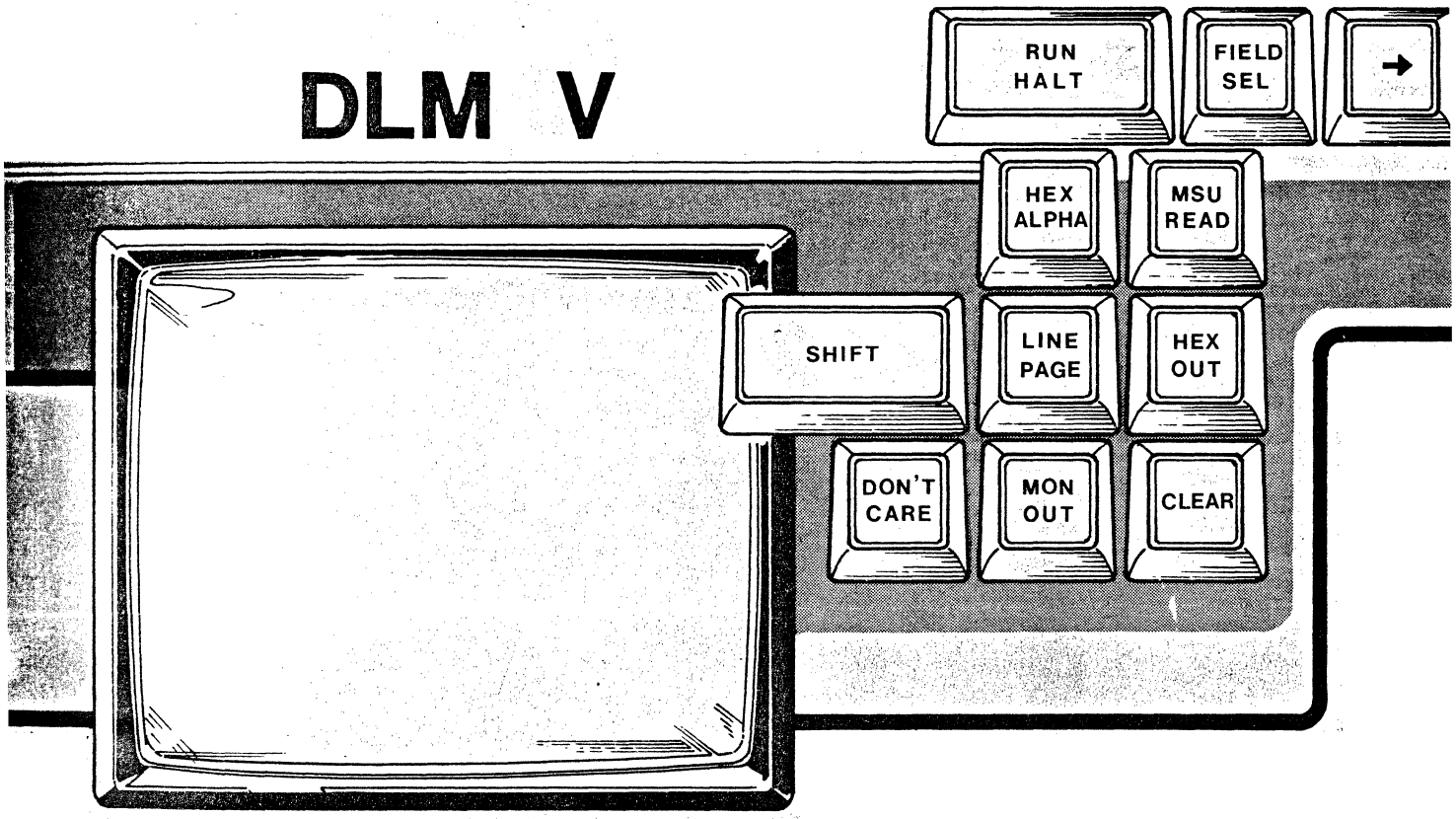
DIGILOG
NETWORK CONTROL DIVISION

DLM V



DATA LINE MONITOR

OPERATOR'S INSTRUCTION MANUAL

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DLM V OPERATOR'S INSTRUCTION MANUAL

PREFACE

The DLM V Operator's Instruction Manual provides the information necessary to operate the DIGILOG DLM V Data Line Monitor. It is intended to be used in conjunction with the manuals supplied with other equipment in the communication system. Where applicable, it can also be used with the manual supplied with the DIGILOG MSU (Mass Storage Unit). The communication system manuals should be referenced before setting up the DLM V parameters; e.g., protocol structure and bits per character. It is assumed that the user is familiar with data communications terminology.

Section 1 of this manual contains a general description of the DLM V along with a listing of its characteristics and specifications.

Section 2 includes descriptions of the unit controls, switches, indicators, connectors, and movable keyboard.

Section 3 provides the information necessary to operate the unit in a communications network.

Section 4 discusses the programmability of the DLM V, giving program examples and explaining the programming instructions.

Four appendices are included at the end of the manual along with a customer service card, which is attached to the unit if it is returned to the factory for repairs. Appendix A contains code charts of the codes that the DLM V is equipped to monitor, as well as a blank code chart, which can be filled in by the customer should an optional customer-selected code be programmed into the DLM V. Appendix B provides information on 3270 Protocol.

Appendix C is an alphabetical listing of X.25 industry standard abbreviations. Appendix D is a Program Library, which gives a description, a listing, and a flowchart for each sample program supplied.

Also included at the back of the manual is a Readers Comments sheet. Our objective when producing a manual is technical and editorial accuracy. In pursuit of that goal, therefore, we would appreciate your evaluation of the contents of the DLM V Operator's Instruction Manual.

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SECTION 1
DESCRIPTION OF EQUIPMENT

1.1 OVERVIEW

This section serves as an introduction to the DIGILOG DLM V Data Line Monitor. Included is a general description of the DLM V, and the list of its characteristics and specifications.

1.2 GENERAL DESCRIPTION

The DIGILOG DLM V is a compact, low cost, data line monitor that can be used to isolate most faults that occur in a communication system. The DLM V can be set up to perform a number of complex diagnostic tests. Also, to ensure its continued reliability, the DLM V performs a number of self-tests at power-up time. Figure 1-1 is an illustration of the DLM V Data Line Monitor.

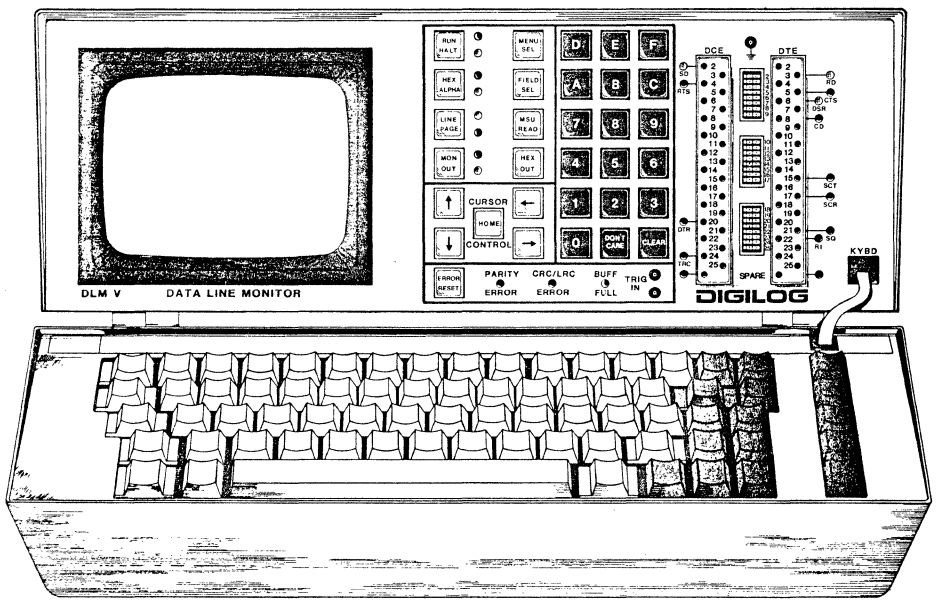


Figure 1-1. DIGILOG DLM V Data Line Monitor

The DLM V is composed of two assemblies. One assembly consists of the unit controls and indicators, a breakout and monitor panel, and a video display screen. It also houses all the internal electronics. The other assembly is a detachable keyboard, which is used to access the rest of the DLM V. The keyboard assembly hinges on the first unit. A six-foot keyboard cable, the use of which allows the operator to move the keyboard to where it is most comfortable, is available as an option.

The microprocessor operating system directs all functions performed by the DLM V. The control program uses menus shown on the unit video display to prompt the entry of the parameters required for system testing. These parameters can be permanently stored in the unit EEPROM (Electrically Eraseable Programmable Read-Only Memory). User-programmed codes are also stored in the EEPROM.

After the parameters are selected, placing the DLM V in the RUN mode causes the DLM V to perform all functions according to the menu contents. The DLM V video display can be used to view the capture buffer contents or to see the results of a diagnostic test.

Standard circuitry enables the DLM V both to transmit and to respond to protocol messages, and to perform bit error-rate tests (BERT). This capability allows operators to exercise terminal equipment at its basic level. In a large system, where equipment is located at remote sites, this interactive capability enables operators to configure the DLM V to emulate either the data terminal equipment (DTE) or the data communication equipment (DCE). Furthermore, the DLM V, in the X.25 mode, strips data at both the frame and packet levels, and displays the header information in industry standard abbreviations on the screen. Send and receive sides of the line are identified in realtime relationship.

In addition to these features, the DLM V is programmable. The programmability feature provides a means of specifying and logically controlling the DLM V commands. Using the keyboard, the user can design programs ranging from simple programs to eliminate manual intervention, to more complex programs used for terminal and CPU emulation. See Figure 1-1 for a front view of the DIGILOG DLM V.

1.3 SPECIFICATIONS AND CHARACTERISTICS

Table 1-1 contains a listing of the DLM V specifications and characteristics. Keyboard specifications are included.

Table 1-1. DLM V Specifications and Characteristics (Part 1 of 3)

CODES	ASCII, EBCDIC, HEX, XS-3, BAUDOT, IPARS, 200UT, EBCD 2740/2741, EBCD 1050, 2740/2741 CORRESPONDENCE; standard. One user-programmable.
TIMING	Synchronous, asynchronous, or isochronous.
PROTOCOLS	BISYNC, SDLC DIRECT, SDLC NRZI, HDLC, BDLC, DDCMP, ADCCP, X.25 HDLC, X.25 BSC.
SPEEDS	50, 75, 110, 134.5, 150, 300, 600, 1050, 1200, 1800, 2000, 2400, 3600, 4800, 7200, 9600, 19200, EXTERNAL, or OTHER.
PARITY	None, odd, even, all 1's, or all 0's.
FRAMING	5, 6, 7, 8, 9, or bit stream. Asynchronous; 1, 1.5, or 2 stop bits. Synchronous; none, 1, or 2 sync bytes.
BLOCK ERROR CHECKS	None, CRC/16, FCS SDLC, CRC/16 Transparent or LRC/8; standard.
START TRAP SEQUENCE	Up to six characters, including DON'T CAREs, or eight bits, can be used to start the trap. Match under mask bit performed.
STOP TRAP SEQUENCE	Up to six characters, including DON'T CAREs, or eight bits, can be used to stop the trap. Match under mask bit performed.
VIDEO DISPLAY	Up to 512 characters; 16 lines composed of 32 characters each. Binary break-out of any selected byte in the Halt mode.
CAPTURE MEMORY CAPACITY	Approximately 12,000 data characters stored in the internal capture buffer. Additional 12,000 attribute characters.
PROGRAMMABILITY	15 Program Functions, plus editing Maximum Program Size: 72 Lines

Table 1-1. DLM V Specifications and Characteristics (Part 2 of 3)

OUTPUT MESSAGES	. FOX message, with user-defined header and trailer. . Four nonvolatile output memory buffers may contain nine messages of 256 bytes each (inactive mode), or a total of 512 two-character messages (active mode). . A bit error-rate test (BERT) message consisting of a 511-bit per block, pseudorandom sequence pattern for sync or async lines. Preprogrammed for X.25 and Bisync message generation. Capture buffer can be "dumped" into the output buffer to transmit user data. Output buffer is nonvolatile.
MENU SETUP	Nonvolatile.
COUNTERS AND TIMERS	Three counters and two timers. Timer resolution 10 msec.
X.25 MODE	Strips data and displays X.25 header data information at frame and packet levels in standard abbreviations. LAP B mnemonics. Identifies send and receive sides of transmission in realtime (correlated display).
DISPLAY ATTRIBUTES	Four available in any combination: blink, underline, reverse video, and half intensity.
INTERFACE	RS-232C and CCITT V.24; standard.
INTERFACE BREAKOUT PANEL	24 interface signals are available at the front panel for monitoring and patching. Pin 1 (interface ground) available for monitoring.
OUTPUT SIGNALS	Composite video output to an external monitor (RS-170). TTL-compatible event marker output to external equipment. Output to an external mass storage device. Output to a serial printer for generating hard copy of the video display data, the capture buffer contents, or the menu.
POWER CONSUMPTION	150 Watts maximum at 115 VAC, 60 Hz; 220 VAC, 50 Hz

Table 1-1. DLM V Specifications and Characteristics (Part 3 of 3)

[illegible] EQUIPMENT	Temperature: 32°F to 120°F; 0°C to 50°C Humidity: up to 90%, noncondensing.
[illegible]BOARD	Standard alphanumeric typing format (ASCII). Five key cursor control cluster. 11 operating state keys. 15 program function keys. Sealed. Modes: normal, shift, control, control shift, function.
[illegible]BOARD OUTPUT [illegible]	TTL levels. Async. serial data; 1200 baud. 1 start and 1 stop bits. 8 data bits; LSB transmitted first. Even parity.
[illegible]BOARD INTERFACE CONNECTOR	BERG-type, 6-position, 6 contact modular telephone jack. Mates with modular telephone plug.

SECTION 2
CONTROLS, INDICATORS, AND CONNECTORS

2.1 INTRODUCTION

This section describes how to configure the DLM V voltage select switches, and how to check and replace the unit fuse. Also included are descriptions of the keyboard, the unit controls, indicators, and connectors.

2.2 OPERATING VOLTAGE

The DLM V is normally shipped from the factory ready to operate using a primary source voltage of 115 VAC, 60 Hz; however, it is designed to operate at either 115 or 220 VAC, and the source can be either 50 or 60 Hz. Perform the following procedure to check or change the unit operating voltage configuration. Use Figure 2-1 to locate the switches referred to in the procedure.

1. Check that the DLM V line cord is not plugged into an outlet.

2. Check the setting of the rear panel voltage select slide switch. The number seen, either 115 or 220, must be in the range of the voltage applied to the DLM V. Setting the switch to 115V allows for voltages between 95V and 130V. Setting the switch to 220V allows for voltages between 190V and 260V.

