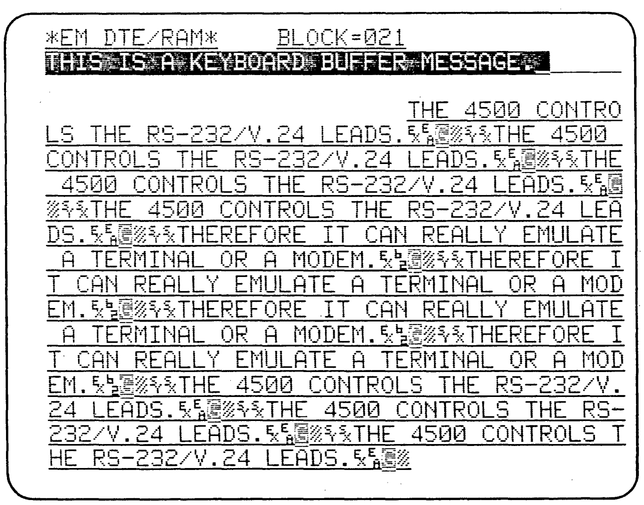


Figure 6.12-5

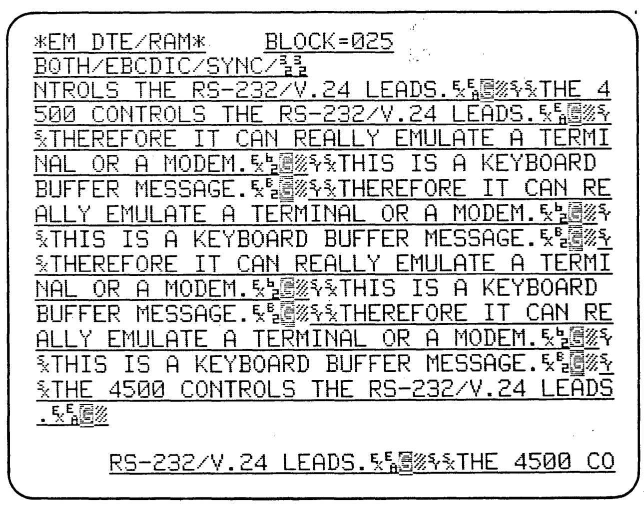


Figure 6.12-6

You may type messages into a Keyboard Buffer while real-time data is displayed. You can have these messages transmitted automatically by triggers, or you can control transmission with the Marker (ENTER key).

6.12 KEYBOARD BUFFER MESSAGES

While real-time data is displayed, you can type a message into the keyboard buffer and modify it as you wish. While you are doing this, the keyboard buffer is inaccessible to triggers. When the message is in final form, you can transfer it to a Transmit Buffer. The triggers will now send it every time the conditions for transmission are true. The content of the Transmit Buffer cannot be changed.

To try out the keyboard buffer, the data you recorded with a timeout in Section 6.8 will be useful. If you use the tape, the tape should be recorded full. If you have the RAM option, it will be more convenient to fill the RAM with this data.

Set up the Parameters 1 menu for EM DTE mode (since the data has been recorded on RD), and TAPE or RAM source.

Clear the triggers. Set Trigger 0 to look for the end of a received data block, e.g., a DCE string of MODEM.ETX DC DC FF. On the Set Xmit line of the Trigger 0 Actions menu, enter the messages E K F. Message menus E and F contain the leading and trailing protocol characters that you entered earlier (Figure 6.12-1). K, of course, stands for Keyboard Buffer message. In a test situation, you might prefer to enter the protocol characters in the Keyboard Buffer. Figure 6.12-2 shows the Trigger Summary.

Now monitor the recorded data (Figure 6.12-3). Press the MESSAGE (or ENTER MSG) key. Notice that the second status line of the display goes away, leaving you a blank line with the cursor at the first position (Figure 6.12-4). You now have access to the Keyboard Buffer. Type in a message as in Figure 6.12-5. CONTROL plus a cursor ARROW, CLEAR FIELD, and SHIFT plus CLEAR FIELD all work just as on program menus. You may enter up to 40 characters. If you enter too many characters, the excess will be discarded from the end of the message.

All alphanumeric, hexadecimal, and control characters are legal. The Flag key may not be used.

To transfer the content of the Keyboard Buffer to the Transmit Buffer, press the MESSAGE (or ENTER MSG) key again. On Line 2, the keyboard buffer message is replaced by the program parameters information. As soon as Trigger 0 is true, the keyboard message is transmitted on TD (Figure 6.12-6). It remains in the Transmit Buffer and is transmitted every time the trigger is true until the Transmit Buffer is cleared.

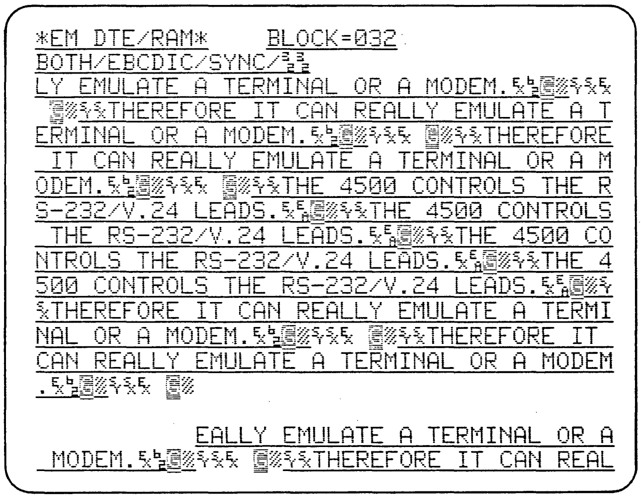


Figure 6.12-7

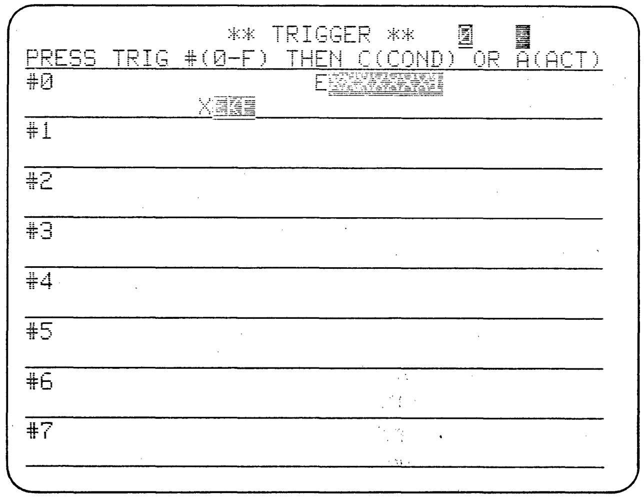


Figure 6.12-8

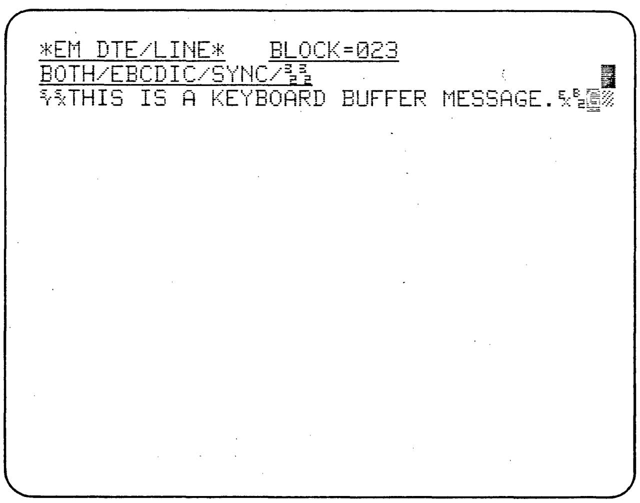


Figure 6.12-9

To clear the Transmit Buffer, you must put the unit in the Keyboard Buffer entry mode by pressing MESSAGE. The message-entry field will again be displayed on Line 2. Press CONTROL plus CLEAR FIELD. You can see from Figure 6.12-7 that the Transmit Buffer is now clear, because only the two formatting messages E and F are being sent when the trigger comes true.

You may wish to verify that CONTROL plus CLEAR FIELD clears both the Keyboard Buffer and the Transmit Buffer.

You may retain access to the Keyboard Buffer after you have entered a message in the Transmit Buffer, as follows: Press the MESSAGE key and type in a message as before. Then, press the ENTER key instead of MESSAGE. When Trigger 0 comes true, the message will be sent but the message-entry field will remain on Line 2. You may modify or replace the current message at any time and you will not lose control of the Keyboard Buffer until you again use the MESSAGE key instead of ENTER.

CAUTION: If you alter the Run Mode Display by pressing MANUAL FREEZE, PROGRAM SUMMARY, or RESULTS, you will lose control of the Keyboard Buffer and it will be cleared, although the Transmit Buffer will not be affected.

HALT, CLEAR CRT, or SELF TEST will not affect either the Keyboard Buffer or the Transmit Buffer.

To control transmission of the Keyboard Buffer from the keyboard, change the Trigger 0 Conditions menu to look for the Marker (see Figure 6.12-8). To use the marker, you must choose LINE as the data source on the Parameters 1 menu. Once you have transferred a keyboard message to the Transmit Buffer, you must forfeit control of the Keyboard Buffer by pressing MESSAGE. You can then send the message whenever you wish by pressing the ENTER key (see Figure 6.12-9).

Notice that a Marker is put on the screen each time you press ENTER.

As we mentioned earlier, the INTERVIEW 4500 is not simply a transmitter. Whenever it is in an Emulate Mode, it assumes control of the side of the EIA interface on which it is to transmit.

7 EIA INTERFACE LEAD CONTROL

TABLE 7.1-1
INTERFACE LEADS CONTROLLED BY THE 4500

RS-232/V.24 LEAD				EM DTE Mode	EM DCE Mode	MONITOR Mode
Pin	Name	EIA	CCITT			
2	TD	BA	103	Driven by 4500	GND via 3 kohms	Input to 30-kohm receiver
3	RD	BB	104	GND via 3 kohms	Driven by 4500	Input to 30-kohm receiver
20	DTR	CD	108/2	Driven by 4500	GND via 4.7 kohms	Input to 30-kohm receiver
4	RTS	CA	105	Driven by 4500	GND via 4.7 kohms	Input to 30-kohm receiver
8	RLSD	CF	109	GND via 4.7 kohms	Driven by 4500	Input to 30-kohm receiver
5	CTS	CB	106	GND via 4.7 kohms	Driven by 4500	Input to 30-kohm receiver
22	RI	CE	125	GND via 4.7 kohms	Driven by 4500	Input to 30-kohm receiver
15	SCT	DB	114	GND via 3 kohms	Driven by 4500	Input to 30-kohm receiver
17	SCR	DD	115	GND via 3 kohms	Driven by 4500	Input to 30-kohm receiver
24	SCTE	DA	113	Driven by 4500	GND via 3 kohms	Input to 30-kohm receiver
6	DSR	CC	107	GND via 4.7 kohms	Driven by 4500	Input to 30-kohm receiver

In Section 6, the 4500's Interface Control menu was mentioned briefly. Here we go into the detail you need to use the Emulate Modes in the real data world.

7.1 WHAT ACTUALLY HAPPENS IN THE EMULATE MODES

In Section 6, you looked briefly at the Interface Control menu (Parameters 4; see Figure 7.1-1). Because the 4500 was talking to itself, or to its own tape, the default interface status was acceptable, and your introduction to transmitting with the 4500 was considerably simplified. When you use the 4500 in your real data world, however, you will have to pay careful attention to this menu.

In order to use either of the 4500's two Emulate modes for live data, you must break the line and connect it to one of the two Emulate connectors on the rear of the unit. In EM DCE mode, if you have used the correct connector for the mode selection, the 4500 will control leads usually controlled by the modem; in EM DTE mode, it will control leads usually controlled by the data terminal equipment.

When you power up the 4500 and plug your equipment into one of the two Emulate connectors, the 4500 will immediately, without waiting for Run Mode, apply an OFF voltage as defined by the RS-232/V.24 standard to each of the leads that it controls in that emulation mode. For EM DCE, these are RI (Pin 22), DSR (Pin 6), RLSD (Pin 8), CTS (Pin 5), SCT (Pin 15), SCR (Pin 17), and RD (Pin 3). For EM DTE, they are DTR (Pin 20), RTS (Pin 4), SCTE (Pin 24), and TD (Pin 2). (For further details on the leads controlled by the 4500, see Table 7.1-1.)

NOTE: The terms ON and OFF imply that an RS-232/V.24 lead is driven to either ON or OFF voltage in accordance with the RS-232/V.24 standard. The standard defines a signal as OFF when it is more negative than -3 volts with respect to signal ground. A signal is defined as ON when it is more positive than +3 volts with respect to signal ground. Thus, OFF always implies that the lead is driven to the OFF state and we use the term inactive to mean that a lead is not being driven ON or OFF.

If you make any changes in either the LINE USE or STATIC LEADS field of the menu, your changes will become effective when you first enter Run Mode.

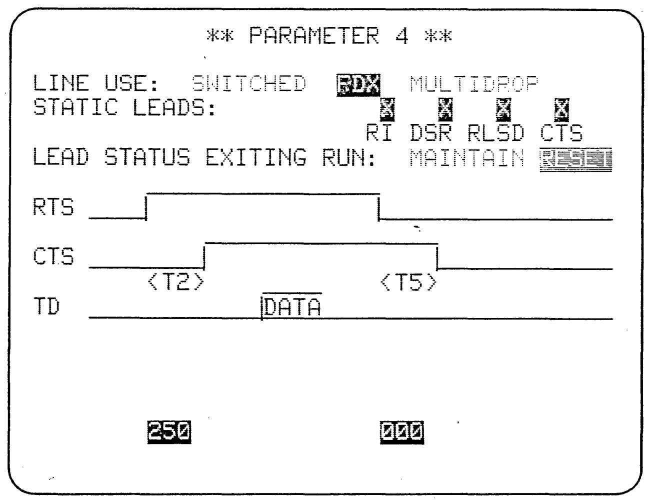


Figure 7.1-1

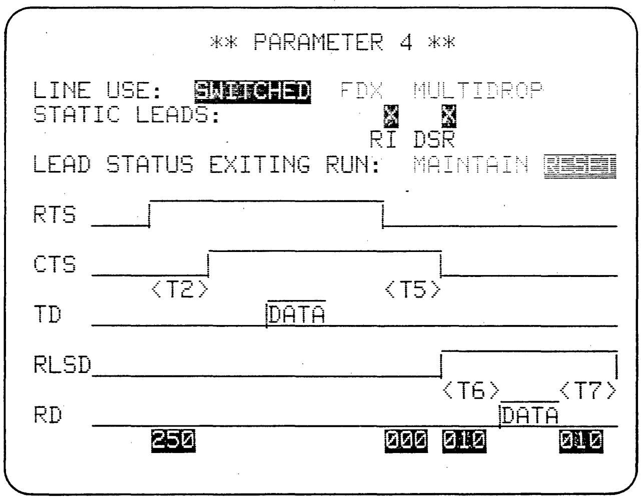


Figure 7.2-1

The seven delay time fields, T1 through T7, are defined as follows:

T1 = Time from trigger true to RTS ON

T2 = RTS ON to CTS ON

T3 = CTS ON to Start Xmit

T4 = End Xmit to RTS OFF

T5 = RTS OFF to CTS OFF

T6 = RLSD ON to Start Xmit

T7 = End Xmit to RLSD OFF

TABLE 7.2-1
PARAMETERS 4 MENU SELECTIONS*

	SWITCHED (HDX)		FDX		MULTIDROP	
SELECTIONS	EM DCE	EM DTE	EM DCE	EM DTE	EM DCE	EM DTE
LEAD						
DTR	--	x	--	x	--	x
DSR	x	--	x	--	x	--
RLSD	--	--	x	--	--	--
RI	x	--	x	--	x	--
RTS	--	--	--	x	--	--
CTS	--	--	x	--	--	--
LEAD STATUS EXITING RUN						
MAINTAIN	x	x	x	x	x	x
RESET	x	x	x	x	x	x
DELAY						
T1	--	x	--	--	--	x
T2	x	--	x	--	x	--
T3	--	x	--	--	--	x
T4	--	x	--	--	--	x
T5	x	--	x	--	x	--
T6	x	--	--	--	x	--
T7	x	--	--	--	x	--

*x means that the selection in the first column is displayed; -- means the selection is unavailable.