3. Check the rating of the fuse in the fuseholder. If the unit is configured to operate at 115 VAC, 50 or 60 Hz, the fuseholder must contain a 1.5A slow blow fuse. If it is configured to operate at 220 VAC, 50 or 60 Hz, the fuseholder must contain a 0.75A slow blow fuse; refer to step 6 for fuse replacement procedures.

4. Check the setting of the voltage frequency select plug located on the central processing board (bottom board when looking into the unit from above). The plug is set for 60 Hz from the factory when delivered to a customer site located in North America. The plug, however, must be positioned to the setting that corresponds to the frequency of the voltage applied to the DLM V. If the unit is being configured to operate using 50 Hz, then pull up the plug until it disengages; rotate the plug to the 50 Hz position and reinstall it.

5. Change the voltage select switch setting by moving the slide to one extreme position or the other. If the DLM V is being configured to operate from 220 VAC, move the slide until it stops and the number 220 is showing.

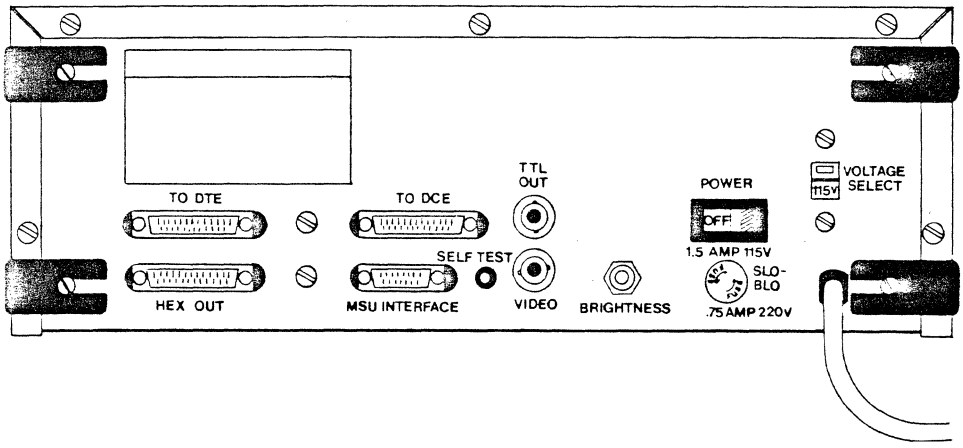


Figure 2-1. Rear Panel Controls and Connectors

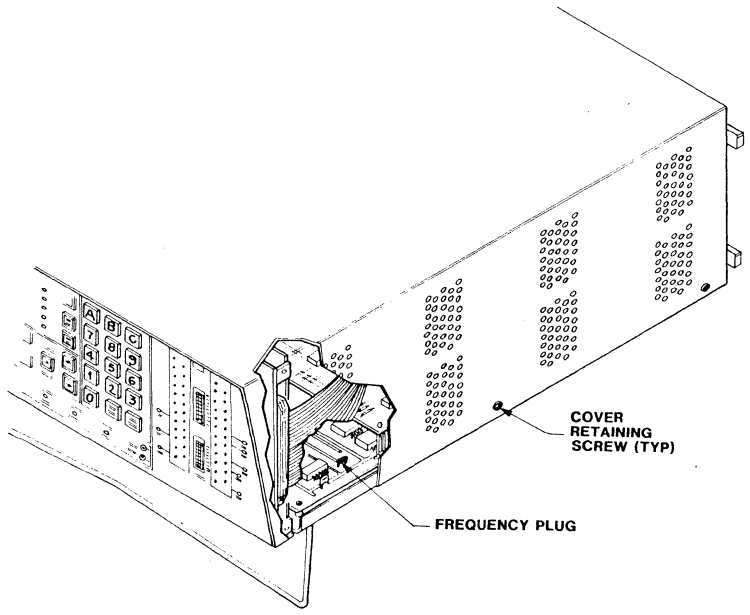


Figure 2-2. Internal Board: Location of the Frequency Select Plug

6. To change the fuse, push in the fuseholder cap, turning it counterclockwise until the cap is free, and pull the cap and fuse out of the fuseholder. If a new fuse is being installed, note the setting of the voltage select switch, and install either a 1.5A slow blow fuse if the switch is set to 115V, or a 0.75A slow blow fuse if the switch is set to 220V. Reinsert the fuse assembly into the fuseholder, push the assembly in and twist clockwise until it is firmly seated in the fuseholder.

2.3 THE KEYBOARD

The keyboard assembly is mounted on hinges on the DLM V and is connected to the unit by a three-inch long cable. The cable has a telephone-type jack that connects the keyboard to a plug located next to the breakout panel on the front of the unit (see Figure 2-4). The keyboard base, when the keyboard assembly is folded up and latched to the rest of the unit, serves as the unit cover.

A six-foot long, coiled keyboard cable allows the operator to detach the keyboard from the unit, and move it to where it is most comfortable and easiest to use. This cable is available from DIGILOG as an option.

The keyboard array is arranged in two clusters. The main cluster is composed of a standard, typewriter-like alphanumeric keyboard, ten operation control keys, and a null key. The smaller cluster comprises five cursor position control keys. See Figure 2-3 for an illustration of the keyboard.

The fronts of 15 of the 16 keys on the top row of the main array are labeled F1 through F15. These keys are used in conjunction with the FUNC (FUNCTION) key. The function keys perform operations involved in programming the unit. Complete details on DLM V programmability are given in Section 4.

Note that there are some keys with an extra inscription above the letter. These keys, when used with the CTRL (CONTROL) key, generate ASCII control characters. All ASCII control characters are implemented, but only certain keys show control legends. Refer to the ASCII chart supplied in Appendix A.

SHIFT LOCK and CAPS LOCK are alternate action keys, each with an LED. When the key is depressed, the LED lights up to show that the function is activated. To deactivate the function, press the key a second time.

The operation control keys (grey), located to the right of the main array, are described in detail in paragraph 2.4.2 and in Table 2-1.

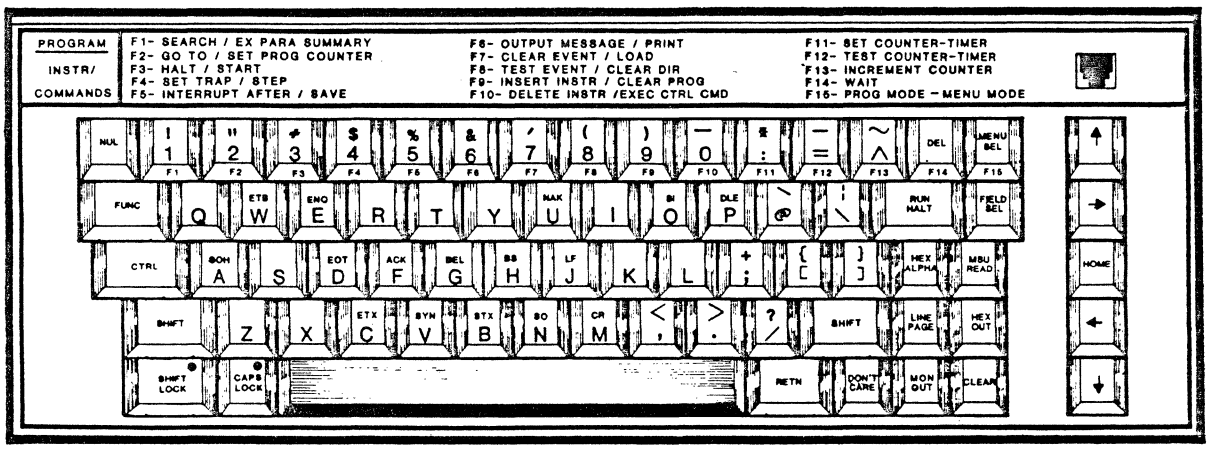


Figure 2-3. The DLM V Keyboard

2.4 FRONT PANEL CONTROLS, INDICATORS, AND CONNECTORS

The DLM V front panel controls, indicators, and connectors are separated into six functional groups; see Figure 2-4.

1. Video display unit (CRT).
2. Control keys and associated indicators.
3. Cursor control keys.
4. Numeric keypad for hexadecimal entries.
5. Error reset key and indicators, and trigger (+) and (-) connectors.
6. Interface breakout and monitor panel.

The following paragraphs contain functional descriptions of the controls, indicators, and/or connectors of each group.

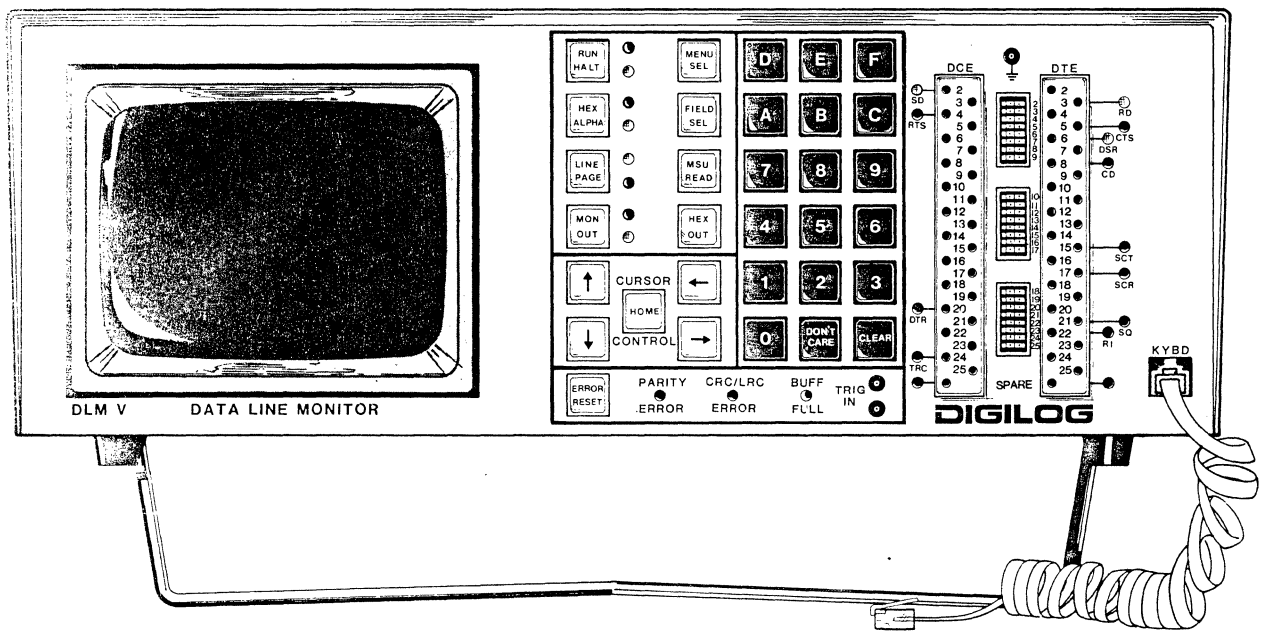


Figure 2-4. Front Panel Controls, Indicators, and Connectors

2.4.1 Video Display Unit

The video display unit contains a 5-inch cathode-ray tube (CRT) that uses P4 phosphor. The CRT is covered by a tinted faceplate to reduce glare and improve contrast of the displayed image. The video display BRIGHTNESS control is located on the unit rear panel; see Figure 2-1.

The video display is used by the DLM V to communicate with the operator. Messages containing prompts appear on the video display and assist the operator in setting up the unit operating parameters. The video display is also used by the operator to view the capture buffer contents.

Four video display attributes are used in various combinations:

1. Underline: All receive data characters are underlined when displayed.

2. Blink: Characters with incorrect parity and those with framing errors, as well as CRC, FCS, LRC, and trap characters, blink when displayed.

3. Reverse Video: Selectable characters concurrent with signals RTS, CD, or signals patched to TRIG (+) and (-) connectors are displayed reverse video.

4. Half Intensity: Characters not in sync during synchronous operation are displayed at half intensity.

When the DLM V is operated in the run state, and monitoring data on-line, up to 448 data characters are displayed. In this case, the displayed data is shown on the first 14 lines of the display, and each line is made up of 32 data characters. The last two lines of the 16 line display are reserved for status information such as baud rate, bits-per-character, and code.

When the unit is operated in the halt state, all 14 display lines are available; two additional lines provide binary breakout and X.25 expansion information.

When the unit is in the program mode, line 14 shows the program number, and line 16 on the screen is reserved for entering program control commands. All other lines on the screen are used for program statements. Refer to Section 4 for information on the Program Mode.

2.4.2 Control Keys and Front Panel Indicators

On the front panel are eight control keys that are used to set up and operate the DLM V. Five of the keys are used to place the unit in an operating state, and the remaining three keys are used to control the unit while it is operating in the selected state. The front panel key functions coincide with the keyboard functions wherever the key inscriptions are identical. For example, the MENU SEL key on the front panel performs the same function as the MENU SEL key on the keyboard.

The key or keys used to set the unit to the desired mode can be pressed either at the keyboard or at the front panel. In either case, LED indicators light on the front panel to identify the DLM V setting. Figure 2-4 shows the location of the keys and indicators on the front panel.

Table 2-1 contains a listing of the keys along with a brief description of each key function. The functions described relate to both the keyboard and the front panel keypad. See Figure 2-3 for a view of the keyboard.

Table 2-1. Control Keys and Front Panel Indicators (Part 1 of 2)

KEY LEGEND	INITIAL STATE	FUNCTIONAL DESCRIPTION
RUN HALT	HALT	HALT is the DLM V operating state after initialization or reset. This is also the state used for setting up the unit, viewing the capture buffer contents, and for playing back data from a mass storage unit. RUN is the DLM V on-line operating state. It is the state used to load the capture buffer during passive operations and to send messages during active operations. RUN/HALT is an alternate action key. The DLM V operating state is indicated by the LED that is turned on next to the key on the front panel.
HEX ALPHA	ALPHA	ALPHA is the operating state used to view data in its alphanumeric form. Except for the menu TIMER and OTHER fields, data affected includes contents of the unprotected variable fields, as well as the capture buffer contents. HEX is the operating state used to view data in its two-character, hexadecimal form. Data affected is the same as for the ALPHA state. HEX/ALPHA is an alternate action key. The DLM V operating state is indicated by the LED that is turned on next to the key on the front panel.
LINE PAGE	LINE	This key determines how the contents of the capture buffer are shown on the video display. LINE is the operating state used to scroll capture buffer data shown on the video display, one line at a time, each time a cursor control key is pressed. PAGE is the operating state used to scroll capture buffer data shown on the video display, one page, or 16 lines, each time a cursor control key is pressed. LINE/PAGE is an alternate action key. The DLM V operating state is indicated by the LED that is turned on next to the key on the front panel.

Table 2-1. Front Panel Control Keys and Indicators (Part 2 of 2)

MON OUT	MON	MON is the DLM V passive, or monitor only, operating state; it is the state used to load data into the capture buffer. OUT is the unit active operating state; monitor and output. This state is used to monitor and transmit messages. MON/OUT is an alternate action key; the DLM V operating state is shown by the LED that is turned on next to the key on the front panel.
MENU SEL	Active	MENU SEL (menu select) is used to call a menu when the DLM V is in the halt state, to call the parameter summary page in the run mode, and to page through the menus. In addition, it is used when programming the EEPROM optional code buffer, and in the program mode. MENU SEL is a momentary action key and does not have LEDs next to the key on the front panel.
FIELD SEL	Active	FIELD SEL (field select) is used to change the contents of each of the menu page variable fields during set up of the DLM V. This key is used to delimit messages in the DLM V output buffer, and is also used in the program mode. FIELD SEL is a momentary action key and does not have LEDs next to the key on the front panel.
MSU READ	Active	MSU READ (mass storage unit read) is used to select data from the MSU when it is in use. Pressing the MSU READ key causes the screen to clear and the message **MSU READ** to be displayed at the bottom of the screen. MSU READ is a momentary action key, and does not have LEDs next to the key on the front panel.
HEX OUT	Active	HEX OUT (hexadecimal output) is used to deliver data from the DLM V to an asynchronous serial printer or another special serial ASCII device. Pressing this key causes a special menu to be displayed. The operator then sets up parameters before data is sent to the device. The RUN key must be pressed to send data to the printer. HEX OUT is a momentary action key, and does not have LEDs next to the key on the front panel.

2.4.2.1 RUN HALT Key

The DLM V initializes in the halt state. Pressing the RUN HALT key the first time causes the DLM V to enter the run state, and it either monitors the line (passive operation) or transmits data (active operation) according to the menu parameters selected.

When the DLM V is in the run state, the only other active control keys are HEX ALPHA, MENU SEL, DON'T CARE, and ERROR RESET. In the run state, the ERROR RESET key turns off the BUFF FULL, CRC/LRC ERROR, and PARITY ERROR indicators.

The DLM V mode is indicated by a lit LED next to the RUN HALT key on the front panel.

2.4.2.2 HEX ALPHA Key

The DLM V initializes in the ALPHA (alphanumeric) state with the lower LED, next to the key on the front panel, turned on; refer to Table 2-1. In this operating state, the video display contents are shown as alphanumeric characters, according to the ASCII format. Pressing the HEX ALPHA key the first time causes the displayed data, except for protected fields in the menu pages, to appear as two-character, hexadecimal codes.

2.4.2.3 LINE PAGE Key

The LINE PAGE key determines how the capture buffer contents are shown on the video display when the DLM V is placed in the halt state. The setting of this key is indicated by the LEDs on the front panel.

The DLM V initializes in the LINE state; refer to Table 2-1. This key is used along with the cursor control UP and DOWN keys to scroll data vertically over the video display. When the cursor is positioned at the top of the screen and the cursor control UP key is pressed, data scrolls off the bottom of the screen one display line at a time. At the same time, new data moves onto the video display at the top of the screen.

When the cursor is positioned at the bottom of the screen and the cursor control DOWN key is pressed, data moves off the top of the screen one line at a time, and new data appears on the bottom line of the screen.

In the PAGE state, data is scrolled over the video display on a page-by-page basis. All 16 display lines are replaced on the video display each time the cursor control keys are pressed, and the direction of movement is the same as described for the LINE state.

2.4.2.4 MON OUT Key

The MON OUT key is used to select either the passive (MON) or active (OUT) operating states; refer to Table 2-1. The DLM V initializes in the passive (MON) state, and loads data into the capture buffer after the operating parameters are entered and the RUN key is pressed.

To select the active operating state, press the MON OUT key once. The active operating state enables transmitting messages that are loaded into the DLM V during setup operations. Both monitor and output operations are performed while the unit is in the active state.

The setting of the MON OUT key also determines which menu pages can be displayed. When the key is set to MON, only the menu pages associated with passive operations are displayed. Setting the key to OUT provides the menu output page. The operating state is indicated by a lit LED next to the MON OUT key on the front panel.

2.4.2.5 MENU SEL Key

The MENU SEL key (menu select) is used to call the menu to the screen; refer to Table 2-1. Pressing MENU SEL while the unit is in the run state accesses the parameter summary display. Pressing it a second time shows the data again. Each time MENU SEL is pressed, a menu page appears on the screen, and each successive keystroke causes a new page to appear. This key is also used in programming the EEPROM optional code buffer.

When the DLM V is connected into a communication system, the MENU SEL key is used to call the menu for entering the setup parameters after the unit self-tests are completed. Later, the menu contents can be reviewed, and possibly changed, by placing the DLM V in the halt state and then pressing the MENU SEL key.

This key is also used in the program mode. In this mode, each time the key is pressed, 12 lines of program are displayed on the screen. Refer to Section 4, paragraph 4.3.

2.4.2.6 FIELD SEL Key

The FIELD SEL key (field select) is used to set up and/or enter parameters in the menu page variable fields, and to delimit messages entered in the output buffer unprotected variable field. This key is used when the DLM V is halted, and after the MENU SEL key is pressed; refer to Table 2-1.

Protected fields are shown full intensity on the video display, and they are not user-programmable. Unprotected fields are shown at half intensity on the video display, and are user-programmable. Data is entered into the unprotected fields using the hexadecimal keypad or the keyboard keys.

Pressing the FIELD SEL key causes the contents of the menu variable field at the cursor position to show the next choice available in that field. When the last choice is shown, pressing this key causes the first choice to be displayed again. In effect, the key "rolls" the variable field contents one position each time it is pressed. For example, in the program mode, this key is used to scroll through the command options. Refer to Section 4, Programmability.

2.4.2.7 MSU READ Key

The MSU READ key (mass storage unit read) is used to select data from the mass storage unit (MSU) when this device is connected to the DLM V, rather than from only the capture buffer. Since data from the MSU is first loaded into the capture buffer, the only change in the DLM V operating characteristics is the increase in storage capacity (approximately 800,000 bytes of data) caused by the MSU being connected to the DLM V capture buffer.

The MSU READ key is active only during the halt state.

Pressing the active MSU READ key clears the screen, and an MSU READ message appears on both sides of the screen, just above the status message line.

A second depression of the active MSU READ key returns the DLM V to normal operation; that is, data is read only from the unit capture buffer.

2.4.2.8 HEX OUT Key

The HEX OUT key is used to set up the DLM V for sending data to an external printer or other serial ASCII-compatible device. The HEX OUT key is active when the DLM V is halted; refer to Table 2-1.

Pressing the HEX OUT key causes a special one-page menu to be shown on the video display. The initial parameters can be altered, and the DLM V then functions according to the final menu state. A prompt shown at the bottom of the screen tells the operator how to begin and end print operations.

2.4.2.9 Cursor Control Keys

The cursor control keys consist of four keys labeled with arrows, and a fifth key labeled HOME; see Figure 2-3. These keys are used to move the blinking block cursor from place to place on the video display screen. These five keys are active when the DLM V is in the halt state.

Four of the keys move the cursor one character position in the direction designated by each key legend. Holding any of these keys down for more than a second causes the cursor to move in the direction of the inscribed arrow for as long as the key is held down. The HOME key jumps the cursor to the first available character position at the upper left corner of the screen.

- Viewing Data

  The cursor control keys are functional when the DLM V is halted and there is data in the capture buffer. Pressing the UP key with the cursor located at the top of the video display screen causes data to scroll off the bottom of the screen. Pressing the DOWN key with the cursor at the bottom of the screen causes data to move off the top of the screen.

  How data scrolls off the screen depends upon the setting of the LINE PAGE key.

If the key is set to LINE, then data moves off, and onto, the screen on a line-by-line basis. If the key is set to PAGE, then data moves over the screen on a page-by-page basis; that is, either 448 or 224 characters are moved at a time, depending on the selection shown in the menu Page 2 DISPLAY field.

Pressing the cursor DOWN key moves data over the screen toward the end of the capture buffer, and scrolling stops when the end of the buffer is reached. The cursor UP key moves data over the screen toward the beginning of the buffer. Pressing the cursor HOME key automatically displays data starting at the beginning of the buffer, and the cursor moves to the home position on top of the buffer first character position.

The cursor LEFT and RIGHT keys move the cursor along the line, and these keys can be used to position the cursor over any character shown on the screen.

If the LEFT key is held down for a period longer than approximately a second, the cursor will automatically move off the beginning of the cursor line and index to the end of the next upper line. If the key is pressed long enough, the cursor will reach the home position and stop moving.

Holding down the RIGHT key causes the cursor to move over the screen on a character-by-character basis. In this case, the cursor indexes down the screen and stops at the last character position in the lower right-hand corner.

- Menu Selection

Cursor up or down commands entered while the cursor is located within a menu field will move the cursor to the next upper or lower field.

Cursor left and right commands can be used to move the cursor within, as well as among, menu fields. A left command, given while the cursor is at the first character position of a field, causes the cursor to move to the preceding field. A right command, given while the cursor is at the last position of a field, causes the cursor to move to the first position of the next field.

If the cursor is located within an unprotected variable field (these fields are shown at half intensity on the video display), the cursor moves one character position left or right for each depression of the cursor LEFT or RIGHT key.

- Program Mode

Refer to Section 4, paragraphs 4.2 and 4.3.1.

2.4.3 Keypad on Front Panel

The keypad contains 18 keys; 0 through F, DON'T CARE, and CLEAR; see Figure 2-4. Keys 0 (zero) through F produce hexadecimal codes which are active when the DLM V is halted and in the menu select state, or when using the logging buffers. The 16 hexadecimal keys are used to enter data in the menu unprotected variable fields.

The DON'T CARE key is used to enter characters having no hexadecimal value. The CLEAR key is used to erase characters. The following paragraphs contain information for using these 18 keys. The DON'T CARE and CLEAR keys are also available on the keyboard.

2.4.3.1 Hexadecimal Keys

Up to two entries (keystrokes) can be made when using the hexadecimal keys on the front panel to enter character data into the menu unprotected variable fields. The first keystroke enters a character code corresponding to the key pressed, and that character appears under the cursor. It is a complete character, but it is made up of the four least significant bits (LSBs) of the 8-bit code used by the DLM V. That is, the four most significant bits (MSBs) of the 8-bit code are still 0's (zeros).

After the initial keystroke, four courses of action are possible:

1. Enter a second hexadecimal digit at the cursor position using keys 0 through F.

2. Press one of the cursor control keys, and move the cursor to another character position.

3. Press the DON'T CARE key.

4. Press the CLEAR Key.

Entering a second digit causes the original four LSBs to become the four MSBs of the 8-bit code. The four LSBs change to the value of the second keystroke digit. After the second keystroke, the character shown is the result of the eight bits entered by both keystrokes. The cursor automatically moves to the next position after the second keystroke. Press a second key.

Pressing one of the cursor control keys causes the cursor to move to either a new character position within the unprotected variable field, or to a new variable field. The character entered by the first keystroke remains in the field at the original cursor position.

2.4.3.2 DON'T CARE Key (multifunctional)

Pressing the DON'T CARE key erases the character entered by the first keystroke. At the same time, a "don't care" character having no hexadecimal value is entered, and the cursor automatically moves to the next position. This key is used to program the EEPROM. Refer to paragraph 3.3.1.1 for further information regarding the use of "don't care" characters.

2.4.3.3 CLEAR Key

Pressing the CLEAR key erases all the characters in the unprotected variable field from the cursor position to the end of the field, including the character at the cursor position. The cursor, however, remains at the original position, and new character data can be entered in the field.

2.4.4 Front Panel Error Reset Key, Indicators, and Trigger Connectors

This functional group consists of a key that resets the two error indicators, the buffer-full indicator, and the two trigger connectors; see Figure 2-4. The components of this group are described in the following paragraphs.

2.4.4.1 ERROR RESET Key

The ERROR RESET key is used to turn off the indicators PARITY, CRC/LRC ERROR, and BUFF FULL on the front panel. This key only clears these indicators after they light, to show that the DLM V circuits have detected a character or block check failure, or to indicate that the capture buffer is full.

2.4.4.2 PARITY ERROR Indicator

The PARITY ERROR indicator lights if one or more individual characters fail a parity test. The parity test performed, however, depends upon the selection entered in the menu Page 3 PAR field. Characters that fail the selected parity test and cause the indicator to light are shown blinking on the video display. Pressing the ERROR RESET key only resets the indicator.

During asynchronous operation, however, the PARITY ERROR indicator does not light if a framing error occurs and the trap feature is not selected. Given these two conditions (framing error and no trap set), characters with framing errors are indicated only as blinking characters on the video display; they do not cause the PARITY ERROR indicator to turn on.

2.4.4.3 CRC/LRC Indicator

The CRC/LRC indicator lights if a block check is selected in the menu Page 3 CRC/LRC field, and the block check character(s) calculated by the DLM V does(do) not match the character(s) contained in the block of data captured. The failed characters are shown blinking on the video display. Pressing the ERROR RESET key only resets the indicator.

It is important to note that when using the IPARS code, the CRC/LRC feature must be set to OFF. Otherwise, the unit will function unreliably.

2.4.4.4 BUFF FULL Indicator

The BUFF FULL indicator (buffer full) lights when the capture buffer counter has counted 12K of data characters. The indicator remains on until the ERROR RESET key is pressed; refer to Table 2-1, and to paragraph 2.4.2.7.

2.4.4.5 Trigger Jacks

The TRIG IN (+) & (-) jacks (see Figure 2-5) are used to produce reverse video characters on the video display screen, and to trigger an output message. Circuits in the DLM V detect a positive signal at the TRIG (+) connector and a negative signal at the TRIG (-) connector. The signal transitions are used to initiate and terminate the reverse video attributes. Inputs to the two jacks can be jumpered from any one of the pin jacks on the unit breakout and monitor panel; refer to paragraph 2.4.5.

2.4.5 Interface Breakout and Monitor Panel

The interface breakout and monitor panel is used for checking and modifying signals at the communications interface. This panel is located directly next to the front panel keypad. All of the leads at the RS-232C (CCITT V.24) interface can be accessed through the breakout panel. The panel supports three operations:

1. Patching the signals of the interface leads between the DTE and DCE for test purposes using the supplied jumper cables.

2. Switching the available interface leads to "opened" or "closed" for test purposes.

3. Monitoring the interface lead status using the LED indicators mounted in the front panel.

2.4.5.1 BREAKOUT PANEL Connectors

The breakout panel contains two strips of 25 test points each, wired directly to the communications interface; one connector is labeled DCE (data communication equipment) and the other is labeled DTE (data terminal equipment); see Figure 2-5 and refer to Table 2-2. Pins 9 and 10 of these strips, however, are connected to power supplies in the DLM V, and can be used to force any interface lead to either a positive or a negative state. Both power supplies (the +12 VDC supply connected to pin 9, and the -12 VDC supply connected to pin 10) contain circuitry that protects them if they are connected to ground.

NOTE: The DLM V does not connect the EIA interface frame ground at pin 1 to its own internal frame ground.