The Parameters 4 menu and the Emulate Mode together determine which leads the 4500 turns ON or OFF and when they are turned on or off.

7.2 THE INTERFACE CONTROL MENU: PARAMETERS 4

CAUTION: In order to use the Parameters 4 menu effectively with a live system, you must be thoroughly familiar with the interface characteristics of the system.

On the Parameters 4 menu (Figure 7.2-1), you can set certain of the leads controlled by the 4500 ON or OFF, and select the intervals at which others will be turned on and off. Your Emulate Mode and Line Use selections determine which leads and which delay times appear on the menu. Table 7.2-1 lists the Static Leads and Delay Time selections and shows which are available for each possible combination of Emulate Mode and Line Use.

7.2.1 Line Use

After you have correctly matched the data connection at the rear of the 4500 with the Emulate Mode selection on the Parameters 1 menu, display the Parameters 4 menu and choose one of the three LINE USE selections. These will be discussed in detail later.

7.2.2 Static Leads

Your LINE USE selection together with the Emulate Mode determines which leads will become active when the 4500 enters Run Mode. It also determines which STATIC LEADS you can choose to be ON or OFF. The static leads will be set to the prescribed state when the 4500 enters Run Mode, and will be maintained in that state until the PROGRAM key is pressed: in other words, these leads are not dynamically controlled in Run Mode.

When the entry in a STATIC LEADS data-entry box is DC (Don't Care), the 4500 will maintain the lead at the OFF voltage. A 0 (zero) in the data-entry box also means OFF voltage level. In FDX Mode, there is one case in which the distinction between DC and 0 is significant: this will be discussed later.

Enter a 1 (one) in the box for any lead that you want to turn ON.

7.2.3 Lead Status Exiting Run

(1) RESET. If you select RESET, then each time the 4500 leaves Run Mode, all active leads will be reset to the OFF voltage level and remain that way until the unit enters Run Mode again.

(2) MAINTAIN. If you have selected MAINTAIN, then none of the active static leads will change in voltage level when the unit leaves Run Mode.

7.2.4 Delay Time

Table 7.2-1 shows which delay times you can set for each combination of Emulate Mode and Line Use selection. Delay times are entered in data-entry boxes below the graphic depiction of lead status sequence.

The default delay time for the data-entry boxes are shown in Figures 7.3-1 through 7.3-6. The maximum time that you may enter is 999 milliseconds. When you position the cursor on a delay-time entry field, the 4500 displays the appropriate definition at the bottom of the screen.

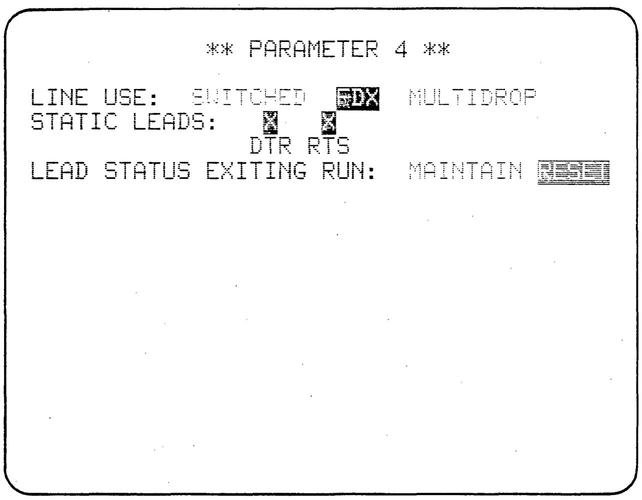


Figure 7.3-1 EM DTE, FDX

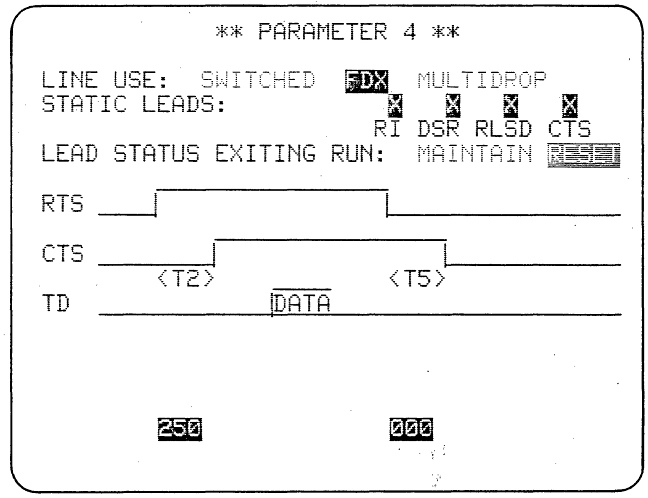


Figure 7.3-2 EM DCE, FDX

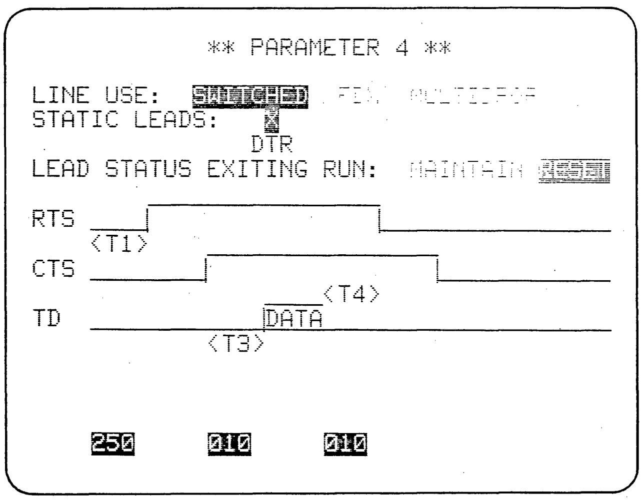


Figure 7.3-3 EM DTE, SWITCHED

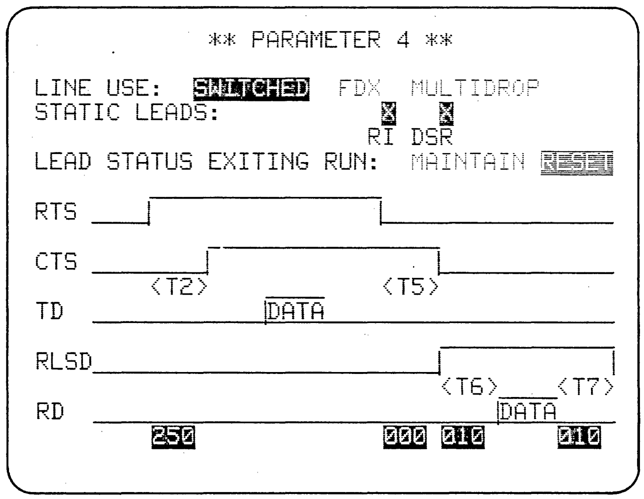


Figure 7.3-4 EM DCE, SWITCHED

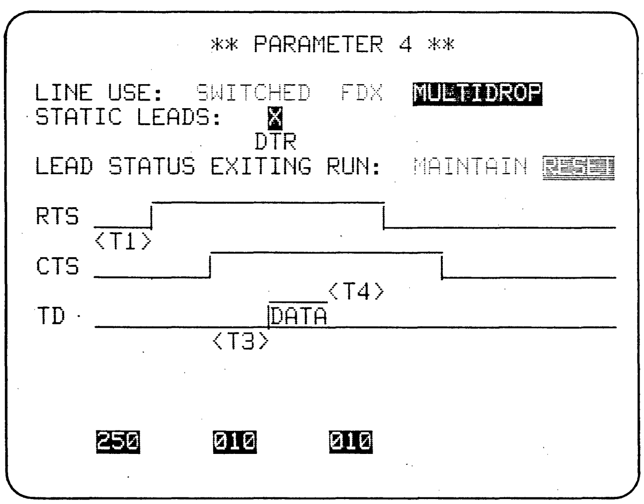


Figure 7.3-5 EM DTE, MULTIDROP

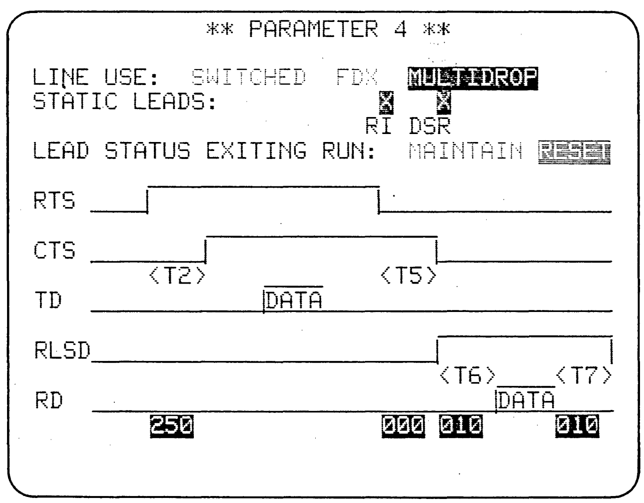


Figure 7.3-6 EM DCE, MULTIDROP

This section explains the differences among the three line use selections: FDX or continuous operation; SWITCHED or half-duplex operation; and MULTIDROP.

7.3 THE THREE LINE USE SELECTIONS: FDX, SWITCHED, AND MULTIDROP

7.3.1 FDX Operation

In FDX (full-duplex or continuous) mode (Figures 7.3-1 and 7.3-2), the active static leads are set to the states assigned them in the Static Leads field. When a trigger Transmit action comes true, the 4500 will transmit data immediately, regardless of the status of any of the interface leads.

EXCEPTION: FDX, EM DCE is the one case in which there is a distinction between Don't Care (DC) and OFF (0) in the Static Leads field: If the entry for CTS in the Static Leads field is DC, then when the terminal turns RTS ON the 4500 will respond with CTS. If you want the 4500 to keep CTS OFF, enter a 0 in the CTS data-entry box; if you want CTS to be continuously ON, enter a 1. Thus if a 0 or 1 is entered in the Static Leads field for CTS, it will not follow RTS after the prescribed delays T2 and T5, but will remain on or off as selected.

For 7E/X.25 and the two SDLC formats, the data leads are also involved in Program Mode: For EM DTE, TD idles with $7E_{16}$ flags; for EM DCE, RD idles with $7E_{16}$ flags.

7.3.2 SWITCHED Operation

(1) EM DTE (Figure 7.3-3). When a trigger comes true to transmit, the 4500 will wait till RLSD is OFF and then start timeout T1. If RLSD is off when the trigger comes true then timeout T1 is started immediately. After T1 milliseconds the 4500 will turn on RTS; it will then wait for CTS. When CTS goes on timeout T3 will start. After T3 milliseconds the 4500 will begin to transmit the message. After the last character has been transmitted timeout T4 will start. After T4 milliseconds the 4500 will turn off RTS and then wait for CTS to go off. At this point the 4500 considers the transmission complete.

(2) EM DCE (Figure 7.3-4). When a trigger comes true to transmit, the 4500 will wait until CTS is off; then turn on RLSD. If CTS is already off, RLSD will be turned on immediately, and timeout T6 will then begin. After T6 milliseconds, the 4500 will begin to transmit the message. After the last character of the message has been transmitted, timeout T7 will start. After T7 milliseconds the 4500 will turn off RLSD. At this point the 4500 considers transmission complete.

The 4500 also monitors RTS. When RTS goes on, timeout T2 starts. After T2 milliseconds the 4500 will turn on CTS; it then waits for RTS to go off. When RTS goes off, timeout T5 starts. After T5 milliseconds the 4500 will turn off CTS.

7.3.3 MULTIDROP Operation

(1) EM DTE (Figure 7.3-5). This mode is the same as switched except that when the trigger comes true, timeout T1 is started immediately. The 4500 will not wait for RLSD to go off before starting timeout T1.

(2) EM DCE (Figure 7.3-6). This mode is the same as switched except that when the trigger comes true the 4500 will immediately turn on RLSD. The 4500 will not wait until it has turned off CTS to turn on RLSD.

The INTERVIEW 4500 has a number of special aids for X.25- and SDLC-type protocols. All readers interested in any of these protocols, including BISYNC-framed X.25, should go through this section. Some readers may then want to read the special discussion of BISYNC framing (Section 9).

8 BIT-ORIENTED X.25-TYPE PROTOCOLS

The X.25-SDLC Training Tape contains three types of data, so you must select the tape blocks that you are going to use.

8.1 THE 4500 X.25-SDLC TRAINING TAPE DATA

8.1.1 Training Tape Content

The 4500 X.25-SDLC Training Tape contains three types of data:

(1) 7E-framed X.25 (Blocks 000 to 070);
(2) BISYNC-framed X.25 (Blocks 080 to 095);
(3) SDLC-SNA (Blocks 150 to 250).

The Training Tape program applies only to the 7E-framed X.25 data. We shall use 7E-framed X.25 as the general case, to familiarize you with the 4500's various special aids for bit-oriented protocols.

Since the training tape program can only monitor the data on Blocks 000 to 070, you will need to rewind the training tape when it reaches Block 070. When the tape has played back past Block 070, no data will be added to the display. Press PROGRAM and then RUN to rewind the tape automatically to Block 000 before playback resumes.

8.1.2 High-Speed Memory

If your unit has the high-speed memory option (RAM), you can use it to play back only the portion of taped data that you want to monitor. Obtain the RAM-Tape Xfer Control menu (Parameters 3) and select TAPE TO RAM, Transfer FROM BLOCK 000 THRU BLOCK 054, STARTING AT BLOCK 000. Press the EXECUTE key. When transfer is complete, select SOURCE RAM on the Parameters 1 menu. You may now play back only the 7E-framed X.25 data without being concerned about running into other types of data.