The signals of each connector are accessed by plugging jumper leads into pin jacks. Jumper cables are provided with the DLM V and are stored in a pouch. Interface frame ground (EIA pin 1) is not accessible for patching; however, interface ground is available for test purposes at the pin jack located just above the breakout and monitor panel; see Figure 2-5.

2.4.5.2 BREAKOUT PANEL Switches

Three banks of miniature switches (Dip Switches, Figure 2-5) are mounted between the two test strips on the panel. Each switch is designated with a number corresponding to the interface lead connected to the switch. The switches are used during testing to open and close individual lines between the DTE and DCE. As Figure 2-5 shows, no switch is provided for pin 1.

2.4.5.3 BREAKOUT PANEL Indicators

Fourteen LED indicators are mounted next to the breakout panel connectors. Twelve indicators are wired directly to specific interface leads as listed in Table 2-2. Legends next to the indicators identify the interface signal monitored by each LED.

The two remaining indicators are not prewired and are labeled SPARE. These indicators can be connected with jumper wires to any of the panel pin jacks, for monitoring the status of the pin jack signal.

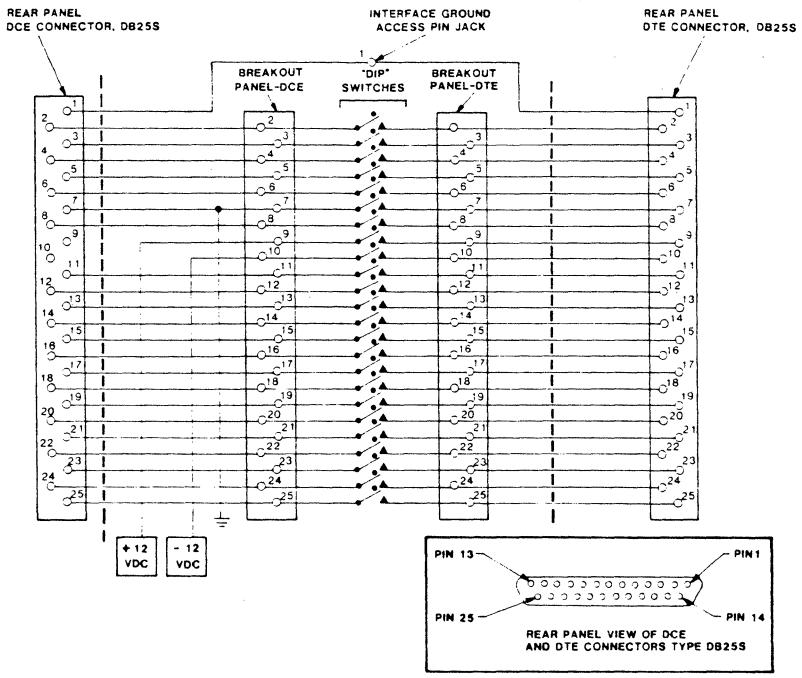


Figure 2-5. Breakout and Monitor Panel: Functional Schematic Diagram

Except for the LEDs connected to interface pins 2 and 3, a minimum of +3 VDC is required to light the indicators, and -3 VDC to extinguish them. In the range between (+) and (-) 3 VDC, their state is undefined. The LEDs connected to pins 2 and 3 require a minimum of -3 VDC to light and +3 VDC to extinguish, and in the range between (+) and (-) 3 VDC, their state is undefined.

Table 2-2. Breakout Panel Indicators and Interface Signals

PIN NO.	SIGNAL	PIN NO.	SIGNAL
PIN 2	SD	PIN 15	SCT
PIN 3	RD	PIN 17	SCR
PIN 4	RTS	PIN 20	DTR
PIN 5	CTS	PIN 21	SQ
PIN 6	DSR	PIN 22	RI
PIN 8	CD	PIN 24	TRC

2.5 REAR PANEL CONNECTORS AND CONTROLS

The rear panel connectors and controls are separated into four functional areas:

1. Monitor (passive) and output (active) connectors that are RS-232C/CCITT V.24 compatible.
2. MSU INTERFACE and HEX OUT connectors.
3. VIDEO and TTL OUT connectors.
4. Operating controls.

The following paragraphs contain functional descriptions of the connectors and controls of each area.

2.5.1 Monitor and Output Connectors; RS-232C/CCITT V.24 Compatible

The monitor and output area consists of two DB-25S connectors; one labeled TO DTE (to terminal equipment), the other TO DCE (to modem); see Figure 2-1. The rear panel connectors are used to connect the DLM V to the communication system for passive and active operations. Both 25-pin female connectors are wired according to RS-232C and CCITT V.24.

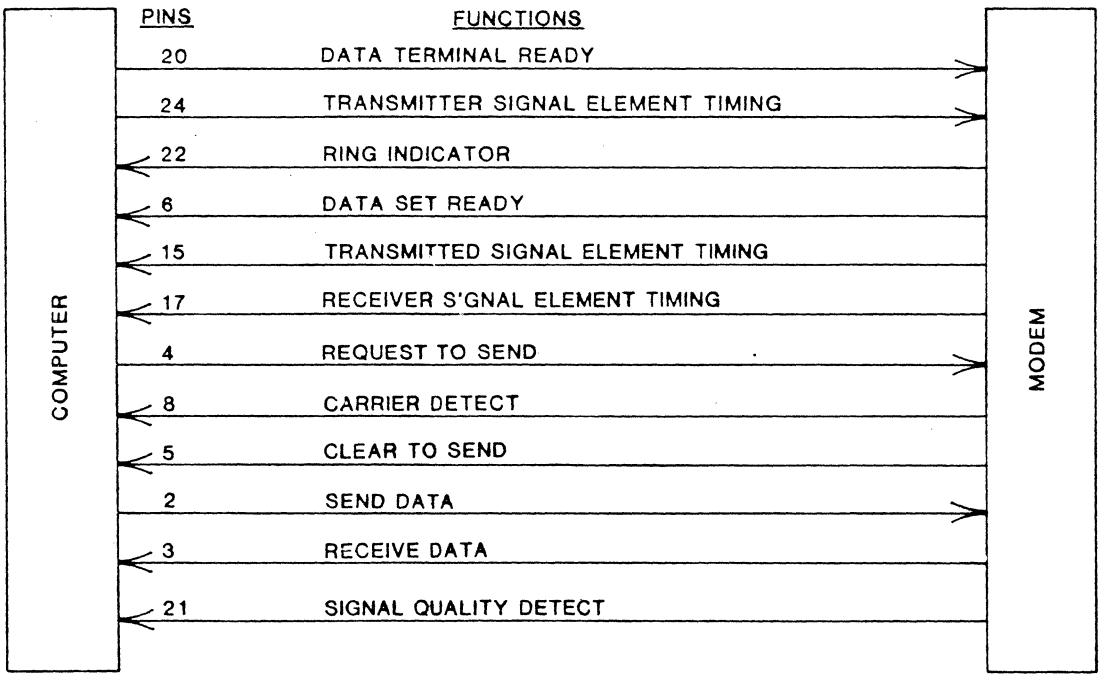


Figure 2-6. EIA RS-232C Flowchart

2.3.2 MSU INTERFACE and HEX OUT Connectors

This area consists of two connectors: a 15-pin connector (DB-15S) labeled MSU INTERFACE, and a 25-pin connector (DB-25S) labeled HEX OUT; see Figure 2-1 and refer to Table 2-3. The MSU INTERFACE connector is wired to provide a TTL-level output signal to an external device for mass storage. The HEX OUT connector is wired to provide an EIA compatible signal output to any printer, or any other device that uses an ASCII compatible asynchronous serial interface (e.g., a tape or disk unit), and acoustic couplers.

Table 2-3. MSU Interface and Hex Output Connectors: Pin Designations

MSU INTERFACE CONNECTOR

EIA PIN NO.	MSU SIGNAL	FUNCTION
PIN 1	TPD0	Data to/from device
PIN 2	TPD1	Data to/from device
PIN 3	TPD2	Data to/from device
PIN 4	TPD3	Data to/from device
PIN 5	TPD4	Data to/from device
PIN 6	TPD5	Data to/from device
PIN 7	TPD6	Data to/from device
PIN 8	TPD7	Data to/from device
PIN 9	WRITE CLK	Timing to device
PIN 10	SIGNAL GND	Ground return
PIN 11	READ CLK	Timing to device
PIN 12	SIGNAL GND	Ground return
PIN 13	TPDS	Write strobe to DLM
PIN 14	READ	Read strobe to DLM
PIN 15	MSU READ	DLM reading disk

HEX OUT CONNECTOR

EIA PIN NO.	HEX OUT SIGNAL	FUNCTION
PIN 3	PTDR	Serial data to device
PIN 6	DSR	Dataset ready
PIN 7	SIGNAL GND	Ground return
OTHER PINS ARE UNASSIGNED		

Signals from the HEX OUT connector can be sent to any destination by setting the parameters in the HEX OUT menu in the DLM V. The unit breakout and monitor panel is then used to provide the necessary signals, or to cross-connect the signals already present, to configure the DLM V output to conform to the receiving equipment input; see Figure 2-5 and refer to paragraph 2.4.5.1.

The manuals for the device being transmitted to (a printer, an acoustic coupler) should be consulted for the configuration of the required signals. Plus and minus 12 VDC levels are available on pins 9 and 10, respectively, of the breakout and monitor panel.

Signals are routed from HEX OUT through the DLM V in the following manner. Place the DLM V in the monitor, or passive, operating mode. Connect the output of HEX OUT to the connector TO DTE, and then connect the receiving equipment to the connector TO DCE.

This procedure is recommended for using the DLM V to send data to a remote site via a communications link.

2.5.3 VIDEO and TTL OUT Connectors

The VIDEO and TTL OUT connectors are standard BNC connectors; see Figure 2-1. The VIDEO connector provides an RS-170 compatible, composite video signal. This is used to go to an external video display. The TTL OUT connector supplies a positive, TTL-compatible marker pulse (of approximately five microseconds duration) when circuits in the DLM V detect a parity error, CRC/LRC error, satisfaction of a trap condition, or when the ERROR RESET key is pressed.

2.5.4 Operating Controls

The operating controls area (see Figure 2-4) includes the video display BRIGHTNESS control, the unit SELF-TEST and POWER ON/OFF switches, and the voltage select slide switch. A fuseholder is mounted near the POWER switch.

2.5.4.1 BRIGHTNESS Control

The BRIGHTNESS control is used to vary the video display intensity, but it can also be used to improve (fine tune) the display contrast.

2.5.4.2 SELF-TEST Switch

CAUTION

USE THIS SWITCH ONLY IF A FAULT IS SUSPECTED IN THE DLM V. A SELF-TEST IS PERFORMED, ALL MEMORY LOCATIONS ARE USED, AND ALL THE MENU VARIABLE FIELDS ARE RESET TO THE POWER-UP CONDITIONS, WITH THE EXCEPTION OF PARAMETERS SET IN THE EEPROM. DURING THE SELF-TEST, CAPTURE BUFFER DATA IS REPLACED WITH TEST DATA.

The SELF-TEST switch is recessed in the DLM V rear panel. Pressing this momentary action switch starts the unit diagnostic routine, and the microprocessor executes the same program that is used when the DLM V is first turned on.

2.5.4.3 Operating Power Controls

The following paragraphs contain functional descriptions of the DLM V operating power controls. Paragraph 2.2 contains instructions for changing the voltage select switch setting and the contents of the fuseholder.

The voltage select slide switch is used to configure the DLM V power supply for operation at either 115 or 220 VAC. Set the slide switch to the position corresponding to the operating voltage available; refer to paragraph 2.2.

The POWER switch is used to apply operating power to the DLM V. The unit can operate using 115 VAC, 50 or 60 Hz; or using 220 VAC, 50 or 60 Hz. Any combination of voltage and frequency can be used if the correct fuse is installed in the fuseholder, and the voltage select switch is positioned to the proper setting.

The fuseholder must contain a 1.5A slow blow fuse if the DLM V is operated using a source of 115 VAC. If a 220 VAC source is used, then the fuseholder must contain a 0.75A slow blow fuse.

A frequency select plug is used to configure the DLM V video display refresh-circuitry for operation at either 50 or 60 Hz. Unless otherwise specified by the customer, the plug is set at the factory based on the shipping destination of the unit. If the unit is to be reconfigured, the plug must be rotated to the proper orientation. The frequency select plug is located inside the unit, on the large central processing unit printed circuit board; see Figure 2-2.

If no unique configuration is specified by the customer when the DLM V is ordered, units shipped to destinations in North America are configured to operate using a source of 115 VAC at 60 Hz, and units shipped outside of North America are configured to operate using 220 VAC at 50 Hz. However, operators can change the configuration at any time using the functional descriptions provided in this paragraph, along with the directions contained in paragraph 2.2.

SECTION 3
OPERATION

3.1 INTRODUCTION

This section describes how to prepare the DLM V for communications network testing. The unit uses menu pages to provide the operator with lists of the unit operating parameters during setup for test operations. Included in this section are instructions for interfacing the DLM V with the communications network, and for selecting among the menu operating parameters.

3.2 POWER-UP PROCEDURES

Set up the DLM V on a flat, clean surface with the backpanel easily accessible. Any cables hooked to the unit should be carefully placed so that they do not get disconnected or damaged.

Cables and manuals can be kept in the DLM V black vinyl accessories pouch on top of the unit. The following items are included:

1. The DLM V Operator's Instruction Manual.
2. Patch cords for the breakout and monitor panel.
3. The RS-232C cable (if the option is purchased).
4. The six-foot coiled keyboard cable (if the option is purchased).

If the long keyboard cable is used, remove the three-inch cable (standard) from the keyboard and replace it with the six-foot cable (optional). The cables are replaced in the same way as a modular telephone cable. Place the smaller cable in the accessories pouch.

The six-foot keyboard cable should not be left attached to the keyboard if the unit is to be latched up; it does not fit properly inside. The cable should be removed and stored in the accessories pouch; otherwise, there is no guarantee that it will not get damaged.

NOTE: Do not replace the keyboard cables when the unit is powered on and monitoring data. The DLM V performs a reset each time the cable is disconnected, and any data on the screen will be lost.

Do not overstuff the accessories pouch, or put sharp objects inside it that might rip or tear the vinyl. Do not place materials inside the pouch that could stain or corrode the vinyl.

If the DLM V is transported on an airplane, it should not be checked in as regular baggage, unless it is placed inside a carrying case. The carrying case is available as an option. Placing the DLM V in the baggage compartment with heavier cargo could cause damage to the unit, without the protection of the special case.

3.2.1 Interface Connections

The DLM V is connected to a communication system between the terminal equipment (DTE) and communications equipment (DCE). Power can be applied to the DLM V before it is connected to the system; however, for illustrative purposes, the following paragraphs describe applying power after connecting the unit.

All system interface connectors are located on the DLM V rear panel; see Figures 2-1 and 3-1, and refer to paragraph 2.5. The terminal equipment connects to the DLM V at the connector TO DTE, and the communications equipment at the connector TO DCE. Both connections are made through EIA interface cables. After these two connections are made and the DLM V is operating in the passive state, it is essentially transparent to the line (see Figure 3-1), and data flows through the unit without being modified.

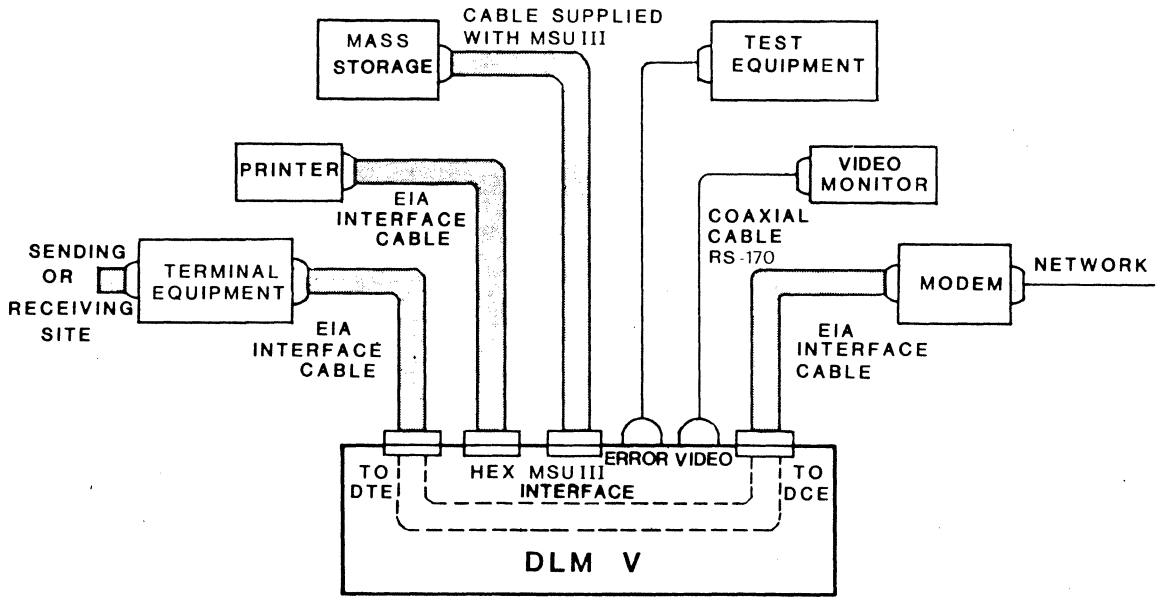


Figure 3-1. System Interface and External Equipment Cable Connectors

If a printer or other serial ASCII device is used with the DLM V, it is connected to the DLM V at the HEX OUT connector via a standard EIA RS-232C cable. The MSU INTERFACE connector is used to connect a mass storage device, any model of the DIGILOG MSU (Mass Storage Unit), to the DLM V.

Coaxial cables, terminated with standard BNC connectors, are used to connect test equipment and a video monitor to the TTL OUTPUT and VIDEO connectors, respectively. The TTL OUTPUT connector provides a TTL-compatible pulse to test equipment when a parity or CRC error is detected, a trap sequence occurs, or the ERROR RESET key (located on the DLM V front panel) is pressed. The VIDEO connector provides a standard RS-170 composite video output signal to as many as 10 monitors, located up to 1500 feet from the unit, with the last monitor in line having a 75-Ohm resistance setting.

3.2.2 Applying Power

Set the rear panel POWER switch to ON. The DLM V automatically performs a lamp test of all LEDs, except those on the breakout panel.

The DLM V performs diagnostic tests at power-on time. The following paragraphs explain those tests.

3.2.2.1 Power-on Diagnostics

The DLM V is programmed to perform a series of diagnostic self-tests each time its power is turned on. If the tests are successfully completed, the following message (with blinking prompt) appears on the video display:

PASSED DIAGNOSTICS X
DEPRESS MENU SEL TO CONTINUE

(X is the software revision level)

If the diagnostic tests are not successfully completed, there are three possible error conditions:

1. The unit RAM (Random-Access Memory) failed
2. One or more of the unit's five PROM (Programmable Read-Only Memory) chips failed
3. The programmable EEPROM (Electrically Eraseable Programmable Read-Only Memory) failed

If any of these three conditions exists, an error message is displayed on the screen. An error message is always followed by the message:

ERROR IN DIAGNOSTICS
DEPRESS MENU SEL TO CONTINUE (blinking prompt)

If a RAM failure occurs, the following error message appears briefly on the screen:

LOCATION = XXXXH

THE BITS READ BACK = XXXXXXXX

DEPRESS "MENU SEL" TO CONTINUE (blinking prompt)

The legend after the LOCATION title represents the memory location, in hexadecimal notation, at which a fault was detected. The DLM V displays a byte next to the BITS READ BACK legend; a 1 (one) in any position within a byte represents the specific bit or bits where the error was found.

A RAM error does not mean that the unit cannot be used; however, a RAM failure may cause an incorrect indication during system testing. If the RAM error is displayed, have the unit repaired as soon as possible.

If there is a problem with a PROM, the following message is displayed on the screen:

PROM CHECKSUM ERROR AT PROM X

The X represents a number from 1 to 5. Those are the numbers assigned to the PROMs.

The DLM V also performs a reliability test on the EEPROM. If the EEPROM is faulty, the DLM V either powers on with the variable field in each menu set to default values, or it displays an error message on the screen. Refer to paragraph 3.7.1 for more information.

3.3 THE MENU PAGES

The following paragraphs discuss all the operational aspects of the DLM V. An in-depth view of each menu page will be given. Each description is supplemented by representative illustrations. The descriptions assume that the menu fields have not been changed from the default values by programming the EEPROM. It is also assumed that all menus are enabled in the Menu Display Inhibit Menu; refer to paragraph 3.3.3.

3.3.1 General Information

All screens contain protected and unprotected variable fields that provide a variety of operating parameter choices. The FIELD SEL key is used to page through the options in each menu page.

In unprotected variable fields, data characters can be entered using the front panel keypad or the keyboard. These fields are displayed at half intensity. At initialization (power-up or reset), they contain either "don't care" characters, or the operator-programmed parameters set in the EEPROM.

A blinking block cursor is used during the menu select operation and appears at the first character position in the menu Page 1 first variable field (SPEED). A message displayed at the bottom of the screen prompts the operator to press the FIELD SEL key to select the next parameter available in the field containing the cursor.

3.3.1.1 Don't Care Characters

The DLM V uses "don't care" characters for several purposes, and their meaning depends upon their use. One application of "don't care" characters is to provide video blanks (spaces) on the screen between displayed data characters. The video blanks used to separate the capture buffer data have no hexadecimal or time value; they are inserted by the DLM V only to make the display easier to read.

"Don't care" characters are also used to provide a timing relationship between data characters, in a stream of data captured by the DLM V. When capture buffer data is displayed, using either the "FDX EXP" or "FDX COMP" (full-duplex compressed) features, gaps may occur in the stream of data. A period between transmitted characters, when no data is received by the DLM V capture buffer, is indicated on the screen by a space between the displayed characters. In "FDX EXP" operation, spaces occur in addition to spaces inserted, expanding the display for easier viewing. Spaces used to indicate gaps in received data have time value in the data stream, but no hexadecimal value. Spaces are also formed by "don't care" characters generated within the DLM V, and inserted between the capture buffer characters sent to the unit video display circuitry.

"Don't care" characters are also used in the unprotected variable fields of the menu to signal the DLM V circuits that no data has been entered in the field. For example, menu fields SYNC, OUT SYNC, and TRAP contain "don't care" characters that appear as video blanks when the DLM V is initialized (if the EEPROM is not programmed with other data). The DLM V treats the "don't care" characters as characters having no hexadecimal value.

NOTE: In some cases, characters other than "don't cares" must be inserted in a field for proper operation. If the DLM V is configured for synchronous operation, it cannot synchronize with the system unless valid characters are inserted in the SYNC field. Unsynchronized data is shown half intensity on the screen, indicating that the DLM V is not in "sync" with the line.

"Don't care" characters can also have an important positional value ir relation to the data stream; for example, when they are used in the menu Page 5 TRAP field. The DLM V interprets this field on a character-by-character basis from right to left; that is, the field is right-justified; see Figure 3-2. When the trap feature is selected, the DLM V searches the line for the exact sequence of characters contained in the TRAP field. In the example shown in Part 1 of Figure 3-2, the trap event takes place when the character sequence ABC occurs on the line. However, in the example shown in Part 2 of the figure, the trap takes place when sequence A_BC occurs. In this case, character _ can be any character in the system code since _ is a "don't care" character entered by the operator.

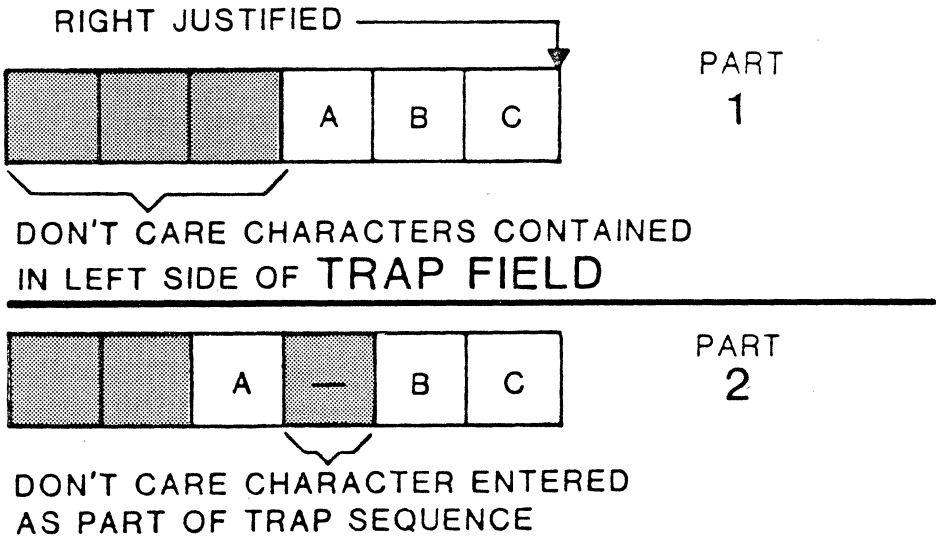


Figure 3-2. "Don't Care" Characters; Trap Field Illustration

In the DLM V output menu Page 6, "don't care" characters are used to indicate unprotected variable fields. They are significant if left in the field when the RUN key is pressed. For example, when the CLEAR key is pressed while the cursor is at the beginning of the SEC field, this field is blanked out and disabled. However, if the SEC field is filled with zeros (0's), the DLM V then transmits messages with a minimum time delay between contiguous messages; that is, no longer intermessage time than one character duration at the current baud rate.

In the BUFFER field, "don't care" characters can be entered within a message to insert spaces between characters in the buffer. These spaces do not occur between characters when the message is transmitted; however, the spaces allow the operator to alter the message at a later time by inserting data characters in their place.

In the OUT FOX field, "don't care" characters can be entered either within the header or trailer segments, or behind data already entered in these two segments. Header and trailer character data is right-justified. As a result, if the right-most character in these fields is a "don't care" character, it has no time or hexadecimal value in the transmitted message. Later, the operator can enter data characters in these spaces to alter the header or trailer information.

After a character has been entered in multicharacter, unprotected variable fields, the cursor automatically moves to the next character position within the field. The cursor moves to the first character position of the next variable field, protected or unprotected, when the last available character position within a field is filled.

Moving the cursor from field to field does not change or destroy the menu field contents. Parameters can be changed, and/or data can be entered while paging through the menu. These selected parameters can be saved in the unit EEPROM so that they are set each time the unit is powered on. However, the DLM V operating program does not change until the DLM V operating state is changed from either run to halt, or halt to run.

3.3.2 Menu Contents: Page 1

After the self-tests are completed, press the MENU SEL key to view the first screen. The first menu page is the Protocol Selection Menu. See Figure 3-3 for a representative illustration.

Five different setups can be saved and recalled by the setups made in this menu. A setup is the collection of parameters made in other menus, grouped under one name. For example, setup 2 could be set for a system that operates at 1200 baud, in the asynchronous mode, with eight bits per character. This setup could be named "1200 async."

Choose a simple name, relevant to the setup; it is easier to remember than an unrelated name. Setup 3, for example, could be made for a system operating in X.25 HDLC at 9600 baud, also with eight bits per character. Setup 3 could be named "9600 X.25 hdlc".

Once each setup is programmed, it is not erased when the DLM V is powered down. Step-by-step procedures on how to program a setup are included in the paragraphs to follow.

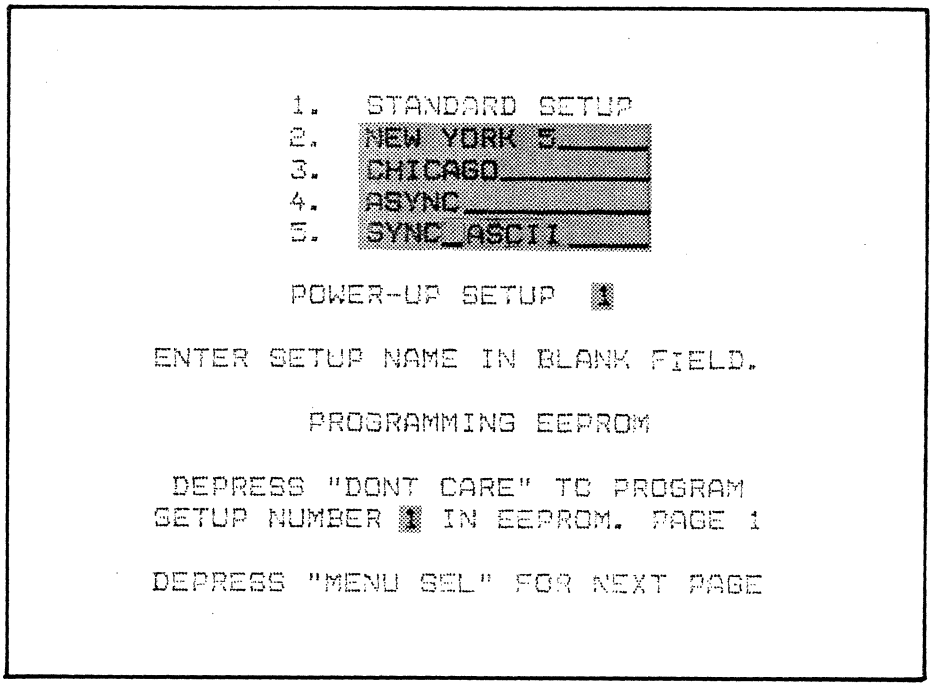


Figure 3-3. Menu Page 1: Representative Illustration

Setup 1 is titled "STANDARD" from the factory, and it is set for the other menu default values for each field. The remaining four setups can be named by the user through the keyboard or the front panel keypad. Although setup 1 is named "STANDARD", parameters can be changed. However, the "STANDARD" setup is the only one where the OUTPUT and the printer menus are saved and recalled (refer to paragraphs 3.3.8 and 3.7) The remaining four setups do not have that capability.