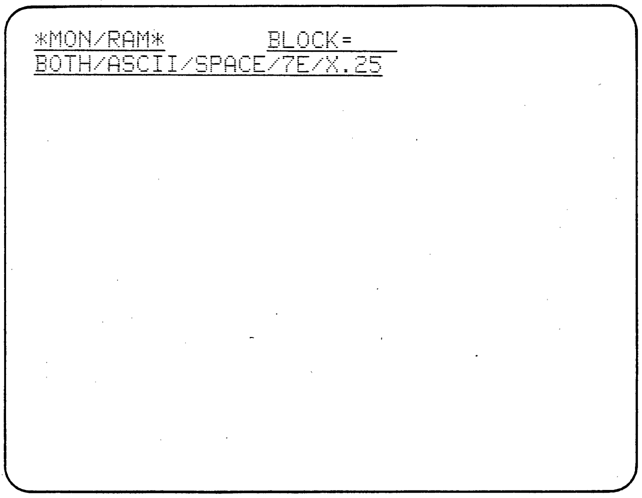


Figure 8.2-1

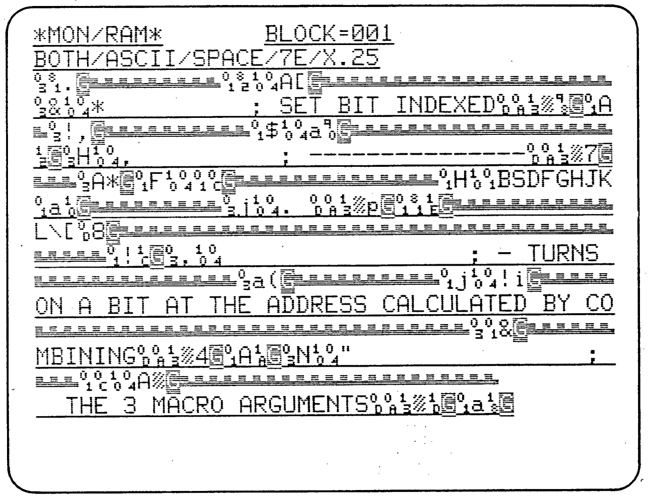


Figure 8.2-2

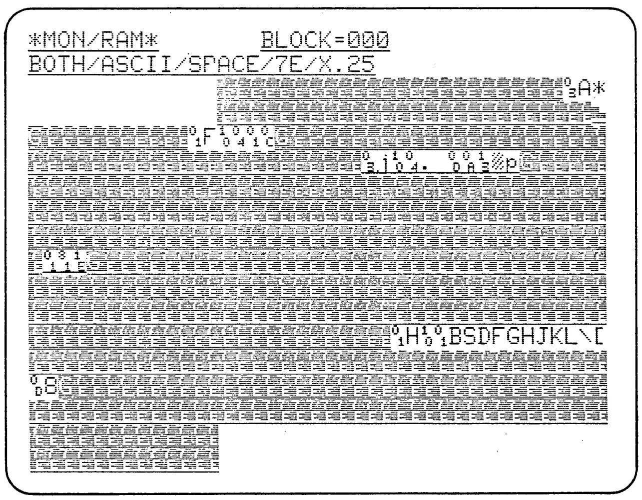


Figure 8.2-3

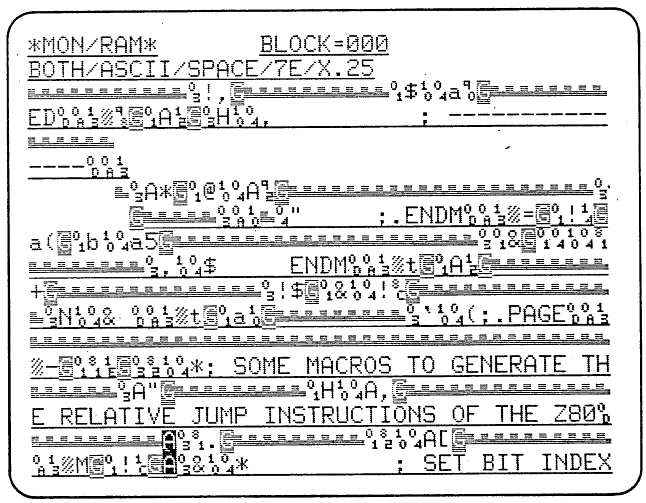


Figure 8.2-4

The training tape program calls for dual-line display, and suppresses idle flag bytes. For X.25 and SDLC data, the 4500 shows aborted frames as well as good and bad BCC's. All protocol characters are automatically displayed in hexadecimal.

8.2 MONITORING X.25 TRAINING TAPE DATA: DATA DISPLAY

Insert the X.25-SDLC Training Tape in your unit and turn on the power. Before data is displayed, the first two lines (Figure 8.2-1) tell us that the 4500 is set up to MONitor data from the TAPE; it is looking for BOTH TD and RD data, in ASCII code with SPACE parity bit in 7E/X.25 format. The training tape program will freeze the display at Block 005.

As Figure 8.2-2 shows, the display is dual line (chosen on the CRT Control menu) to bring out the time correlation of the full-duplex data. DTE data is always displayed on the first line; DCE data, on the second line. As in single-line display, DCE data is underlined. To maintain time correlation between DTE and DCE data, idle time on either side of the line is represented with L-shaped fill symbols.

The idle flag bytes between frames are suppressed (compare Figure 8.2-2 with Figure 8.2-3). This accounts for the pauses in writing the display.

All control characters for the selected code--in this case, ASCII--are displayed in hexadecimal. For BSC/X.25, 7E/X.25, SDLC, and SDLC/NRZI, this is true whenever the 4500 first enters Run Mode. To see the control character mnemonics, press CONTROL plus the HEX key.

For 7E/X.25, Block Check is always ON in the unit and the received BLOCK CHECK selection is absent from the Parameters menu (this applies to the SDLC formats as well). On the data display the second frame check byte (FCS) is replaced with the indicator letter G for Good BCC or B for Bad BCC. Aborted frames are also identified by a bright reverse-image A (Figure 8.2-4).

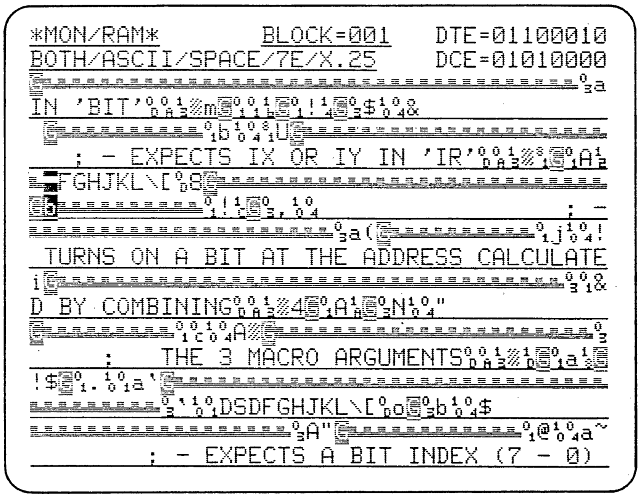


Figure 8.3-1

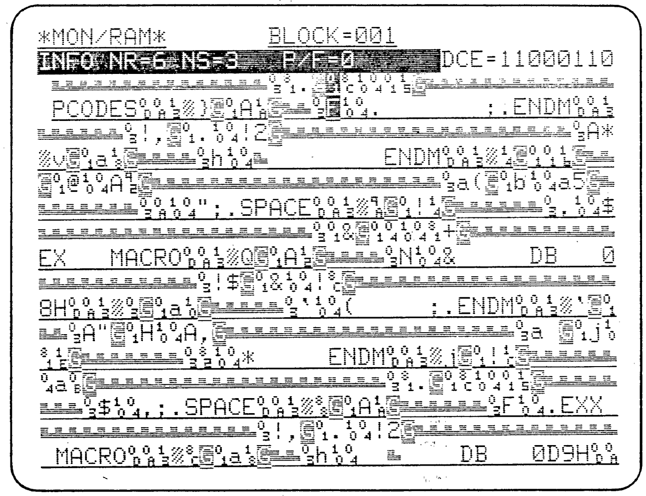


Figure 8.3-2

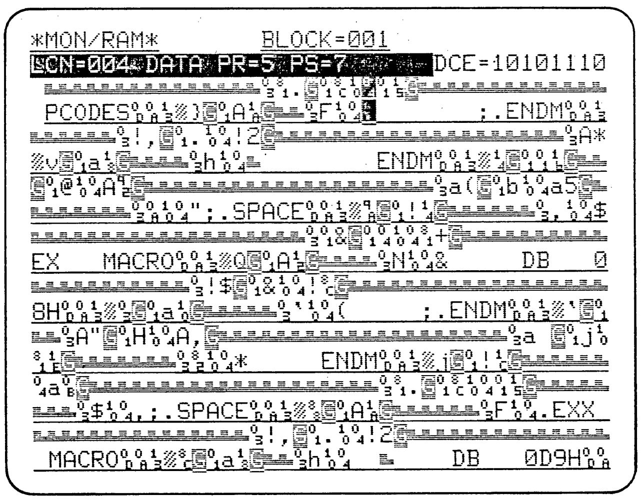


Figure 8.3-3

When X.25 or SDLC data is manually frozen, the 4500 can find all frame and packet control bytes in the display buffer and show you a mnemonic expansion of each. You can also choose characters for frame and packet expansion manually.

8.3 X.25 DATA: FRAME AND PACKET LOCATORS

8.3.1 Binary Cursor Character Expansion

FREEZE the X.25 Training Tape data display before Block 005. Because of the dual-line display, there are binary expansions for two cursor characters at the upper right corner of the display (see Figure 8.3-1). Remember that the low-order bit, the first serial bit, is always the rightmost bit on the 4500 screen. This permits you to read the hexadecimal equivalent directly from the bit pattern. This is an important point, as there is much inconsistency about the order in which bit patterns are printed in the literature for bit-oriented protocols.

8.3.2 Automatic Frame and Packet Locators

The cursor can be tabbed through the display to automatically locate each frame-control byte or packet-type octet. When the cursor comes to rest on one of these bytes, a bit analysis is performed on it and the 4500 displays the frame-control or packet-type acronyms and other associated protocol information.

To obtain expansions of frame-control bytes:

(1) Operate the B key to position the cursor at the beginning of the display buffer.

(2) Press the F key to locate the first frame-control byte. Figure 8.3-2 shows a typical display with a frame-control byte expanded on Line 2. The expansion includes frame type, NR and (or) NS, and P or F bit value.

Notice that although the cursor points to both a DTE and a DCE character simultaneously, you can identify which character has been expanded by which binary breakdown (DTE or DCE) appears at the upper right-hand corner of the screen.

(3) Each time you operate the F key, the cursor will move to the next frame-control byte. When the cursor is at the bottom of the CRT the next line will be scrolled onto the CRT from the display buffer. When the cursor reaches the end of the buffer, CONTROL BYTE NOT FOUND will be displayed.

If 7E/X.25 or BSC/X.25 has been selected on the Parameters 1 menu, the 4500 will also expand packet-type octets:

(1) Press the B key.

(2) Operate the P key to locate the first packet-type octet. Figure 8.3-3 is typical.

Octets 1 and 2 as well as the packet-type octet (Octet 3) are expanded on Line 2. The logical channel number is displayed as a hexadecimal number, and if the Q, D, and M bits are 1 the appropriate characters are displayed.

(3) You can tab through the buffer with the P key until CONTROL BYTE NOT FOUND is displayed.

Alternately pressing F and P will move the cursor back and forth between the frame-control byte and packet-type octet within one frame until one of the two keys is pressed twice in succession. If you should want to see a previous expansion again, remember that the cursor arrows will move the cursor back or up through the display to a point from which you can use the F or P key.

NOTE: For the automatic locators to work correctly, no CRT enhancements should be programmed, and all leading bytes in a frame must be displayed.

NOTE: This feature cannot be used in High-Speed Monitor Mode.

8.3.3 Manual Frame and Packet Expansions

As you will see later, some CRT control programs may prevent valid operation of the automatic locators by excluding some data from the CRT buffer. However, you may obtain a mnemonic expansion for any character on the screen by (1) positioning the cursor at the desired byte and then (2) pressing CONTROL plus F or CONTROL plus P. There is no difference in the mnemonic displays for automatic and manual operation.

NOTE: In this case, the logic cannot distinguish between a genuine frame-control byte or a packet-type octet and the numerous invalid possibilities.

Table 8.4-1
Frame-Control Mnemonics

Bit Pattern 8 7 6 5 4 3 2 1	SDLC or SDLC NRZI Mnemonic	SDLC or SDLC NRZI Definition	7E/X.25 or BSC/X.25 Mnemonic	7E/X.25 or BSC/X.25 Definition
N(R) P N(S) 0	INFO	INFOrmation	INFO	INFOrmation
N(R) P/F 0 0 0 1	RR	Receiver Ready	RR	Receiver Ready
N(R) P/F 0 1 0 1	RNR	Receiver Not Ready	RNR	Receiver Not Ready
N(R) P/F 1 0 0 1	REJ	REJect	REJ	REJect
N(R) P/F 1 1 0 1	SREJ	Selective REJect	SREJ	Selective REJect
0 0 0 P/F 0 0 1 1	NSI	Non-Sequenced Information	---	---
0 0 0 P/F 0 1 1 1	SIM/RQI	Set Initialization Mode/ReQuest Initialization	---	---
0 0 0 F 1 1 1 1	SARM/ROL	Set Asynchronous Response Mode/ Request OnLine	DM/SARM	Disconnect Mode/ Set Asynchronous Response Mode
0 0 1 P/F 0 0 1 1	NSP	Non-Sequenced Poll	---	---
0 0 1 P 1 1 1 1	---	---	SABM	Set Asynchronous Balance Mode
0 1 0 P 0 0 1 1	DISC/RQD	DISConnect/ReQuest Disconnect	DISC	DISConnect
0 1 0 P/F 0 1 1 1	RGA	Remote Go-Ahead	---	---
0 1 1 F 0 0 1 1	NSA	Non-Sequenced Acknowledge	UA	Unnumbered Acknowledge
1 0 0 F 0 1 1 1	CMDR	CoMmanD Reject	FRMR	FRaMe Reject
1 0 0 F 0 0 1 1	SNRM	Set Normal Response Mode	---	---
1 0 1 P/F 1 1 1 1	XID	eXchange station ID	---	---
1 1 0 P/F 0 1 1 1	CFGR	ConFIGuRe	---	---
1 1 1 P/F 0 0 1 1	TEST	link TEST	---	---
1 1 1 F 1 1 1 1	BCN	BeaCoN	---	---
All other patterns		UNKNOWN		UNKNOWN

The 4500's frame and packet locators display the mnemonic expansions shown in the tables.

8.4 THE 4500'S FRAME AND PACKET MNEMONIC SET

The 4500 displays frame control-byte mnemonics for X.25, including LAP B, and X.75 (when 7E/X.25 or BSC/X.25 has been selected on Parameters 1) or SDLC (for SDLC or SDLC/NRZI Parameters 1 selection). These are all listed in Table 8.4-1.

Where one bit pattern is used in two ways, both mnemonics are displayed by the 4500.

The packet mnemonic set (Table 8.4-2) applies only to X.25 and X.75, and is available only for the two X.25 Parameters 1 selections.