Aside from the "STANDARD" setup, there are four 14-character blank variable fields next to the numbers on the screen. The operator-selected setup names are entered in those fields. The numbers represent the setup numbers.

Next to the legend, "power-up setup", there is a one-character field. In this field the operator selects the setup number by using the FIELD SEL key. Pressing this key sequences through the setup numbers as follows: 1, 2, 3, 4, and 5.

The last variable field is part of the instructions on how to program a setup. Selecting the setup number is also done by pressing the FIELD SEL key.

To program a setup, the steps are as follows:

1. Use key MENU SEL to access other menu pages. Enter the selections using the FIELD SEL key.

2. Return to the protocol selection menu using the MENU SEL key. Move the cursor to the first blank line. If no setup has been previously programmed, the cursor appears at the first character space of setup 2.

3. Choose a name for the setup, and enter it in the blank field.

4. Use the cursor control keys to position the cursor in the last variable field on the screen. Be sure that the number matches the line chosen in step 3. Do not select a blank line.

5. Press the DON'T CARE key.

6. The flashing message **PROGRAMMING EEPROM** appears on the screen.

7. When the message disappears, the EEPROM is programmed.

The setup number in the one-character field at the bottom of the screen must coincide with the setup number assigned. Otherwise, the EEPROM will not program, even though the programming message appears on the screen. In addition, always assign a name to a setup number, or else the message **SETUP NAME BLANK** flashes on the screen.

The variable field next to the **POWER-UP SET-UP** legend on the menu is used to access a setup after initialization or reset time. To access a setup, place the cursor in the field, and use FIELD SEL to select the number that corresponds to the setup. Once this is accomplished, press the MENU SEL key to continue operations.

A setup is erased by deleting the setup name and turning the unit off.

3.3.3 The Menu Display Inhibit Menu

The Menu Display Inhibit menu is the second page that appears when pressing the MENU SEL key. It is used to control the display of menu pages on the screen. See Figure 3-4 for a view of this menu page.

There are six fields in this menu, each one associated with a menu. Two choices are available in each field; they are "no" and "yes." The "no" option is the default.

Setting a field to "yes" disables the display of a menu. For example, selecting "yes" next to the legend **INHIBIT MENU PAGE 6** will disable the display of menu Page 6. Setting the field back to "no" allows the menu to be displayed. The options are selected using the FIELD SEL key.

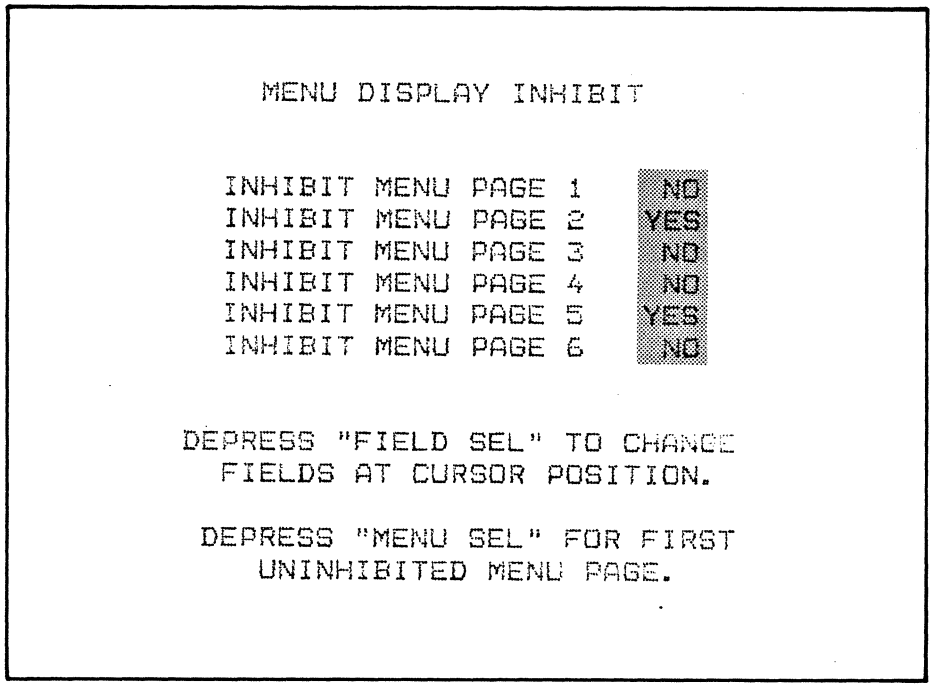


Figure 3-4. Menu Display Inhibit Menu; Representative Illustration

Some menus are not used to perform certain tasks. Suppose, for example that the third and fourth menus are never used.

Rather than page through the six menus each time that the unit is used the operator can page to the Menu Display Inhibit menu, position the curso next to INHIBIT MENU PAGE 3 and INHIBIT MENU PAGE 4 fields, and change the from "no" to "yes." Once "yes" is chosen, the menu pages are not displaye when the operator scrolls through the menus. To enable the third and fourt menu pages, the fields in the Menu Inhibit Display menu must be changed bac to "no." Selections made in this menu page can be part of a setup and save in the EEPROM.

3.3.4 Menu Contents: Page 2

The following paragraphs detail menu Page 2. A description of each variable field is supplied along with tables on X.25 packet types and frame types. Refer to Figure 3-5 for a representative illustration of menu Page 2.

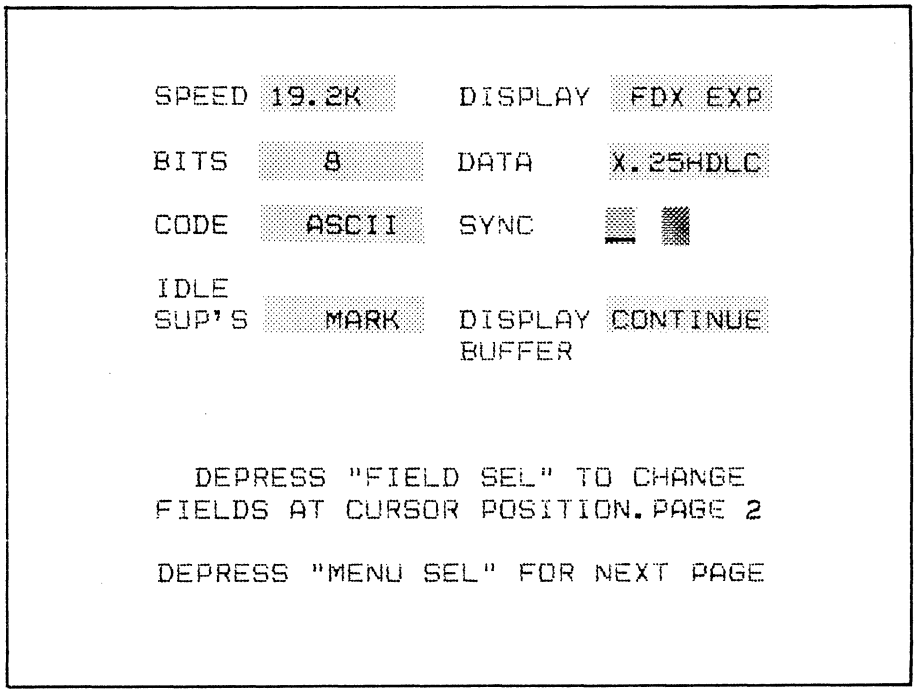


Figure 3-5. Menu Page 2: Representative Illustration

SPEED

The DLM V initializes to 2400 baud, and parameters available are:

50	134.5	600	1800	3600	9600	OTHER
75	150	1050	2000	4800	19.2K	
110	300	1200	2400	7200	EXTERNAL	

"Other" is displayed in an unprotected variable field, and parameter data is entered in the field using the numeric keys on the keypad, or on the keyboard. Any speed parameter that is a multiple of 1 and greater that 28 baud can be entered; however, there are upper limits on the baud rate data entered into this field.

The DLM V operating mode defines the upper limit of the baud data entered into "other" by the operator. In the monitor (passive) mode, the upper limit is 59,999; and in the output (active) mode, the limit is 19,999. In both cases, if a number exceeding the upper limit is entered into the field, the error message **SPEED TOO HIGH** is displayed when the RUN key is pressed.

The DLM V supplies its own character timing when operated in all parameters but "external". If the "external" option is selected, timing (clocking) must be provided to the DLM V by the data communication equipment.

NOTE: If a modem is supplying clocking on pins 15 and 17, "ext" should be selected regardless of the baud rate.

DISPLAY

If the default values are not changed by programming the EEPROM, the DLM V initializes to "fdx exp" (full duplex expanded, see Figure 3-5), and the parameters available are:

FDX EXP.....Full duplex expanded; 224 characters are displayed and separated by video spaces that are "don't care" characters, for easier reading. Transmit and receive data is shown on separate lines; receive data is underlined.

FDX COMP....Full duplex compressed; 448 characters are displayed side-by-side. Transmit and receive data is shown on separate lines; receive data is underlined.

HDX.....Half duplex; both transmit and receive data is displayed on the same line. Receive data is displayed underlined.

SEND.....Send only; transmit data displayed are characters at pin 2 of the EIA interface.

RECEIVE.....Receive only; receive data displayed are characters at EIA interface pin 3. Receive data is displayed underlined.

EXP FRM.....X.25 frame level data expansion. X.25 stripped receive and transmit data is displayed on the screen at the frame level. Frame addresses are identified; frame type, send and receive frame sequence numbers, and poll final bits are listed on a special screen.

EXP PKT.....X.25 packet level data expansion. X.25 stripped receive and transmit data is displayed on the screen at the packet level. Packets are identified; packet type, modulo type, send and receive packet sequence numbers, logical channel number, and qualifier and delivery confirmation bits are displayed on a special screen.

The data screen is accessed by sequentially pressing the MENU SEL key past menu Page 6. The data appears on the screen depending on the option set in the DISPLAY field; see Figure 3-5. The cursor can be moved on this screen by using the cursor control keys on the unit keypad or keyboard.

The data screen provides the binary readout of any character at the cursor position on the bottom of the screen. The selected character is listed as being either send or receive data (DTE or DCE, respectively). In codes with less than eight bits, the bits are shown right-justified, with the unused bit locations set to zero (0).

In addition, when the selected code is X.25 HDLC or X.25 BSC, the screen also displays other parameters pertaining to that particular character. Pressing the FIELD SEL key while accessing the data, allows the operator to obtain information about the data at the frame level or at the packet level. For example, when the option "frame" is shown in the highlighted area at the bottom of the screen, the frame type, transmitter sequence receive and send counts, and the poll final bit setting are listed on the screen.

- Autosearch

  The DLM V incorporates an autosearch feature that searches for the beginning of each X.25 protocol data packet and frame. The display mode selected on menu Page 2 should be <u>other than</u> the "exp frm" or "exp pkt" options. To use the autosearch feature, proceed as follows:

  1. Press the MENU SEL key to view the data screen.

  2. Press the RUN/HALT key to stop the data from running.

  3. Press the FIELD SEL key to select the frame or packet automatic search. A highlighted legend at the bottom of the screen indicates the selection.

  4. Press the cursor right key to start the search.

  5. The cursor automatically stops at the beginning of the frame or packet (depending on the selection). Receive and send data are selected alternately.

  Information relating to the frame or packet is shown on the last line of the data screen display. For example, when the option "frame" is shown in the highlighted area at the bottom of the screen, the frame type, transmitter sequence receive and send counts, and the poll final bit setting are listed on the screen. When the option "packet" is highlighted, information such as the logical channel number, type of packet, and packet number is listed on the last line of the screen.

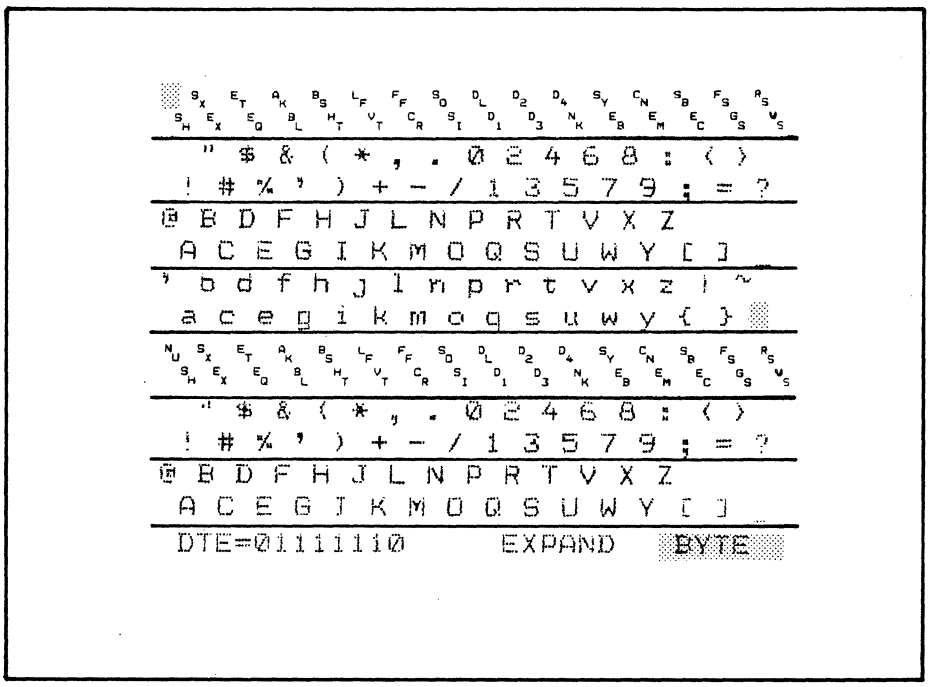


Figure 3-6. Selectable Video Display Parameters:
Part 1, Full Duplex Expanded (Alphanumeric)

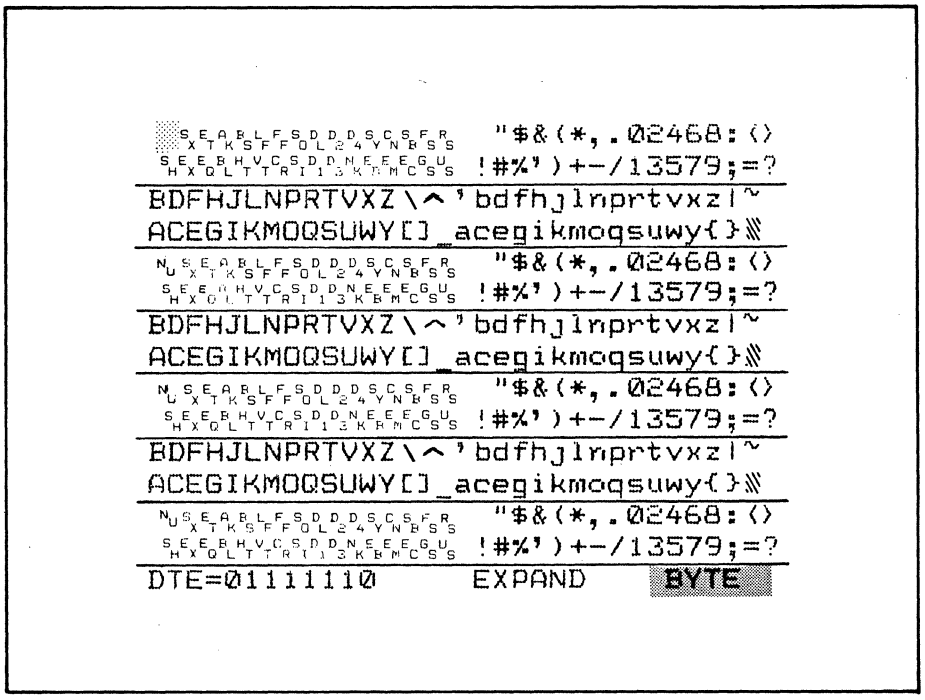


Figure 3-6. Selectable Video Display Parameters:
Part 2, Full Duplex Compressed (Alphanumeric)