Table 8.4-2
Packet-Type Mnemonics

Octet 3								Display		
8	7	6	5	4	3	2	1	(XXX=HEX 000-FFF)	Mnemonic	Definition
0	0	0	0	1	0	1	1	LCN = XXX	CALL	CALL
0	0	0	0	1	1	1	1	LCN = XXX	CALL ACC	CALL ACCept
0	0	0	1	0	0	1	1	LCN = XXX	CLEAR	CLEAR
0	0	0	1	0	1	1	1	LCN = XXX	CLEAR C	CLEAR Confirm
P(R)			M	P(S)			0	LCN = XXX	DATA	DATA
1	1	1	1	0	0	0	1	LCN = XXX	DIAG	DIAGnostic
0	0	1	0	0	0	1	1	LCN = XXX	INT	INTerrupt
0	0	1	0	0	1	1	1	LCN = XXX	INT CONF	INTerrupt CONFirm
P(R)			0	0	0	0	1	LCN = XXX	RR	Receiver Ready
P(R)			0	0	1	0	1	LCN = XXX	RNR	Receiver Not Ready
P(R)			0	1	0	0	1	LCN = XXX	REJ	REJect
0	0	0	1	1	0	1	1	LCN = XXX	RESET	RESET
0	0	0	1	1	1	1	1	LCN = XXX	RESET C	RESET Confirm
1	1	1	1	1	0	1	1	LCN = XXX	RSTRT	ReSTaRT
1	1	1	1	1	1	1	1	LCN = XXX	RSTRT C	ReSTaRT Confirm
P(R)			0	1	1	0	1	LCN = XXX	SREJ	Selective REJect
All other									UNKNOWN	

```
            ** PARAMETER 1 **

TEST ID:
MODE   :  MON   EM DTE   EM DCE   H-SPD MON
SOURCE :  LINE   TAPE   RAM

MON    :  BOTH DTE DCE
CODE   :  EBCDIC    ASCII    EBCD   XS-3
          IPARS  REV EBCD  SELECTRIC HEX


FORMAT :  SYNC   BSC/X.25   7E/X.25   SDLC
          SDLC/NRZI   ASYNC
   SYNC CHARS:      AUTOSYNC:  OFF   ON
   OUT SYNC   :  OFF  ON     CHAR:     #:1
BLK CHK:  OFF  ON
I/F    :  EIA   MIL
CLOCK  :  EXT   INT    SPEED:    2400
```

Figure 8.5-1

```
            ** PARAMETER 1 **

TEST ID:
MODE   :  MON   EM DTE   EM DCE   H-SPD MON
SOURCE :  LINE   TAPE   RAM
        START AT:  BLOCK 000   CONT
MON    :  BOTH DTE DCE
CODE   :  EBCDIC    ASCII    EBCD   XS-3
          IPARS  REV EBCD  SELECTRIC HEX


FORMAT :  SYNC   BSC/X.25   7E/X.25   SDLC
          SDLC/NRZI   ASYNC
   SYNC CHARS:      AUTOSYNC:  OFF   ON
   OUT SYNC   :  OFF  ON     CHAR:     #:1
BLK CHK:  OFF  ON
I/F    :  EIA   MIL
                       SPEED:    2400
```

Figure 8.5-2

```
            ** PARAMETER 1 **

TEST ID:
MODE   :  MON   EM DTE   EM DCE   H-SPD MON
SOURCE :  LINE   TAPE   RAM
        START AT:  BLOCK 000   CONT
MON    :  BOTH DTE DCE
CODE   :  EBCDIC    ASCII    EBCD   XS-3
          IPARS  REV EBCD  SELECTRIC HEX
   BITS   :8  7
   PARITY:EVEN   ODD   SPACE   MARK   NONE
FORMAT :  SYNC   BSC/X.25   7E/X.25   SDLC
          SDLC/NRZI   ASYNC
   SYNC CHARS:      AUTOSYNC:  OFF   ON
   OUT SYNC   :  OFF  ON     CHAR:     #:1
BLK CHK:  OFF  ON  TYPE: CRC16  EVLRC  ODLRC
I/F    :  EIA   MIL
                       SPEED:    2400
```

Figure 8.5-3

```
            ** PARAMETER 1 **

TEST ID:
MODE   :  MON   EM DTE   EM DCE   H-SPD MON
SOURCE :  LINE   TAPE   RAM
        START AT:  BLOCK 000   CONT
MON    :  BOTH DTE DCE
CODE   :  EBCDIC    ASCII    EBCD   XS-3
          IPARS  REV EBCD  SELECTRIC HEX
   BITS   :8  7
   PARITY:EVEN   ODD   SPACE   MARK   NONE
FORMAT :  SYNC   BSC/X.25   7E/X.25   SDLC
          SDLC/NRZI   ASYNC



I/F    :  EIA   MIL
                       SPEED:    2400
```

Figure 8.5-4

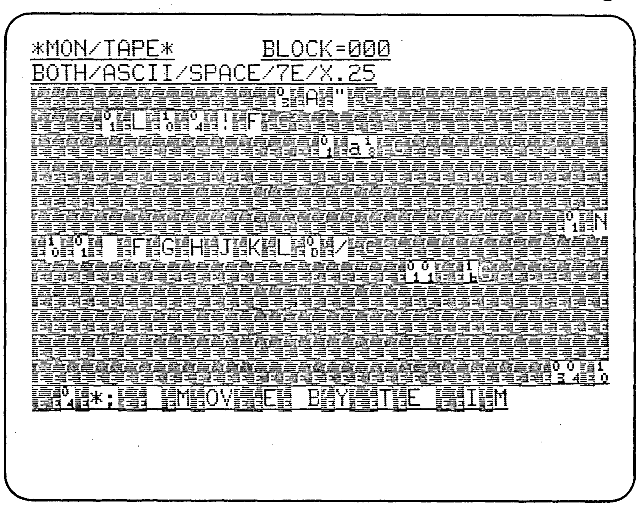


Figure 8.5-5

Just as you did for BISYNC data, you can select all the parameters necessary to monitor X.25 on the Parameters 1 menu. The menu will be altered as you go along to offer only pertinent selections.

8.5 SELECTING X.25 PARAMETERS

To give you experience in programming the 4500, we shall not use the training tape program here, but you will need the tape for a data source. Power up the 4500 without a tape; then install the X.25-SDLC Training Tape. Display the Parameters 1 menu.

Because the unit has just been powered up without a tape, the default BISYNC program will be in the unit (Figure 8.5-1).

For MODE, accept the default selection, MONitor. In the SOURCE field, choose TAPE (or RAM, if you intend to transfer the training tape data to RAM). This automatically brings up a START field on the next line. Leave the default entry, BLOCK 000, as this is where the X.25 data begins.

In the CODE field, enter the data code. In this case, it is ASCII, 7 bits (which is the default selection), SPACE parity. When you select ASCII, two new fields appear, BITS and PARITY (compare Figure 8.5-2 with Figure 8.5-3). The default selection in the BITS field is 7, so you can tab directly to the PARITY field. In the training tape data, the eighth bit (parity) is space. (This is the case with most DEC equipment, for example.) In the PARITY field, therefore, select SPACE.

Now go to the FORMAT field. Select 7E/X.25 for the X.25 data on the training tape. The remaining Format lines go away because they are not applicable to monitoring 7E-framed protocols. (Compare Figures 8.5-3 and 8.5-4.) Your Parameters 1 menu should now appear as in Figure 8.5-4. You can monitor the X.25 data on the training tape without any further selections. (see Figure 8.5-5).

```
         ** PARAMETER 2 **

             CRT CONTROL
DISPLAY MODE: SINGLE DUAL
SUPPRESS    :
ENHANCE     : CHAR  PARITY
            :
```

Figure 8.6-1

```
         ** PARAMETER 2 **

             CRT CONTROL
DISPLAY MODE: SINGLE DUAL FRAME PACKET
SUPPRESS    :
ENHANCE     : CHAR  PARITY
            :
```

Figure 8.6-2

```
         ** PARAMETER 2 **

             CRT CONTROL
DISPLAY MODE: SINGLE DUAL FRAME PACKET


                1=ENH  X=NORM  0=SUPP
TYPE SELECT:   X    X   X    X    X
           :  INFO RR RNR REJ NSEQ
ADDR       :  ALL  ONLY  SUPPRESS
```

Figure 8.6-3

```
*MON/TAPE*        BLOCK=001
BOTH/ASCII/SPACE/7E/X.25/FRAME
            DTE              |            DCE
ADDR TYPE  R S P/F           | ADDR TYPE  R S P/F
 01 *INFO  6 3  0            |  03  INFO  3 5  0
 01  INFO  6 4  0            |  01 *RR    4    0
 03  RR    7    0            |  01 *RR    5    0
 01 *INFO  7 5  0            |  03  INFO  5 6  0
 03  RR    0    0            |  01 *RR    6    0
 01 *INFO  0 6  0            |  03  INFO  6 7  0
 03  RR    1    0            |  01 *RR    7    0
 01 *INFO  1 7  0            |  03  INFO  7 0  0
 03 *RR    2    0            |
 01 *INFO  2 0  0            |  03  INFO  7 1  0
                             |  01 *RR    0    0
 03  RR    3    0            |  01 *RR    1    0
 01 *INFO  3 1  0            |  03  INFO  1 2  0
                             |  01 *RR    2    0
```

Figure 8.6-4

With one selection on the Parameters 2 menu, you can obtain a sequential display of frame protocol menemonics for data being played back from tape or RAM.

8.6 FRAME PROTOCOL MNEMONIC DISPLAY

8.6.1 Interpreting the Frame Mnemonic Display

Display the Parameters 2 menu. When you selected 7E/X.25 on the Parameters 1 menu, two new selections became available on the Parameters 2 menu, namely, FRAME and PACKET (compare Figures 8.6-1 and 8.6-2). Move the cursor to FRAME. Notice that several new lines appear (Figure 8.6-3). We shall return to these later.

Press RUN. The Run Mode display (see Figure 8.6-4) shows the frame protocol mnemonics in two columns, DTE on the left, and DCE on the right. As new frames are received in the display buffer from the Capture Memory, the display scrolls up, so the oldest received frames are at the top of the screen. If multiple frames are received on one side of the line, then spaces are inserted on the other side to maintain time correlation between TD and RD. If two frames are received at about the same time they are displayed on the same line. An asterisk precedes the control-type mnemonic of the frame that was received first.

The address, control type, NR and NS counts, and P/F bit status are displayed. Good, Bad, and Aborted frames are indicated by reverse-image G, B, and A just as on the data display. The mnemonic set is the same one given in Section 8.4.

Although the display appears to be real time up to 9600 bps, it is not designed to be used on line.

8.6.2 Using the Cursor

Vary the playback speed using the Up and Down cursor arrows in the same way as for data display. Then freeze the display and scroll through the buffer using the B, E, and cursor keys.

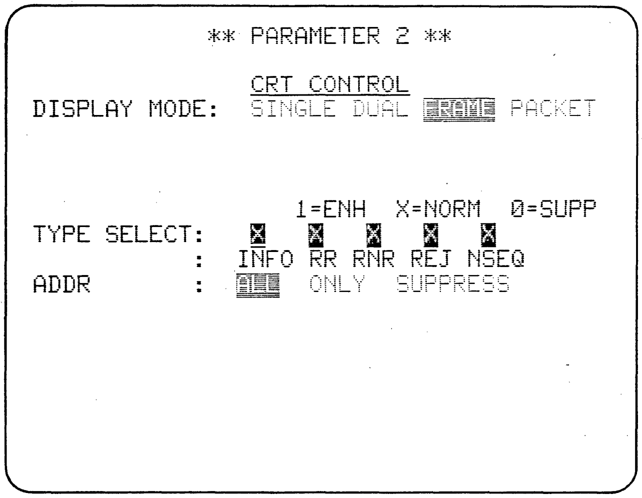


Figure 8.7-1

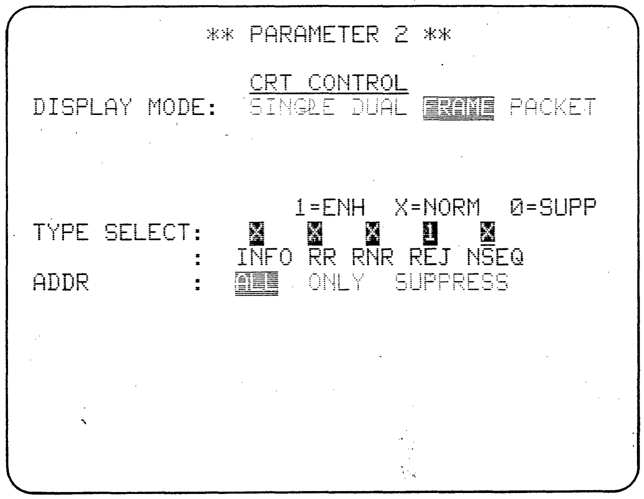


Figure 8.7-2

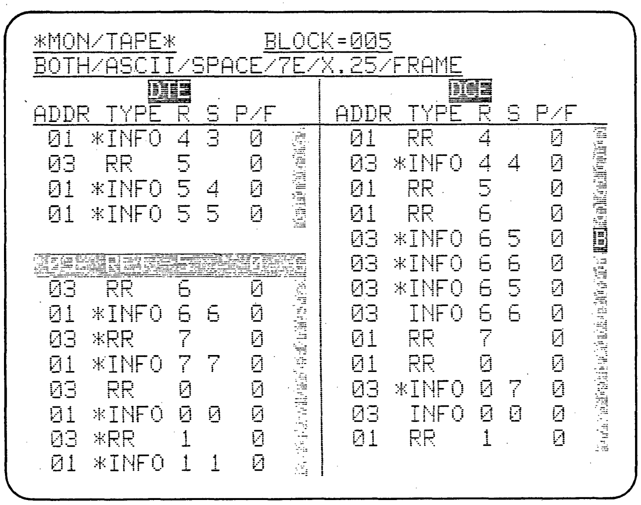


Figure 8.7-3

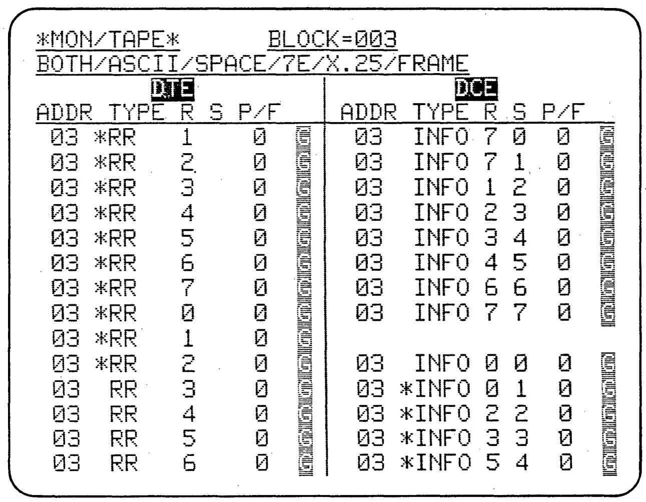


Figure 8.7-4

On the Frame protocol mnemonics display, you may selectively enhance or suppress any of five control frame types, and you may selectively display or suppress DCE and DTE traffic to specific addresses.

8.7 SELECTIVE FRAME PROTOCOL DISPLAY

Obtain the Parameters 2 display again and tab to the TYPE SELECT field (Figure 8.7-1). This is a data-entry field that appears only when FRAME or PACKET has been chosen. The default condition is normal (X) video display of the five selections, INFO, RR, RNR, REJ, and NSEQ. If you enter 1's for any of the frame types, your selections will be displayed in low-intensity reverse image. If you enter 0's for any frame types, they will be suppressed from the display.

Enter a 1 for REJ (Figure 8.7-2) and return to Run Mode. Around Block 004, you will easily find a REJect frame (see Figure 8.7-3) in low-intensity reverse image.

Return to the Parameters 2 menu. On the training tape, there are frames for two addresses, 03_{16} and 01_{16}. It will be much easier to follow the NS and NR count sequence if we look at only one address at a time.

So, tab to the ADDR line and select ONLY. Underneath it two new data-entry fields appear, DTE and DCE. An address must be entered in each of these fields: where there is no entry the selection will default to zero. Enter 03 in each field. Do not use the HEX key here. Now look at the frame mnemonics display (Figure 8.7-4).

When FRAME or PACKET has been selected for display mode on the Parameters 2 menu, no trigger CRT enhancements except Clear CRT and CRT Freeze should be programmed.

MON/TAPE BLOCK=002
BOTH/ASCII/SPACE/7E/X.25/PACKET

DTE LCN	TYPE	R	S	QDM	DCE LCN	TYPE	R	S	QDM
001	*DATA	2	1	G					
004	*RR	1		G	004	DATA	5	0	G
004	*RR	2		G	004	DATA	5	1	G
001	*RR	3		G	001	DATA	2	2	G
004	*RR	3		G	004	DATA	5	2	G
004	*RR	4		G	004	DATA	5	3	G
004	*RR	5		G	004	DATA	5	4	G
004	*RR	6		G	004	DATA	5	5	G
004	RR	7		G	004	*DATA	5	6	G
001	*DATA	3	2	G					
004	*RR	0		G	004	DATA	5	7	G
004	*RR	1		G	004	DATA	5	0	G
004	*RR	2		G	004	DATA	5	1	G
001	*RR	4		G	001	DATA	3	3	G

Figure 8.8-1

MON/TAPE BLOCK=047
BOTH/ASCII/SPACE/7E/X.25/PACKET

DTE LCN	TYPE	R	S	QDM	DCE LCN	TYPE	R	S	QDM
					004	*DATA	5	5	G
004	RR	7		G	004	*DATA	5	6	G
004	RR	0		G	004	*DATA	5	7	G
004	*RR	1		G	004	DATA	5	0	G
004	*RR	2		G	004	DATA	5	1	G
004	*RR	3		G	004	DATA	5	2	G
004	*RR	4		G	004	DATA	5	3	G
001	*CLEAR	$^{0}_{0}{}^{D}_{b}$		G	001	CLEAR	C		G
004	*RR	5		G	004	DATA	5	4	G
004	*RR	6		G	004	DATA	5	5	G
004	*RR	7		G	004	DATA	5	6	G
004	*RR	0		G	004	DATA	5	7	G
004	*RR	1		G	004	DATA	5	0	G
004	*RR	2		G	004	DATA	5	1	G

Figure 8.8-2

EM DTE/RAM BLOCK=015
BOTH/ASCII/ODD/7E/X.25/PACKET

DTE LCN	TYPE	R	S	QDM	DCE LCN	TYPE	R	S	QDM
001	RR	$^{7}_{1}$		G	001	*DATA	$^{0}_{2}$	$^{7}_{0}$	G
001	RR	$^{7}_{2}$		G	001	*DATA	$^{0}_{2}$	$^{7}_{1}$	G
001	RR	$^{7}_{3}$		G	001	*DATA	$^{0}_{2}$	$^{7}_{2}$	G
001	RR	$^{7}_{4}$		G	001	*DATA	$^{0}_{2}$	$^{7}_{3}$	G
001	RR	$^{7}_{5}$		G	001	*DATA	$^{0}_{2}$	$^{7}_{4}$	G
001	RR	$^{7}_{6}$		G	001	*DATA	$^{0}_{2}$	$^{7}_{5}$	G
001	RR	$^{7}_{7}$		G	001	*DATA	$^{0}_{2}$	$^{7}_{6}$	G
001	RR	$^{7}_{8}$		G	001	*DATA	$^{0}_{2}$	$^{7}_{7}$	G
001	RR	$^{7}_{9}$		G	001	*DATA	$^{0}_{2}$	$^{7}_{8}$	G
001	RR	$^{7}_{A}$		G	001	*DATA	$^{0}_{2}$	$^{7}_{9}$	G
001	RR	$^{7}_{B}$		G	001	*DATA	$^{0}_{2}$	$^{7}_{A}$	G
001	RR	$^{7}_{C}$		G	001	*DATA	$^{0}_{2}$	$^{7}_{B}$	G
001	RR	$^{7}_{D}$		G	001	*DATA	$^{0}_{2}$	$^{7}_{C}$	G
001	RR	$^{7}_{E}$		G	001	*DATA	$^{0}_{2}$	$^{7}_{D}$	G

Figure 8.8-3

```
             ** PARAMETER 2 **

                 CRT CONTROL
DISPLAY MODE:    SINGLE DUAL FRAME PACKET


                   1=ENH  X=NORM  0=SUPP
TYPE SELECT:     X    X   X   X   X
            :    DATA RR  RNR REJ OTHER
LCN         :    ALL   ONLY  SUPPRESS
```

Figure 8.8-4

```
             ** PARAMETER 2 **

                 CRT CONTROL
DISPLAY MODE:    SINGLE DUAL FRAME PACKET


                   1=ENH  X=NORM  0=SUPP
TYPE SELECT:     X    X   X   X   X
            :    DATA RR  RNR REJ OTHER
LCN         :    ALL   ONLY  SUPPRESS
                 DTE: 001   DCE: 001
```

Figure 8.8-5

A sequential display of packet-type mnemonics may also be selected on the Parameters 2 menu. You can enhance or suppress any of five packet types, and selectively display or suppress DCE and DTE traffic on specific logical channels.

8.8 PACKET PROTOCOL MNEMONIC DISPLAY

8.8.1 Interpreting the Packet Mnemonic Display

Return to the Parameters 2 menu. Restore the TYPE SELECT and ADDR fields to default condition by pressing CONTROL plus CLEAR FIELD. Select PACKET. The Run Mode display should appear as in Figure 8.8-1. The Logical Channel Number (LCN), packet type, and PR and PS counts are displayed. Q, D, and M bit status are displayed when they are ON (bit value = 1).

As for the FRAME display Good, Bad, and Aborted blocks are identified.

In some nonsequenced packet types there are additional bytes of interest. In these cases, since there are no PR or PS counts, the space reserved for PR and PS is used to display the additional causing characters in hexadecimal. For CALL and INTERRUPT packets, one additional byte is displayed (Octet 4), and for CLEAR, RESET, RESTART, and DIAGNOSTIC packets, two extra bytes (Octets 4 and 5) are shown (see Figure 8.8-2, for example). Figure 8.8-3 shows a display for modulo 128.

8.8.2 Selective Packet Mnemonic Display

The Packet TYPE SELECT and LCN fields are similar to those for FRAME (see Figure 8.8-4). The choices are DATA, RR, RNR, REJ, and OTHER.

In the LCN field, the LCNs should be entered as three-digit hexadecimal numbers (Figure 8.8-5). As for FRAME addresses, do not use the HEX key.

The Packet display is available only for 7E/X.25 and BSC/X.25. The Packet mnemonics that may be displayed are the same as for the packet locator.

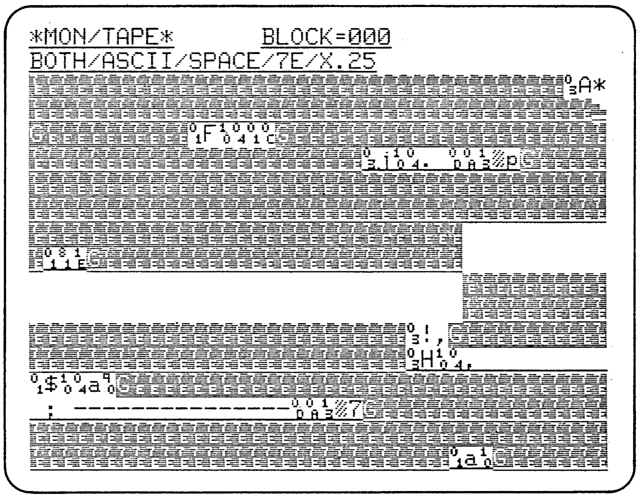


Figure 8.9-1

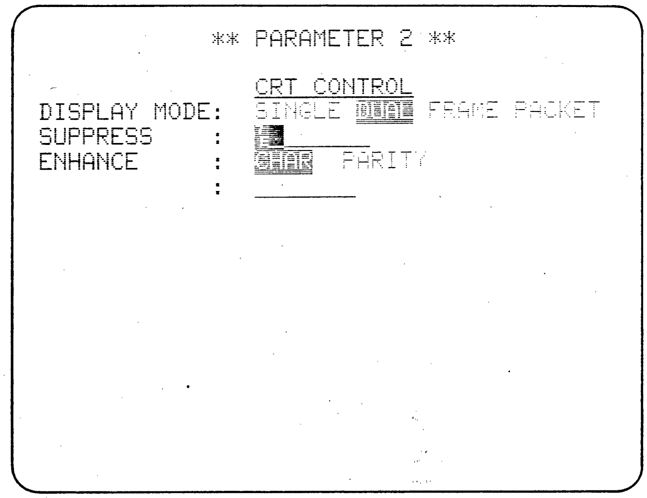


Figure 8.9-2

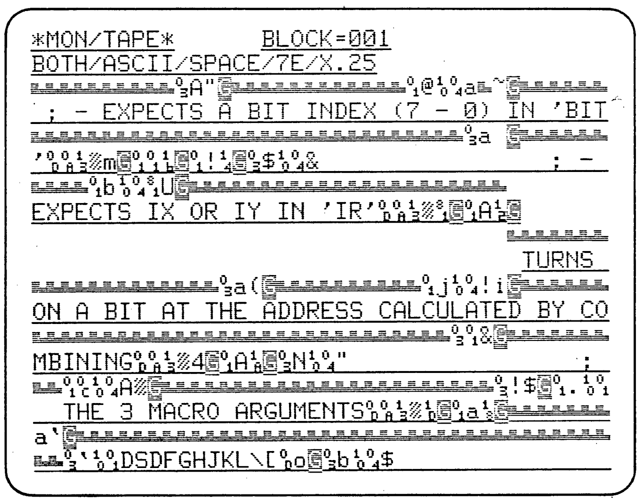


Figure 8.9-3

All idle Flags can be suppressed from the data display without affecting transparent data 7E's.

8.9 SUPPRESSING IDLE FLAGS

On the Parameters 2 menu, select DUAL-line display. Press RUN. Notice that idle 7E Flags take up most of the display space (Figure 8.9-1). We shall SUPPRESS them, as was done in the Training Tape program. Return to the CRT Control menu and move the cursor to the SUPPRESS field.

To suppress idle Flags, press CONTROL plus the FLAG key simultaneously. This enters a low-intensity 7E in the SUPPRESS field (Figure 8.9-2). A low-intensity entry in a data-entry field always means that the symbol represents something other than itself. In this case, it means that a Flag is intended, and the logic will treat it as a Flag, rather than a data 7E.

Monitor the taped data and notice how much more compact the display is with the idle Flags suppressed (Figure 8.9-3). You can still distinguish frames by the reverse-image G, B, and A symbols.

Verify that when you use the key sequence HEX, 7, E, the data entry will not be low-intensity and the 4500 will not suppress Flags.

```
          ** TRIGGER **   0   F
PRESS TRIG #(0-F) THEN C(COND) OR A(ACT)
#0            SFEM
                           C1I
#1            SFEM           L
                           C2I
#2            S04            L
                           C5I
#3 F0XXXXXXXSM
6  FXXXXXXX1X5 CX0XXXX     C6I
#4            SFE
                           C4I
#5            SFEM000
 A            X5           C3I  CM
#6            SFEM000
 A            X5      T1S  C3I  CM
#7
```

Figure 8.10-1

```
          ** TRIGGER **   8   F
PRESS TRIG #(0-F) THEN C(COND) OR A(ACT)
#8 FXXXXXXX1S0
                          C7IBI
#9 F0XXXXXX1SFE
A  FXXXXXXX0    CX1XXXX   C7R
#A            BDBCC
B  F1XXXXXXX          T1R
#B
#C
#D
#E
#F
```

Figure 8.10-2

```
      ** TRIGGER 0 CONDITIONS **

    C1I
MON:  NEITHER DTE DCE     LINK:  NO YES
 FOR: STRG 1 OF PARER GDBCC BDBCC ABORT
FEM                M1:XXXXXX11

MON:  EIA  NO  YES

MON:  FLAGS  NO  YES

MON:  TIMEOUT                NO  YES

MON:  OUTSTANDING FRAME      NO  YES
MON:  NS REC NOT = NS EXP    NO  YES
```

Figure 8.10-3

```
      ** TRIGGER 1 CONDITIONS **

    C2I
MON:  NEITHER DTE DCE     LINK:  NO YES
 FOR: STRG 1 OF PARER GDBCC BDBCC ABORT
FEM                M1:XXXXXXX0

MON:  EIA  NO  YES

MON:  FLAGS  NO  YES

MON:  TIMEOUT                NO  YES

MON:  OUTSTANDING FRAME      NO  YES
MON:  NS REC NOT = NS EXP    NO  YES
```

Figure 8.10-4

```
      ** TRIGGER 2 CONDITIONS **

    C5I
MON:  NEITHER DTE DCE     LINK:  NO YES
 FOR: STRG 1 OF PARER GDBCC BDBCC ABORT
04

MON:  EIA  NO  YES

MON:  FLAGS  NO  YES

MON:  TIMEOUT                NO  YES

MON:  OUTSTANDING FRAME      NO  YES
MON:  NS REC NOT = NS EXP    NO  YES
```

Figure 8.10-5

```
      ** TRIGGER 3 CONDITIONS **
CRT:X0XXXX       FLG:XXXXXXX1
    C6I    XMT:8         GD          ALT
MON:  NEITHER DTE DCE     LINK:  NO YES
 FOR: STRG 1 OF PARER GDBCC BDBCC ABORT
M                  M1:XXXXXXX0

MON:  EIA  NO  YES

MON:  FLAGS  NO  YES      87654321
                          0XXXXXXX
MON:  TIMEOUT                NO  YES

MON:  OUTSTANDING FRAME      NO  YES
MON:  NS REC NOT = NS EXP    NO  YES
```

Figure 8.10-6

The program on the training tape monitors the X.25 data starting at Block 000. It is intended not as a model program, but rather to give examples of some techniques that will be useful for monitoring bit-oriented protocols.