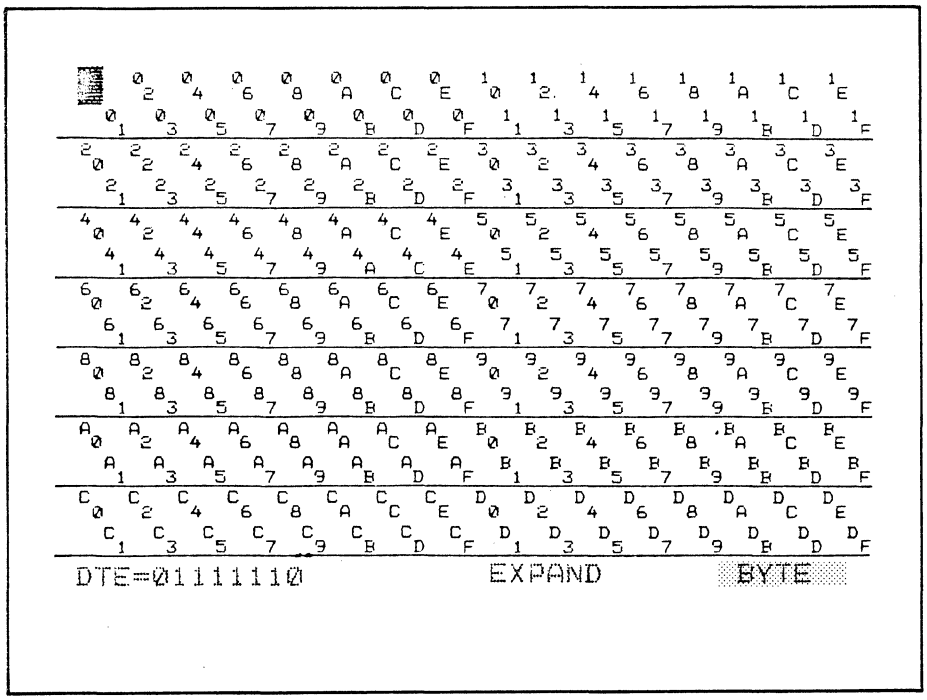


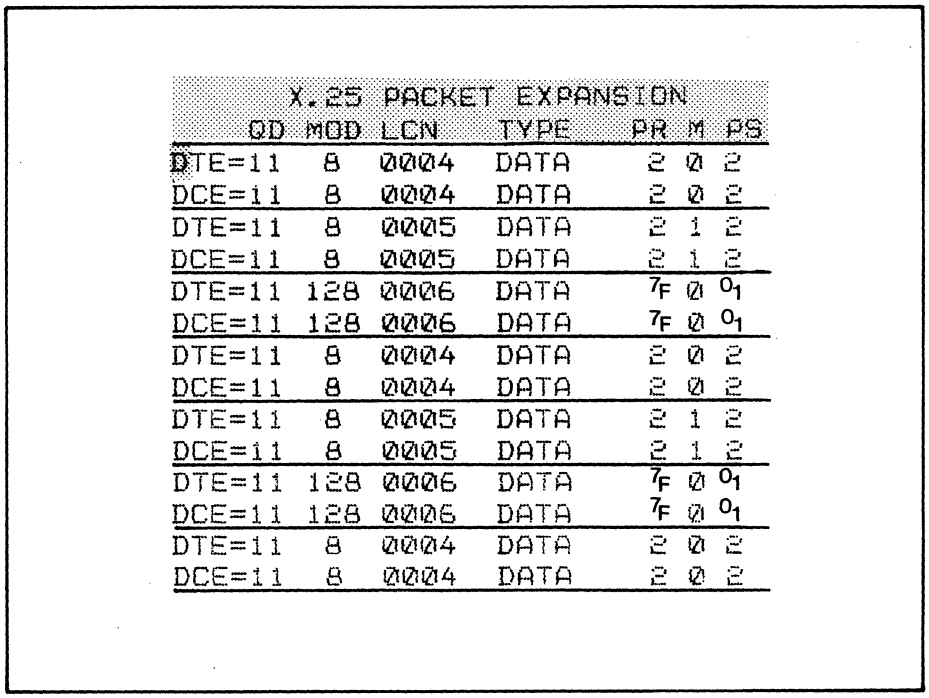
Figure 3-6. Selectable Video Display Parameters: Part 3, Full Duplex Expanded (Hexadecimal)

- Packet Level Data Screen

A special screen is reserved to examine the data, fully expanded, at the packet level. To examine data at the packet level, set the DISPLAY field in menu Page 2 to option "exp pkt". The packet expansion screen appears after menu Page 4 (if in the monitor mode) or after menu Page 5 (if in the output mode), as the operator sequentially presses the MENU SEL key.

The DLM V uses a time-correlated display on which X.25 mnemonics are listed on a horizontally split screen. The receive data line (DCE) is underlined; the transmit data line (DTE) is not underlined. Pressing the RUN key when viewing this screen causes the data screen to scroll one or two lines at a time, depending on the type of data being monitored. Pressing the HALT key clears the screen of data.

The following paragraphs contain information relating to the packet level, X.25 data expansion screen. See Figure 3-7 for a representative illustration. Appendix C contains a list of the industry standard X.25 abbreviations listed in alphabetical order.



X.25 PACKET EXPANSION

QD	MOD	LCN	TYPE	PR	M	PS
DTE=11	8	0004	DATA	2	0	2
DCE=11	8	0004	DATA	2	0	2
DTE=11	8	0005	DATA	2	1	2
DCE=11	8	0005	DATA	2	1	2
DTE=11	128	0006	DATA	7_F	0	0_1
DCE=11	128	0006	DATA	7_F	0	0_1
DTE=11	8	0004	DATA	2	0	2
DCE=11	8	0004	DATA	2	0	2
DTE=11	8	0005	DATA	2	1	2
DCE=11	8	0005	DATA	2	1	2
DTE=11	128	0006	DATA	7_F	0	0_1
DCE=11	128	0006	DATA	7_F	0	0_1
DTE=11	8	0004	DATA	2	0	2
DCE=11	8	0004	DATA	2	0	2

Figure 3-7. X.25 Packet Level Data Expansion Screen: Representative Illustration

- QD
  This legend seen on the packet expansion screen represents two separate pieces of information. The "Q" identifies the qualifier bit in the packet; the "D" identifies the delivery confirmation bit.

- MOD
  This legend stands for "modulo"; this term refers to the base of the packet number being sent or received over the communications line. The modulo most commonly used is 8; however, the DLM V has the capability to support a modulo of 128, CCITT undefined, or expanded.

- LCN
  The legend "LCN" stands for "Logical Channel Number." The DLM V uses hexadecimal notation, in a range between 0 and FFF, to represent the logical channel number. If the DLM V is set for the alphabetic display, a number ranging between decimal 0 and 4095 is displayed beneath the LCN heading. LCN 0 (zero) is reserved for network diagnostics.

- TYPE
  This title identifies the type of packet being monitored on the line. The following table helps the operator identify the different packet types; refer to this table as needed.

Table 3-1 divides the packet types into four major categories; the category names are found on the left-hand side of the table. The packet types are also divided according to the direction in which data transmission is taking place (from DCE to DTE or from DTE to DCE).

The noticeably highlighted and capitalized characters within each listed packet type represent the mnemonics seen on the screen. If for example, a mnemonic is RST IND listed on a DCE line (underlined), Table 3-1 shows that the packet is a restart indicator.

Table 3-1. X.25 Packet Types

TYPE	DCE → DTE (underlined)	DTE → DCE
CALL SETUP and CLEARING	**IN**coming **CALL** **CALL CONN**ected **CLEAR IN**Dication DCE **CLEAR CONF**irmation	**CALL REQ**uest **CALL AC**Cepted **CLEAR REQ**uest DTE **CLEAR CONF**irmation
DATA and INTERRUPT	DCE **DATA** DCE **INT**errupt **IN**Dicator DCE **INT**errupt **CONF**irmation	DTE **DATA** DTE **INT**errupt **REQ**uest DTE **INT**errupt **CONF**irmation
FLOW CONTROL and RESET	DCE **R**eceive **R**eady DCE **R**eceive **N**ot **R**eady DCE **REJ**ect **RESET IN**Dication DCE **RESET CONF**irmation	DTE **R**eceive **R**eady DTE **R**eceive **N**ot **R**eady DTE **REJ**ect **RESET REQ**uest DTE **RESET CONF**irmation
RESTART and DIAGNOSTIC	**ReST**art **IN**Dication **ReST**art **CONF**irmation **DIAGNOSTIC**	**ReST**art **REQ**uest **ReST**art **CONF**irmation **DIAGNOSTIC**

- PR
  PR stands for $P_{(r)}$; the subscript (r) represents the packet number to be received.

- M
  The M stands for the MORE data bit. If the number under this title is one (1), more data for this packet is expected.

- PS
  PS is the abbreviation for $P_{(s)}$; the subscript (s) is the packet number to be sent.

- Frame Level Data Screen

Another special screen is reserved for X.25 data; the frame expansion screen. This screen is used when the operator wishes to examine the stripped data at the frame level. This is accomplished by setting the DISPLAY field in menu Page 1 to the "exp frm" option.

As with the packet expansion screen, data is stripped, and mnemonics are listed horizontally on the screen; the mnemonics are listed under headings to provide the operator with information about the communications line. Receive data is underlined and is labeled "DCE". Transmit data is not underlined and is labeled "DTE". The following paragraphs describe each heading and the mnemonics viewed on this screen. See Figure 3-8 for the appearance of this screen. Appendix C contains a more detailed list of the industry standard abbreviations used with X.25.

X.25 FRAME EXPANSION

ADDRESS	TYPE	N(R)	P/F	N(S)
DCE= Ø1	INFO	3	Ø	3
DCE= Ø1	INFO	1	Ø	1
DCE= Ø1	INFO	2	Ø	2
DCE= Ø1	INFO	3	Ø	3
DCE= Ø1	INFO	1	Ø	1
DCE= Ø1	INFO	2	Ø	2
DCE= Ø1	INFO	3	Ø	3
DCE= Ø1	INFO	1	Ø	1
DCE= Ø1	INFO	2	Ø	2
DCE= Ø1	INFO	3	Ø	3
DCE= Ø1	INFO	1	Ø	1
DCE= Ø1	INFO	2	Ø	2
DCE= Ø1	INFO	3	Ø	3
DCE= Ø1	INFO	1	Ø	1

Figure 3-8. X.25 Frame Level Data Expansion Screen: Representative Illustration

- ADDRESS

The ADDRESS heading refers to the X.25 frame address; this address is either 01 or 03. In X.25, 03 corresponds to the letter A, and 01 corresponds to the letter B. A and B can be either commands or responses; the assignments depend on the direction in which communications are taking place (i.e., DTE to DCE or vice-versa).

- TYPE

TYPE refers to the type of frame monitored through the DLM V. When monitoring frame level stripped data, the operator will find an abbreviation under the TYPE heading. Any abbreviation appearing on the screen is included in Table 3-2. The highlighted areas indicate the mnemonics seen on the screen.

Notice that RR, RNR and REJ are the same whether the frame is a command or a response. RR, RNR and REJ are either commands or responses, depending on the direction in which data transfer is taking place.

Table 3-2. X.25 Frame Types

INFORMATION TRANSFER	SUPERVISORY	UNNUMBERED
COMMANDS: **INFO**rmation Frame	**RR** Receive Ready **RNR** Receive Not Ready **REJ** Reject	**SABM** Set Asynch. Balanced Mode **DISC** Disconnect
RESPONSES:	**RR** Receive Ready **RNR** Receive Not Ready **REJ** Reject	**DM** Disconnected Mode **UA** Unnumbered Acknowledge **FRMR** Frame Reject

- N(R)

This title stands for $N_{(r)}$, which is the transmitter sequence receive count (the next expected frame to be received).

- P/F

This title stands for the poll final bit. The bit is set to 0 (zero) or to 1 (one).

- N(S)

This title stands for $N_{(s)}$ which is the transmitter sequence send count.

Pressing the RUN key causes the data shown on this screen to scroll a line or a page at a time. How data scrolls depends on how the LINE PAGE key is set. Press the HALT key to clear the data screen of data and to restore the heading.

BITS

The number in this field determines the number of bits per character, with parity, used by the DLM V. The DLM V is shipped to initialize using 8-bit characters, and parameters available are:

5	7	9	NOTE: STREAM is used for
6	8	STREAM	sync capture only.

In asynchronous operation, the DLM V uses the first space in a line of data to establish timing by mid-bit sampling. In synchronous operation, data bits are timed using the supplied clock pulse trailing edges.

If "stream" is selected, data bits are loaded into the capture buffer without framing. After the data bits are loaded and the unit is halted, the bits can be shifted using the cursor control keys. Data bits are shifted one bit at a time, to the right, each time a cursor left or right key is pressed.

DATA

The DLM V initializes for synchronous operation (if the EEPROM is not programmed with another option), and parameters available are:

ASYNC 1	ASYNC 2	SDLC DIR	X.25 HDLC
ASYNC 1.5	SYNC	SDLC NRZI	X.25 BSC

In asynchronous operation, the DLM V properly sends and receives data using 1 (async 1), 1.5 (async 1.5), or 2 (async 2) stop bits.

In synchronous and X.25 BSC operation, the DLM V can be synchronized using one or two sync characters. In addition, the two sync characters can be either the same or different.

In the "SDLC DIR", "SDLC NRZI", and "X.25 HDLC" states, synchronization begins when a flag character (hex 7E) is received. A single 7E (hex) is displayed to designate each message. Inserted zeros are automatically removed for display data and added for output data. The DLM V provides flag idle suppression when sync suppress is selected.

In the SDLC mode, the flag 7E will always be displayed in hexadecimal notation. A data 7E is displayed, depending on the selection made through the HEX/ALPHA key.