8.10 THE X.25-SDLC TRAINING TAPE PROGRAM

The training program on the X.25-SDLC Training Tape monitors the 7E-framed X.25 data, which runs through Block 070 of the tape. This program illustrates the following techniques:

- Using Bit Masks to find specific categories of frame-control and packet-type bytes.
- Linking triggers to (1) identify specific packets, and (2) take a series of actions stepwise as successive bytes are received in a frame.
- Displaying a Prompt and stopping the program upon receipt of certain data to ensure that you don't miss the readings.
- Controlling the Capture Memory during replay to ensure that you don't miss any of the data stream while you are inspecting specific portions of it.
- Using alternate banks of triggers to divide a program into modules. The low bank analyzes frame types and transfers the program to the upper bank for analysis of data packets.
- Making error recovery measurements on a packet network.

The Program Summary is shown in Figures 8.10-1 and 8.10-2. Please study Sections 8.10.1 through 8.10.3 before you load and run the program.

8.10.1 Frame Analysis

Trigger 0: Trigger 0 (see Figure 8.10-3) identifies DCE nonsequenced frames by the string 7E, Not Equal 7E, Bit Mask (XXXX XX11); that is, a leading flag, a character not equal to a flag (the address byte), and the frame-control byte with Bits 1 and 2 equal to 1. Thus, Counter 1 counts any nonsequenced frame.

Trigger 1: Trigger 1 (see Figure 8.10-4) uses Counter 2 to count DCE information frames. It looks at the control byte position of the opening sequence for a byte with Bit 1 = 0 (Bit Mask XXXX XXX0).

Trigger 2: Trigger 2 (see Figure 8.10-5) uses Counter 5 to count all packets to logical channel number 004. The LCN is identified by linking the LCN string to the frame opening sequence in Trigger 1. It could have been found by using a Bit Mask, XXXX 0000, for the first packet byte, but for the training tape data we can be more specific and select modulo 8.

Trigger 3: This trigger (see Figure 8.10-6) is linked to Triggers 1 and 2 to find data packets on LCN 004 by identifying the packet-type octet (XXXX XXX0). It counts data packets on Counter 6. The rest of the Trigger 3 entries will be explained under Data Packet Analysis.

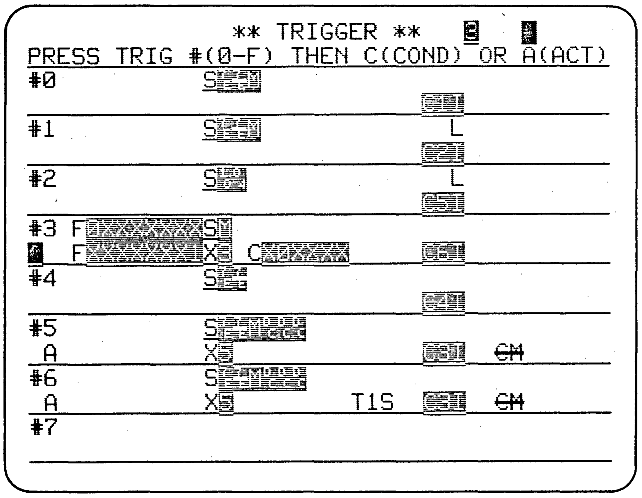


Figure 8.10-7

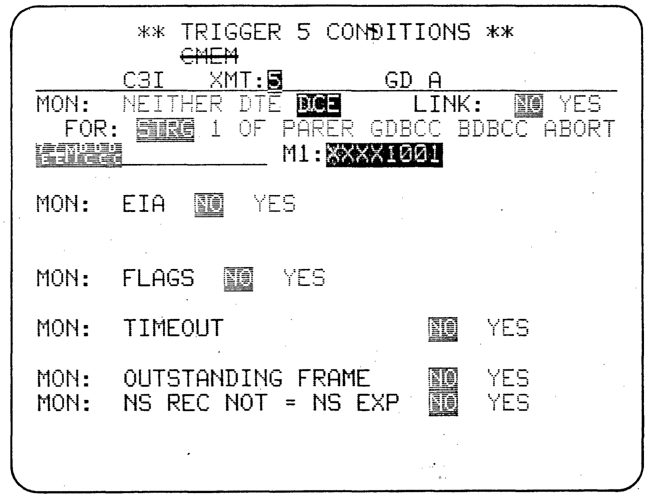


Figure 8.10-8

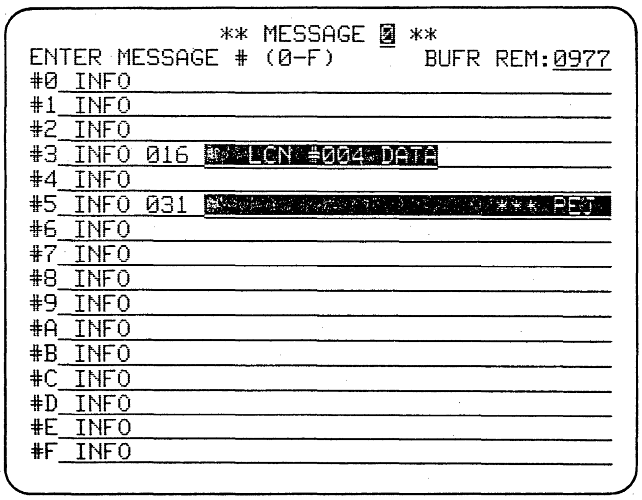


Figure 8.10-9

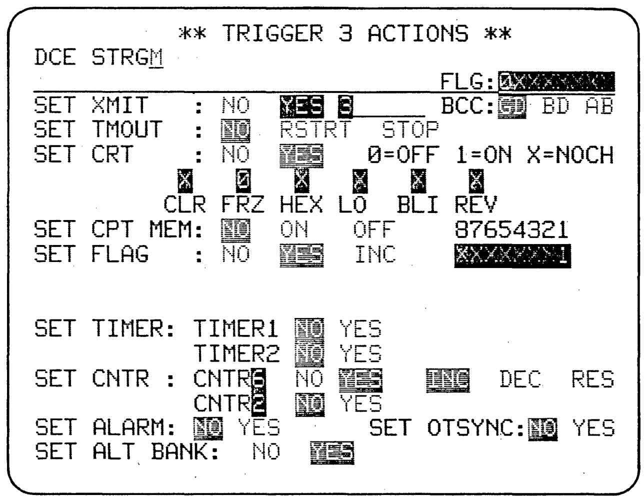


Figure 8.10-10

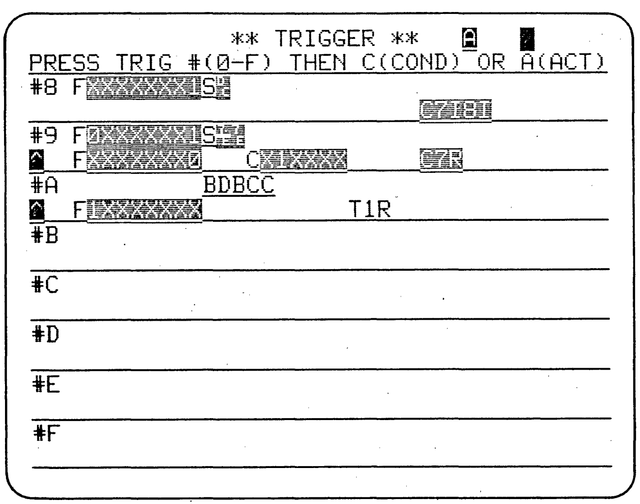


Figure 8.10-11

Trigger 4: Trigger 4 uses Counter 4 to count all DCE frames. It looks for a DCE string of 7E, Not Equal 7E; that is, the start of any frame.

Triggers 5 and 6: Triggers 5 and 6 (see Figure 8.10-7) look for Rejects (XXXX 1001; see Figure 8.10-8) on each side of the line. When either trigger sees a Reject, it is counted on Counter 3 and announced with the audible alarm and a Prompt (Message 5; see Figure 8.10-9) on Line 2. The Capture Memory playback is also stopped, so the REJ prompt is frozen on the display until you restart the program by pressing the RUN key.

NOTE: Two (or more) triggers can increment one counter.

The three Don't Care characters in the string are not necessary to the program.

8.10.2 Data Packet Analysis

Trigger 3: Trigger 3 (see Figure 8.10-10) is linked to Triggers 2 and 1 to look for packet-type octets (Bit Mask XXXX XXX0) for data packets on LCN 004. It puts up a Prompt, LCN #004 DATA (see Figure 8.10-9), for each data packet received on LCN 004. It also turns Flag 1 on and switches the program to the alternate bank of triggers (Figure 8.10-11).

Trigger 8: Trigger 8 is effectively linked to Trigger 3 because the only access to the high bank is through Trigger 3 and is controlled by Flag 1. Trigger 8 is set to increment Counters 7 and 8 as soon as any DCE character is received while Flag 1 is on. Thus both counters count message characters in DCE message packets on LCN 004.

Trigger 9: Trigger 9 looks for the end of each LCN 004 data packet, identified by the closing flag, and turns Flag 1 off to stop the Trigger 8 actions. It resets Counter 7 but not Counter 8. Thus Counter 8 counts total packet message characters, but Counter 7 counts only the characters in each packet message.

NOTE: Because Trigger 9 must identify the end of the packet, Counters 7 and 8 each count three extra characters for each packet, the two FCS bytes and one flag. Since Counter 6 is counting the number of data packets to LCN 004, you can adjust the cumulative count on Counter 8 by subtracting 3 x Counter 6 from the Counter 8 reading, and you can subtract 3 from each reading on Counter 7. Another approach would be to use a trigger to DECrement the counters by 3 for each data packet received.

At the end of each data packet, Trigger 9 freezes the CRT and restores program control to the alternate bank. The CRT freeze will not be cancelled until Trigger 3 has detected the packet-type octet for the next data packet on LCN 004. Thus, once the first such packet is received, only the message content of data packets for LCN 004 can be displayed.

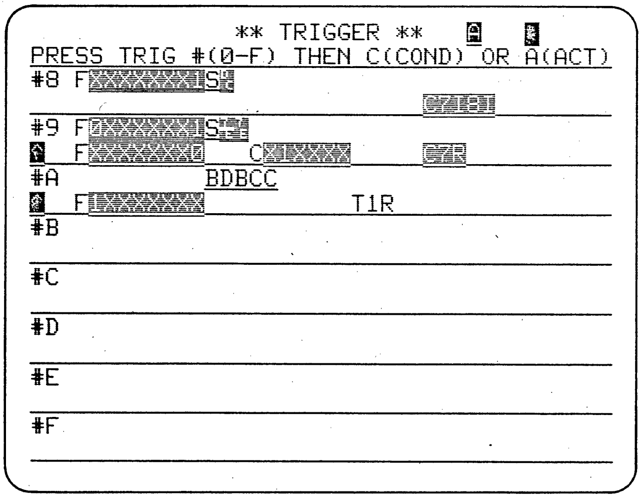


Figure 8.10-12

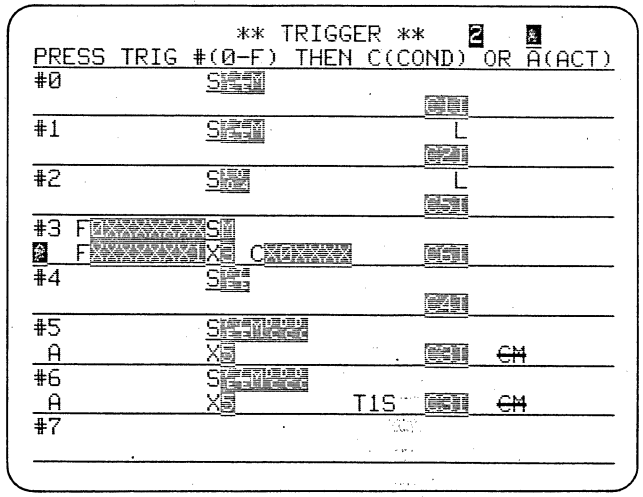


Figure 8.10-13

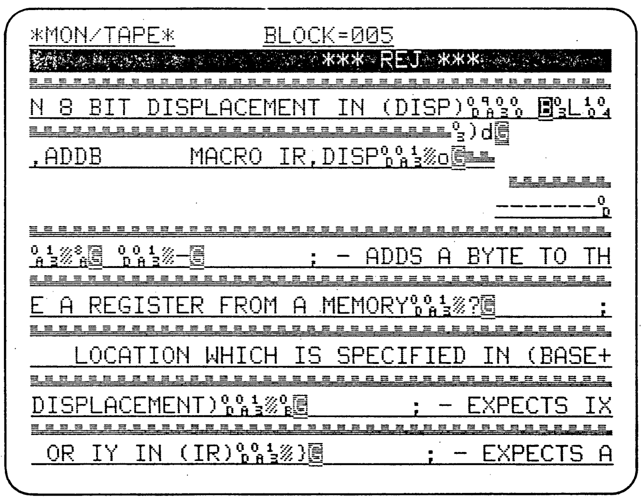


Figure 8.10-14

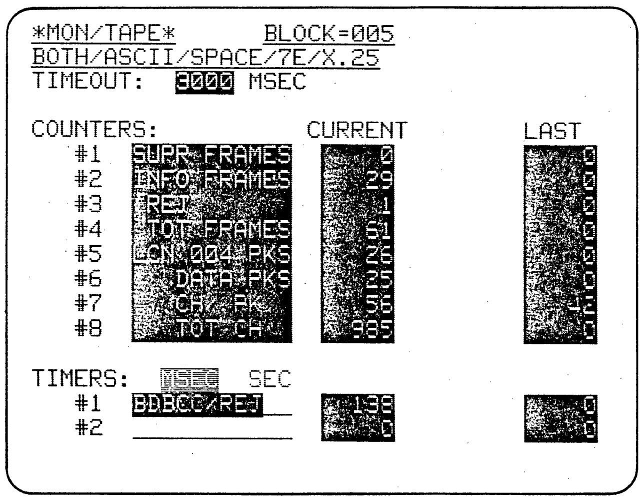


Figure 8.10-15

8.10.3 Error Recovery

The high bank, that is, Trigger A (see Figure 8.10-12), also looks for Bad Block Checks on DCE frames with data packets on LCN 004 (these are the only block checks that the high bank can see, since the only access to it is from Trigger 3).

When Trigger A sees a Bad BCC it restarts Timer 1, sets Flag 8 on, and switches the program to the low bank.

When Trigger 6 (on the low bank; see Figure 8.10-13) sees the next DTE Reject, it stops the timer and stops Capture Memory playback.

Because Trigger A turned Flag 8 on when it switched the program to the low bank, the program cannot switch back to the high bank unless you restart the program (the RUN key initializes all flags to 0). The low bank is thus forced to wait for the DTE REJect and make the recovery time measurement.

Trigger 5 is also set to turn off the Capture Memory upon receipt of a DCE reject. It happens that there are no DCE Rejects in the X.25 training tape data. In a situation where they might be encountered, however, you might prefer to change the Trigger 5 Actions Capture Memory selection to NO so that you could concentrate on the DTE side only.

8.10.4 Program Operation

Start the training tape program running. Around Block 005, the alarm will sound, REJ will be displayed on the Prompt line, and the tape motion will be stopped (Figure 8.10-14). Press the Results key and record the counter and timer values (Figure 8.10-15). Press the DATA key to restore the data display; then restart the program by pressing RUN. Tape motion will begin from the point at which it stopped, so you will not miss any data. The program will restart, and stop again when it finds the next Reject. Each time the bright reverse-image B will be on the screen for your inspection and the recovery time will be displayed on the Results display.

The counters will all reset each time the program is restarted, so it is important to record the values after each Reject so that you can total them for an overall result.

Notice that this program allows the CRT to display only the message content for packets to LCN 004. This means that you cannot see the address and frame control bytes on the display. Therefore, you might prefer to select CRT NO on Triggers 9 and 3 to display all of the data.

NOTE: The Capture Memory Stop used in this program would not be suitable to use with live data because turning off the Capture Memory would only stop recording of the data without doing anything to help you inspect the data.

When either of the X.25 or SDLC formats is selected on the Parameters 1 menu, a number of special fields appear on the message-entry menus to simplify the frame-level programming. Packet-level protocol is entered as part of the message text.

8.11 X.25 TRANSMISSIONS

This program demonstrates how to use a 4500 to set up a link, and to establish and clear a call in a 7E-framed X.25 system. The 4500 emulates a DTE sending to a node. A call is established at packet level to the same link, so the program handles both requests and confirmations.

You will find a display of both the frame and the packet protocol sequences at the end of this section. It is printed on a foldout so that you can follow it as you go through the step-by-step program description. Remember that an asterisk on a mnemonic means that that frame or packet arrived before the other one on the same line of the display.

Below are shown the basic Parameters menus and the Statistics menu (no counters or timers are used).

The program and the sequential protocol display are reproduced from the 4500's output to an ASCII printer via the PRINTER/REMOTE interface. Section 15 of the Technical Manual, ATLC-107-895-105, gives detailed instructions on how to use the Parameters 3 Printer Control menu to print both programs and data.

```
** PARAMETER 1 **

TEST ID:  X.25 DTE SIMULATE  05/26/81
MODE   :  EM DTE
SOURCE :  RAM
  START AT:  BLOCK 000
MON    :  BOTH
CODE   :  EBCDIC
FORMAT :  7E/X.25
I/F    :  EIA
SPEED:  2400


** PARAMETER 2 **

DISPLAY MODE:  PACKET
TYPE SELECT:  X   X   X   X   X
ADDR       :  ALL
```

```
** PARAMETER 4 **

LINE USE:  FDX
STATIC LEADS:           X   X   X   X
LEAD STATUS EXITING RUN:  RESET
T2 (RTS ON TO CTS ON)     =   250
T5 (RTS OFF TO CTS OFF)   =   000


** STATISTICS **

TIMEOUT:  3000
#1
#2
#3
#4
#5
#6
#7
#8
TIMERS:  MSEC
#1
#2
```

Triggers 0, 1, and 2 set up the link. Trigger 0 looks for Flag 8 to be 0. If Flag 8 is 0, then Trigger 0 will transmit to the node (address 10_{16}) a SARM (Set Asynchronous Response Mode; Message 0), which is a nonsequenced frame with control byte $0F_{16}$ (0000 1111). Trigger 0 then sets Flag 8 to 1.

Notice that both the address and the frame type are entered as hexadecimal characters, and there is no need to make any entry on the TEXT line. Specify the address of either the sending or receiving station, whichever is appropriate for the frame type to be transmitted.

The node should respond with a UA followed by a SARM. When Trigger 1 of the 4500 sees a SARM returned by the node, it will return Message 1, which is an Unnumbered Acknowledgment from address 03_{16} (control byte 0110 0011, or 63_{16}).

```
** TRIGGER 0 CONDITIONS **

MON:    NEITHER
MON:  EIA  NO
MON:  FLAGS  YES
   0XXXXXXX
MON:  TIMEOUT                NO
MON:  OUTSTANDING FRAME      NO
MON:  NS REC NOT = NS EXP    NO

** TRIGGER 0 ACTIONS **

SET XMIT    :  YES   0
 BCC:  GD
SET TMOUT  :  NO
SET CRT    :  NO
SET CPT MEM:  NO
SET FLAG   :  YES   1XXXXXXX
SET TIMER: TIMER1  NO
           TIMER2  NO
SET CNTR : CNTR  1   NO
           CNTR  2   NO
SET ALARM:  NO
SET OTSYNC:  NO
SET ALT BANK:  NO
```

```
** TRIGGER 1 CONDITIONS **

MON:    DCE
  LINK:  NO
  FOR:  STRG   :7E 03 0F:DC:DC:7E
MON:  EIA  NO
MON:  FLAGS  NO
MON:  TIMEOUT                NO
MON:  OUTSTANDING FRAME      NO
MON:  NS REC NOT = NS EXP    NO

** TRIGGER 1 ACTIONS **

SET XMIT    :  YES   1
 BCC:  GD
SET TMOUT  :  NO
SET CRT    :  NO
SET CPT MEM:  NO
SET FLAG   :  INC
SET TIMER: TIMER1  NO
           TIMER2  NO
SET CNTR : CNTR  1   NO
           CNTR  2   NO
SET ALARM:  NO
SET OTSYNC:  NO
SET ALT BANK:  NO
```

```
** MESSAGE 0 **

DESTINATION:  LINE
BEGIN FRAME:  YES
  ADDRESS:  01
  TYPE   :  NSEQ 0F
TEXT:

** MESSAGE 1 **

DESTINATION:  LINE
BEGIN FRAME:  YES
  ADDRESS:  03
  TYPE   :  NSEQ 63
TEXT:
```

Trigger 2 looks for an INFO frame (Bit Mask XXXX XXX0) with a Restart packet (packet-type octet 1111 1011) for the 4500's address, 03_{16}. When it has received the entire frame, as indicated by the closing flag in the string, the 4500 transmits Message 2, which is an INFO frame with a Restart Confirm packet (1111 1111) on LCN 000. Notice that the packet is entered in the TEXT field of the message menu.

This is the first frame in which the 4500 must control the NR and NS counts. As with all other messages in this program, both the NR and NS counts are set to AUTO. In this message, the NS count will be 0 and the NR count will be 1 since the 4500 has received one good frame with NS count 0.

Notice that the string condition for Trigger 2 is filled out to the end of the frame with Don't Care characters and the closing flag because the Receive NR count will not be updated until the frame has been received with a good FCS. If the 4500 were to transmit a message before the Restart packet was completely received, it would transmit an NR count of 0, and so would not have acknowledged the frame.

The node responds to the 4500's Restart Confirm packet with an RR.

```
** TRIGGER 2 CONDITIONS **

MON:   DCE
  LINK:  NO
  FOR:  STRG   :7E 03:M :DC:DC FB:DC:DC:DC:DC:7E
 M1:  XXXXXXX0
MON:  EIA  NO
MON:  FLAGS  YES
    XXXX0001
MON:  TIMEOUT                NO
MON:  OUTSTANDING FRAME      NO
MON:  NS REC NOT = NS EXP    NO
```

```
** TRIGGER 2 ACTIONS **

SET XMIT   :  YES   2
 BCC:  GD
SET TMOUT  :  NO
SET CRT    :  NO
SET CPT MEM:  NO
SET FLAG   :  INC
SET TIMER: TIMER1  NO
           TIMER2  NO
SET CNTR : CNTR  1   NO
           CNTR  2   NO
SET ALARM:  NO
SET OTSYNC:  NO
SET ALT BANK:  NO
```

```
** MESSAGE 2 **

DESTINATION:  LINE
BEGIN FRAME:  YES
  ADDRESS:  01
  TYPE   :  INFO
   P/F:  0
   NR:  AUTO
   NS:  AUTO
TEXT:   10 00 FF
```

Trigger 3 looks for the RR (Bit Mask XXXX 0001) from address 01_{16} and transmits Message 3, a Call request packet ($0B_{16}$) on LCN 002. Again, this is an INFO frame with the NR and NS counts set to AUTO. In this example, the node is looping back the call to LCN 000 on the same link.

```
** TRIGGER 3 CONDITIONS **

MON:    DCE
  LINK:  NO
  FOR:  STRG   :7E 01:M :DC:DC:7E
 M1:  XXXX0001
MON:  EIA  NO
MON:  FLAGS  YES
    XXXX0010
MON:  TIMEOUT               NO
MON:  OUTSTANDING FRAME     NO
MON:  NS REC NOT = NS EXP   NO


** TRIGGER 3 ACTIONS **

SET XMIT   :  YES   3
 BCC:  GD
SET TMOUT  :  NO
SET CRT    :  NO
SET CPT MEM:  NO
SET FLAG   :  INC
SET TIMER: TIMER1  NO
           TIMER2  NO
SET CNTR : CNTR  1   NO
           CNTR  2   NO
SET ALARM:  NO
SET OTSYNC:  NO
SET ALT BANK:  NO


** MESSAGE 3 **

DESTINATION:  LINE
BEGIN FRAME:  YES
  ADDRESS:  01
  TYPE   :  INFO
   P/F:  0
   NR:  AUTO
   NS:  AUTO
TEXT:    10 02 0B 09 17 50 00 01 90 00
```

Triggers 4 and 5 are linked together to look for the Call Request packet from the DCE. When this is received, Trigger 5 transmits Message 4. The message is a Call Accept packet for the Call Request on LCN 000. The node will then send a Call Accept packet for LCN 002 to complete setup for both ends of the call.

```
** TRIGGER 4 CONDITIONS **

MON:    DCE
  LINK:  YES
  FOR:  STRG   :7E 03:M  10 00 0B:DC:DC:DC:DC:DC:DC:DC:DC:DC:DC
 M1:  XXXXXXX0
MON:  EIA  NO
MON:  FLAGS  NO
MON:  TIMEOUT              NO
MON:  OUTSTANDING FRAME    NO
MON:  NS REC NOT = NS EXP  NO


** TRIGGER 4 ACTIONS **

SET XMIT    :  NO
SET TMOUT   :  NO
SET CRT     :  NO
SET CPT MEM:  NO
SET FLAG    :  NO
SET TIMER: TIMER1  NO
           TIMER2  NO
SET CNTR : CNTR  1   NO
           CNTR  2   NO
SET ALARM:  NO
SET OTSYNC:  NO
SET ALT BANK:  NO
```

```
** TRIGGER 5 CONDITIONS **

MON:    DCE
  LINK:  NO
  FOR:  STRG   :DC:7E
MON:  EIA  NO
MON:  FLAGS  YES
    XXXX0011
MON:  TIMEOUT                NO
MON:  OUTSTANDING FRAME      NO
MON:  NS REC NOT = NS EXP    NO

** TRIGGER 5 ACTIONS **

SET XMIT    :  YES   4
 BCC:  GD
SET TMOUT   :  NO
SET CRT     :  NO
SET CPT MEM:  NO
SET FLAG    :  INC
SET TIMER: TIMER1  NO
           TIMER2  NO
SET CNTR : CNTR  1   NO
           CNTR  2   NO
SET ALARM:  NO
SET OTSYNC:  NO
SET ALT BANK:  NO


** MESSAGE 4 **

DESTINATION:  LINE
BEGIN FRAME:  YES
  ADDRESS:  01
  TYPE   :  INFO
   P/F:  0
   NR:  AUTO
   NS:  AUTO
TEXT:   10 00 0F
```

Trigger 6 looks for the Call Accept from the DCE and transmits an RR (Message 5) to acknowledge receipt of the frame. Trigger 6 also switches the program to the alternate bank.

Trigger 8 then looks for RRs from the DCE. Each time the 4500 receives an RR, it will send an RR and increment the flag mask.

```
** TRIGGER 6 CONDITIONS **

MON:    DCE
  LINK:  NO
  FOR:  STRG   :7E 03:M  10 02 0F:DC:DC:7E
 M1:  XXXXXXX0
MON:  EIA  NO
MON:  FLAGS  YES
    XXXX0100
MON:  TIMEOUT                NO
MON:  OUTSTANDING FRAME      NO
MON:  NS REC NOT = NS EXP    NO


** TRIGGER 6 ACTIONS **

SET XMIT   :  YES   5
 BCC:  GD
SET TMOUT  :  NO
SET CRT    :  NO
SET CPT MEM:  NO
SET FLAG   :  INC
SET TIMER: TIMER1  NO
           TIMER2  NO
SET CNTR : CNTR  1   NO
           CNTR  2   NO
SET ALARM:  NO
SET OTSYNC:  NO
SET ALT BANK:  YES
```

```
** TRIGGER 8 CONDITIONS **

MON:    DCE
  LINK:  NO
  FOR:  STRG   :7E 01:M :DC:DC:7E
 M1:  XXXX0001
MON:  EIA  NO
MON:  FLAGS  YES
    XXX0XXXX
MON:  TIMEOUT                NO
MON:  OUTSTANDING FRAME      NO
MON:  NS REC NOT = NS EXP    NO


** TRIGGER 8 ACTIONS **

SET XMIT   :  YES   5
 BCC:  GD
SET TMOUT  :  NO
SET CRT    :  NO
SET CPT MEM:  NO
SET FLAG   :  INC
SET TIMER: TIMER1  NO
           TIMER2  NO
SET CNTR : CNTR  1   NO
           CNTR  2   NO
SET ALARM:  NO
SET OTSYNC:  NO
SET ALT BANK:  NO
```

```
** MESSAGE 5 **

DESTINATION:  LINE
BEGIN FRAME:  YES
  ADDRESS:  03
  TYPE   :  RR
   P/F:  0
   NR:  AUTO
TEXT:
```

After the 4500 has received 12 RRs from the DCE, Trigger 9 will see Flag 5 ON and respond to the next RR by transmitting Message 6, which is a Clear request packet on LCN 002. The DCE will respond with a Clear request packet on LCN 000.

Trigger A looks for the Clear request packet from the DCE and transmits Message 7, which is a Clear Confirm on LCN 000. Both ends of the call have now been cleared.

```
** TRIGGER 9 CONDITIONS **

MON:    DCE
  LINK:  NO
  FOR:  STRG    :7E 01:M
 M1:  XXXX0001
MON:  EIA  NO
MON:  FLAGS  YES
    XXX10000
MON:  TIMEOUT                NO
MON:  OUTSTANDING FRAME      NO
MON:  NS REC NOT = NS EXP    NO

** TRIGGER 9 ACTIONS **

SET XMIT    :  YES   6
 BCC:  GD
SET TMOUT   :  NO
SET CRT     :  NO
SET CPT MEM:  NO
SET FLAG    :  INC
SET TIMER: TIMER1  NO
           TIMER2  NO
SET CNTR : CNTR  1   NO
           CNTR  2   NO
SET ALARM:  NO
SET OTSYNC:  NO
SET ALT BANK:  NO
```

```
** TRIGGER A CONDITIONS **

MON:    DCE
  LINK:  NO
  FOR:  STRG    :7E 03:M  10 00 13:DC:DC:DC:7E
 M1:  XXXXXXX0
MON:  EIA  NO
MON:  FLAGS  YES
    XXX10001
MON:  TIMEOUT                NO
MON:  OUTSTANDING FRAME      NO
MON:  NS REC NOT = NS EXP    NO

** TRIGGER A ACTIONS **

SET XMIT    :  YES   7
 BCC:  GD
SET TMOUT   :  NO
SET CRT     :  NO
SET CPT MEM:  NO
SET FLAG    :  INC
SET TIMER: TIMER1  NO
           TIMER2  NO
SET CNTR : CNTR  1   NO
           CNTR  2   NO
SET ALARM:  NO
SET OTSYNC:  NO
SET ALT BANK:  NO
```

```
** MESSAGE 6 **

DESTINATION:  LINE
BEGIN FRAME:  YES
  ADDRESS:  01
  TYPE    :  INFO
   P/F:  0
   NR:  AUTO
   NS:  AUTO
TEXT:   10 02 13 00

** MESSAGE 7 **

DESTINATION:  LINE
BEGIN FRAME:  YES
  ADDRESS:  01
  TYPE    :  INFO
   P/F:  0
   NR:  AUTO
   NS:  AUTO
TEXT:   10 00 17
```

Trigger B looks for the Clear Confirm from the DCE, responds with an RR, and increments the flags. After this, the 4500 responds to an RR with an RR.

In this program, the 4500 tests and increments the flags with each transmission. Trigger 0 starts the whole sequence by detecting Flag 8 OFF. Trigger 8 sends the 12 RRs after the Call has been established. It sends the RR and increments the flags each time it receives an RR from the DCE, until Flag 5 equals 1. Once Flag 5 equals 1, Trigger 9 starts the Clear sequence. Once the flag mask is 1001 0011, Trigger C will send an RR each time it receives an RR. Since Trigger C does not increment the flags, the program will continue to send RRs until it is restarted.

```
** TRIGGER B CONDITIONS **

MON:    DCE
  LINK:  NO
  FOR:  STRG   :7E 03:M  10 02 17:DC:DC:7E
 M1:  XXXXXXX0
MON:  EIA  NO
MON:  FLAGS  YES
    XXX10010
MON:  TIMEOUT                 NO
MON:  OUTSTANDING FRAME       NO
MON:  NS REC NOT = NS EXP     NO

** TRIGGER B ACTIONS **

SET XMIT    :  NO
SET TMOUT   :  NO
SET CRT     :  NO
SET CPT MEM:  NO
SET FLAG    :  INC
SET TIMER: TIMER1  NO
           TIMER2  NO
SET CNTR : CNTR  1   NO
           CNTR  2   NO
SET ALARM:  NO
SET OTSYNC:  NO
SET ALT BANK:  NO
```

```
** TRIGGER C CONDITIONS **

MON:    DCE
  LINK:  NO
  FOR:  STRG   :7E 01:M :DC:DC:7E
 M1:  XXXX0001
MON:  EIA  NO
MON:  FLAGS  YES
    XXX10011
MON:  TIMEOUT                 NO
MON:  OUTSTANDING FRAME       NO
MON:  NS REC NOT = NS EXP     NO

** TRIGGER C ACTIONS **

SET XMIT    :  YES   5
 BCC:  GD
SET TMOUT   :  NO
SET CRT     :  NO
SET CPT MEM:  NO
SET FLAG    :  NO
SET TIMER: TIMER1  NO
           TIMER2  NO
SET CNTR : CNTR  1   NO
           CNTR  2   NO
SET ALARM:  NO
SET OTSYNC:  NO
SET ALT BANK:  NO
```

```
** MESSAGE 5 **

DESTINATION:  LINE
BEGIN FRAME:  YES
  ADDRESS:  03
  TYPE   :  RR
   P/F:  0
   NR:  AUTO
TEXT:
```

8.11 X.25 TRANSMISSIONS (CONTINUED)

```
*MON/RAM*        BLOCK=000
BOTH/EBCDIC/7E/X.25/FRAME

        DTE                            DCE
ADDR TYPE R S    P/F          ADDR TYPE R S    P/F
 01 *DM/SARM      0  G         01  UA           0  G
 03  UA           0  G         03 *DM/SARM      0  G
 01  INFO 1 0     0  G         03 *INFO 0 0     0  G
 01  INFO 1 1     0  G         01 *RR    1      0  G
 01  INFO 2 2     0  G         03 *INFO 2 1     0  G
 03  RR    3      0  G         03 *INFO 3 2     0  G
 03  RR    3      0  G         01 *RR    3      0  G
 03  RR    3      0  G         01 *RR    3      0  G
 03  RR    3      0  G         01 *RR    3      0  G
 03  RR    3      0  G         01 *RR    3      0  G
 03  RR    3      0  G         01 *RR    3      0  G
 03  RR    3      0  G         01 *RR    3      0  G
 03  RR    3      0  G         01 *RR    3      0  G
 03  RR    3      0  G         01 *RR    3      0  G
 03  RR    3      0  G         01 *RR    3      0  G
 03  RR    3      0  G         01 *RR    3      0  G
 03  RR    3      0  G         01 *RR    3      0  G
 01  INFO 3 3     0  G         01 *RR    3      0  G
 01  INFO 4 4     0  G         03 *INFO 4 3     0  G
                               03 *INFO 5 4     0  G
 03  RR    5      0  G         01 *RR    5      0  G
 03  RR    5      0  G         01 *RR    5      0  G
 03  RR    5      0  G         01 *RR    5      0  G
 03  RR    5      0  G         01 *RR    5      0  G
 03  RR    5      0  G         01 *RR    5      0  G
 03  RR    5      0  G         01 *RR    5      0  G
 03  RR    5      0  G         01 *RR    5      0  G

*MON/RAM*        BLOCK=004
BOTH/EBCDIC/7E/X.25/PACKET

        DTE                            DCE
LCN  TYPE R S    QDM          LCN  TYPE R S    QDM
000  RSTRT C         G        000 *RSTRT 07 00     G
002 *CALL  09        G        000  CALL  90        G
000 *CALL ACC        G        002  CALL ACC        G
002 *CLEAR 00 6F     G        000  CLEAR 00 67     G
000 *CLEAR C         G        002  CLEAR C         G
```

9 BISYNC-FRAMED X.25

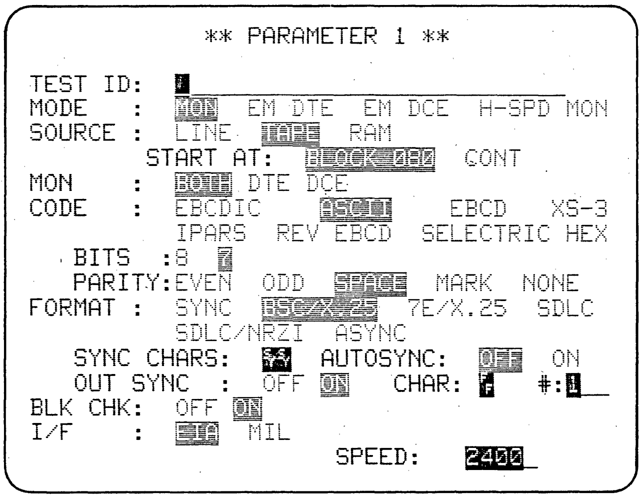


Figure 9.1-1

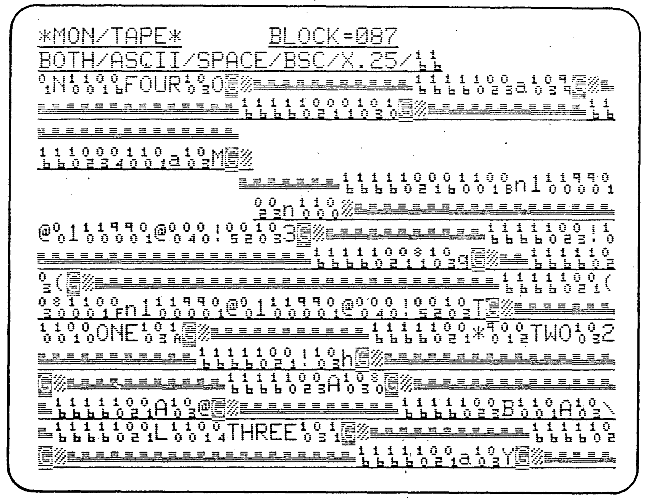


Figure 9.1-2

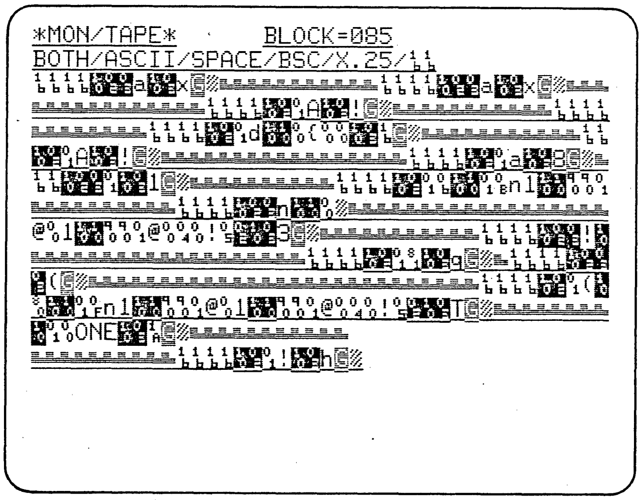


Figure 9.1-3

BISYNC-framed X.25 can be selected as a format on the Parameters 1 menu. The display modes are similar to those for 7E/X.25.

9.1 OBTAINING THE DISPLAY

9.1.1 Parameter Selection

Two types of BISYNC framing are in general use: EBCDIC with SYN = 32 32_{16} and ASCII with SYN = 16 16_{16}. ASCII with SYN = 96 96_{16} is rarely found. The EBCDIC or ASCII framing does not necessarily define the data code: EBCDIC data may be framed with ASCII; or ASCII data may be framed with EBCDIC.

(1) Select the correct data code on the Parameters 1 menu and, if necessary, the number of bits and parity. The training tape data code is ASCII, 7 bits, SPACE parity.

(2) For Format, select BSC/X.25. The synchronization characters default to the correct values for the code selected. You may enter different characters if needed, but the space-parity ASCII default values of 16 16_{16} are correct for the BISYNC-framed X.25 data on the X.25-SDLC training tape.

(3) The BISYNC-framed data begins at Block 080 of the training tape and runs to Block 095. To monitor this data, select SOURCE TAPE and BLOCK 080.

The menu should now appear as in Figure 9.1-1.

When BSC/X.25 has been selected, you have the option of turning Block Check OFF on this menu.

9.1.2 Data Display

Press RUN and observe the training tape data display (Figure 9.1-2). The second line of the display tells you that you are seeing SPACE-parity ASCII in BISYNC-framed X.25 format with synchronization pattern 16 16_{16}.

As for 7E/X.25, the 4500 displays all control characters--in this case the ASCII control characters--in hexadecimal, but you may see the control character mnemonics by pressing CONTROL plus HEX.

If you could enhance STX, ETX, and DLE, the frames would be clearly delineated. On the Parameters 2 menu, enter these three control characters on the ENHANCE data-entry line and then look at the data playback again (see Figure 9.1-3). The three control characters are displayed in blinking bright reverse image, and you can easily pick out the beginning and end of each frame.

The automatic frame and packet locators work just as for the 7E/X.25 display.

9.1.3 Frame and Packet Display

FRAME or PACKET sequential mnemonic display may be selected on the Parameters 2 menu just as for 7E/X.25 and the same mnemonic sets are used. Notice that for these display modes, the block check is computed and shown as G or B even when Received Block Check is off (Parameters 1).

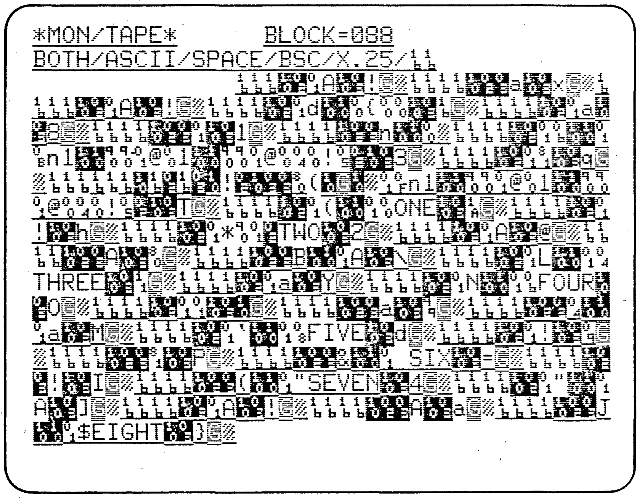


Figure 9.2-1

DLE	STX	DC	M(XXXX XXX0)	DC	DC	M(XXXX XXX0)
		Frm Addr	Frm Cntrl	Oct 1	Oct 2	Oct 3 Pkt Cntrl

Figure 9.2-2

10	01	03	00	10	10	01	00
DLE	STX	Frm Addr	Frm Cntrl	Insrtd DLE	Oct 1	Oct 2	Oct 3 Pkt Cntrl

Figure 9.2-3

For BSC/X.25, inserted DLEs are displayed, but ignored by the trigger and block check logic. This section contains reminders to help you interpret the display.

9.2 INTERPRETING THE DISPLAY

Since DLE (10_{16}) is used as an indicator prior to STX and ETX, it must be distinguished from 10_{16} in the data. The BISYNC rules require that another 10_{16} be inserted before any data 10_{16}. The extra DLE is thrown away upon receipt, but of course you will see it when you are monitoring the line. Octet 1 is very often 10_{16} for LCNs below 256; therefore the dual DLE ($10\ 10_{16}$) occurs with some frequency in this display. When you are counting to find a particular octet, remember to disregard one of every two consecutive 10_{16}.

In transparent BISYNC-framed X.25, DLEs are frequently inserted near the LCN. The automatic packet locator activated by the P key is programmed to ignore the extra DLE when it counts character locations. When you are observing the display or manually selecting the bytes to be expanded using CONTROL plus P, be sure to consider the rules for transparency.

You can see that Received Block Check is on in Figure 9.2-1 because the second CRC character is replaced with G. However, for BSC/X.25 format, you can turn Received Block Check off on the Parameters 1 menu, which enables you to see the block check character actually received or sent.

The 4500 strips inserted DLEs from the BCC calculations.

Although you see inserted DLEs on the screen, once a DLE STX has been received to start a frame, the 4500 ignores inserted DLEs. Therefore, you should not enter inserted DLEs in the trigger string-entry fields.

For instance, suppose that you want to count all data packets on one side of the line. The string to look for would be Figure 9.2-2. Notice that the packet-type octet is the seventh byte in the string. If a data packet were received from LCN #001 then the string might actually appear as in Figure 9.2-3.

The packet-type octet is the eighth byte in this string. Thus, if the inserted DLE were not ignored this data packet would not be counted.

If you want to find the end of a frame, you cannot look for a string of DLE ETX because the single DLE will be ignored by the string search logic. Instead, use the string ETX DC DC FF_{16}.