Asynchronous data can also be sent and received using isochronous methods; that is, either by using an external timing source or by setting up the DLM V to operate as a synchronous DCE. In this case, "ASYNC 1.5" cannot be selected.

In simple terms, the packet switching network uses the X.25 protocol specification with an HDLC format. The raw data is taken and put into an HDLC format by being "framed" with a header and trailer. This newly formatted information is what is sent down the communications line.

Since X.25 is a relatively new protocol, some equipment cannot handle its format (HDLC). For those systems not equipped with this capability, X.25 can be handled in the bisync format. If this is the case, the DATA field on menu Page 1 should be set for "X.25 BSC".

CODE

The DLM V is configured from the factory to initialize using the ASCII code (the title ASCII appears in the field). The codes available are:

EBCDIC	EBCD1050	IPARS	2740/2741 CORRESPONDENCE
ASCII	HEX	200UT	OPTIONAL
EBCD2740/2741	BAUDOT	XS-3	

With the code "optional", the operator can program any 5-, 6-, 7-, or 8-bit code through the keypad on the unit front panel, or through the keyboard. Refer to paragraph 3.7.1 for information on how this is accomplished. Refer to Appendix A of this manual for charts on each of the listed codes.

SYNC

This character field defines the synchronizing characters used by the DLM V for proper protocol operation. The DLM V initializes with this unprotected variable field blank, unless another option is programmed in the EEPROM. Blank characters in this field are treated as "don't care" characters; refer to paragraph 3.3.1.1.

Synchronous operation requires character framing to start when the DLM V detects a specific sync character sequence. Any two identical or different characters can be entered in the SYNC field using either the hexadecimal keypad or keyboard, but a single sync character can also be used. The DLM V displays data even if the character(s) in the SYNC field are not found.

Data, captured by the DLM V when it is synchronized, is shown at fu intensity on the screen. Data, captured when the DLM V is u synchronized, is shown at half intensity to indicate that the unit searching for sync characters.

IDLE SUP'S

The DLM V is configured to initialize with IDLE SUP'S (idle suppressio set to "mark". The other parameters available are "off", "space", a "sync". With idle suppression "off", all characters available at t communications interface are loaded into the capture buffer. The fie contents at the time of initialization can be modified by programming t EEPROM.

NOTE: When communications equipment is in an idle state and the DLM V detects noise on the line, the unit will display characters on the screen. These characters are not "ghost" characters; the DLM V is equipped to detect noise on the line.

Selecting "mark" prevents all mark characters (hex FF), occurring a either side of the interface, from being loaded into the capture buffer Selecting "space" prevents space characters (hex 00), occurring at eithe side of the interface, from being loaded into the buffer. Selectin "sync" prevents loading characters, identified in the menu "sync" field into the capture buffer. However, if two different characters are entere in the "sync" field, then only the <u>first</u> character is suppressed. Flag are also suppressed when this option is used.

DISPLAY BUFFER

The DLM V initializes to "continue" (continuous); the remaining operatin parameters are "stop full" and "stop imm" (stop immediate).

In "continue" (continuous) operation, the capture buffer is loaded under control of the RUN HALT key. Pressing this key the first time places the DLM V in the run state, and data is continuously loaded into the capture buffer. Pressing the RUN HALT key the second time halts the unit, and the capture buffer stops loading data.

In "stop full" operation, the DLM V starts loading data the first time the RUN key is pressed. However, the capture buffer stops loading data after 12K of characters are loaded, and the DLM V halts automatically. At the same time, the RUN indicator turns off and the HALT and BUFF FULL indicators turn on; refer to the "trap" field description contained in paragraph 3.3.6.1 for stop full operations with trap.

In the "stop imm" operation, the DLM V starts loading data the first time the RUN key is pressed. However, the capture buffer stops loading data when either a CRC/LRC error or trap (SEARCH set to something other than "off") is found. The DLM V then halts automatically, the RUN indicator turns off, and the HALT indicator turns on.

If a trap condition is set up, and the "search" field is set to "send" or "receive", then the buffer will continue to load data until the trap is found. In this case, the DLM V halts automatically when the buffer has loaded approximately 6K of characters after the trap sequence.

3.3.5 Menu Contents: Page 3

As is true for all menu page fields, the parameter value shown in a field after the cursor leaves the field, or after the MENU SEL or RUN HALT keys are pressed, is the DLM V operating parameter. Figure 3-9 is an illustration of menu Page 3.

OUT SYNC

The "out sync" field is intended to be used when the DLM V is connected into communication systems that employ binary synchronous communications data link control (BI-SYNC DLC). This operating parameter is set as one hex pair. A match of the character contained in this field with a captured character, causes the DLM V to drop sync and begin searching for the next data link sequence of synchronizing characters.

NOTE: Never enter the system sync character in the "out sync" field.

This field should contain a "don't care" character, if the system BI-SYNC DLC inserts more than four pad characters between character EOT and the next sync characters during a polling sequence; see Figure 3-10, Part 1.

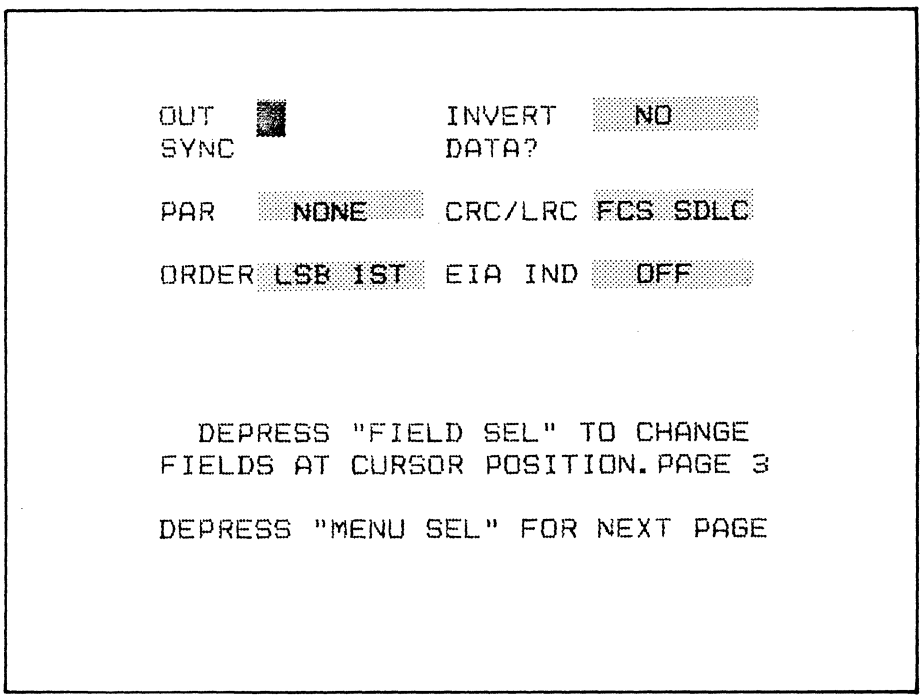


Figure 3-9. Menu Page 3: Representative Illustration

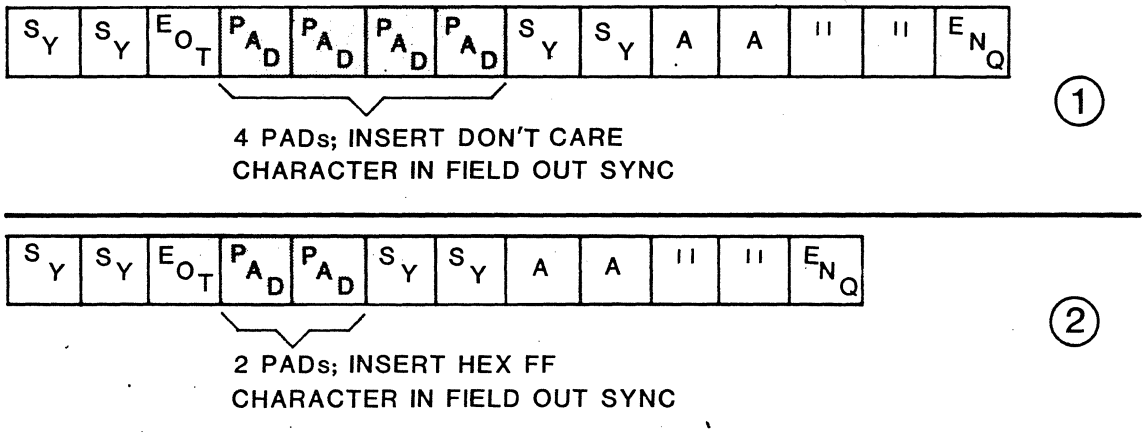


Figure 3-10. "Don't Care" Characters: Binary Synchronous Data Link Control (BI-SYNC DLC) Illustration

When four pad characters are detected after character EOT, the DLM V automatically drops sync when it detects the fourth sequential pad character, and immediately begins searching for the next sync character (SY of Figure 3-10).

The OUT SYNC field should contain a pad character (hex FF) if the BI-SYNC DLC does not insert exactly four pad or more characters between characters EOT and the next SY; see Figure 3-10, Part 2. When the DLM V detects a pad character following an EOT, the pad character is compared with the contents of the OUT SYNC field. The DLM V drops sync automatically when pad characters are matched, and the unit then begins searching for the next SY character group.

The following hypothetical paragraph explains when it is necessary to place a pad character (hex FF) in the OUT SYNC field. It is based on circumstances that usually occur in systems using IBM 3270.

Assume that the DLM V displays some, or all, poll sequences where the character string SY SY EOT is shown correctly, but the poll address characters (command and ENQ) are garbled. This type of garbling is usually the result of an insufficient number of pad characters being inserted between the messages to resync the unit.

The garbling can be eliminated by entering a pad character (hex FF) in the OUT SYNC field. This pad character causes the DLM V to resync on the poll address characters following the SY SY EOT character string.

During synchronous operation, regardless of the form of DLC used by the system, the DLM V drops sync automatically and begins searching for sync characters after detecting either four mark bytes (hex FF) or 32 mark bits. In addition, the DLM V screen displays captured data at half intensity until the unit is synchronized with the line.

The DLM V ignores the contents of the OUT SYNC field when the unit is operated in an asynchronous configuration.

INVERT DATA?

The DLM V is set from the factory not to invert data, and the word "no" appears in this field. The optional selection is "yes." If "yes" is selected, all data is inverted at both the input to, and output from the DLM V; that is, one bits are changed to zero bits, and zero bits are changed to one bits. Selecting "yes" enables the DLM V to be used in systems such as IPARS/SABRE, MIL-188C, and others using inverted data signals.

PAR (parity)

The DLM V initializes with no parity specified, and the word "none" appears in this field. Parameters available are:

NONE	EVEN	ALL ONES
ODD	ALL ZEROS	

When the initial selection (none) is specified in this field, the DLM V does not perform any parity tests. If one of the parity tests is selected, the DLM V checks each character for correct parity. Characters failing a parity test are shown blinking on the screen, and cause the PARITY ERROR indicator to light. Also, if parity is selected, that parity is output in the selected configuration. The operator must always be sure that the parity selected at output time coincides with the destination configuration.

CRC/LRC

The DLM V initializes with no block check specified, and the word "off" appears in this field. The options available are:

OFF	FCS SDLC
CRC/16	LRC/8

When any selection is specified in this field, the DLM V performs block check calculations and inserts a block check character for each message loaded.

NOTE: Select FCS SDLC for all bit-oriented protocols (BOPS), such as HDLC, X.25 and the IBM SDLC. If you select "mark" idle while using SDLC, FCS bytes are automatically added to any messages sent from the DLM V.

The control character DLE, plus any characters entered into the menu Page 2 "sync" field, are excluded from calculations, when CRC/16 is selected and the DLM V is operated in the monitor (passive) mode. The character STX is excluded from calculations when LRC/8 is selected and the unit is operated in the monitor mode.

Calculation of a block check character that does not match the check character found in the captured data, causes the failed sequence of characters to be shown blinking on the screen, and turns on the CRC/LRC ERROR indicator.

The polynomials used by the DLM V to calculate check characters are:

CRC/16: PRESET 0, $(X)^{16} + (X)^{15} + (X)^2 + 1$ for sync protocols

FCS/SDLC: PRESET 1, $(X)^{16} + (X)^{12} + (X)^5 + 1$ for SDLC protocol

LRC/8: $(X)^8 + 1$ for async protocols

ORDER

The DLM V initializes to show the least significant bit (LSB) of each character first. The remaining selection shows the most significant bit (MSB) first. The contents of this field can be changed after the capture buffer is loaded. The field contents can also be preprogrammed to either option.

In the data screen, if the bit order is changed through setting this option, the change is reflected in the character's binary value. Refer to paragraph 3.3.4, DISPLAY.

EIA IND

The DLM V highlights a selected interface parameter in reverse video. The DLM V is preconfigured to initialize without displaying, in reverse video, characters associated with parameters specified in this field; that is, "off" shows in this field at initialization. If the parameters are changed in the EEPROM, the available parameters are:

RTS.....The DLM V indicates signals RTS and send data. Characters occurring after RTS goes true are displayed in reverse video.

CD.....The DLM V indicates signals CD and receive data. Characters occurring after CD goes true are displayed in reverse video.

RTS & CD.....The DLM V indicates signals RTS, CD, as well as associated send and receive data. Characters concurring with RTS and CD appear in reverse video.

TRIG + & -...The DLM V indicates both interface signals as well as data. Characters occurring after, or between, signals patched to the TRIG (+) and/or TRIG (-) connectors are displayed in reverse video.

3.3.6 Menu Contents: Page 4

Menu Page 4 is made up of two separate screen faces; one for the logging buffer active state, the other for the logging buffer inactive state; see Figures 3-11 and 3-12. The DLM V uses these two pages for the trap and bit mask, and multiple interactive trap features, respectively. The following paragraphs describe how these features are used.

3.3.6.1 Logging Buffer Active

At power-up time, this is the screen face that normally appears first. The screen contains variable fields in which the operator enters data through the keyboard, or the front panel keypad. The following paragraphs detail each field.

TRAP

The screen contains two unprotected fields, a start trap and a stop trap, in which the operator enters data to be trapped on. The DLM V initializes with these unprotected variable fields blank; that is, full of "don't care" characters having no hexadecimal value. This assumes that the configuration is not changed by reprogramming the EEPROM. The trap fields can contain a maximum of six characters. When in the halt mode, trap sequence characters found in data captured by the DLM V are shown blinking on the video display.

When both traps are set, the trapped data is sent to the capture buffer where the data is stored; the capture buffer acts as a selective logging buffer. One use for this feature, for example, would be to access and examine a specific address in a multidrop system.

When both traps are set, before any data is logged, data not contained within the limits set for the traps is discarded. The logged data includes any characters entered in the trap fields, whether or not they are part of the trap.

When the start trap and stop trap features are set together, the feature is used mainly to trap sections of data. Do not set the search field to "both" to count characters on both sides of the line. One trap must be set to "send", and the other to "receive", because the DLM V only counts events that are separate.

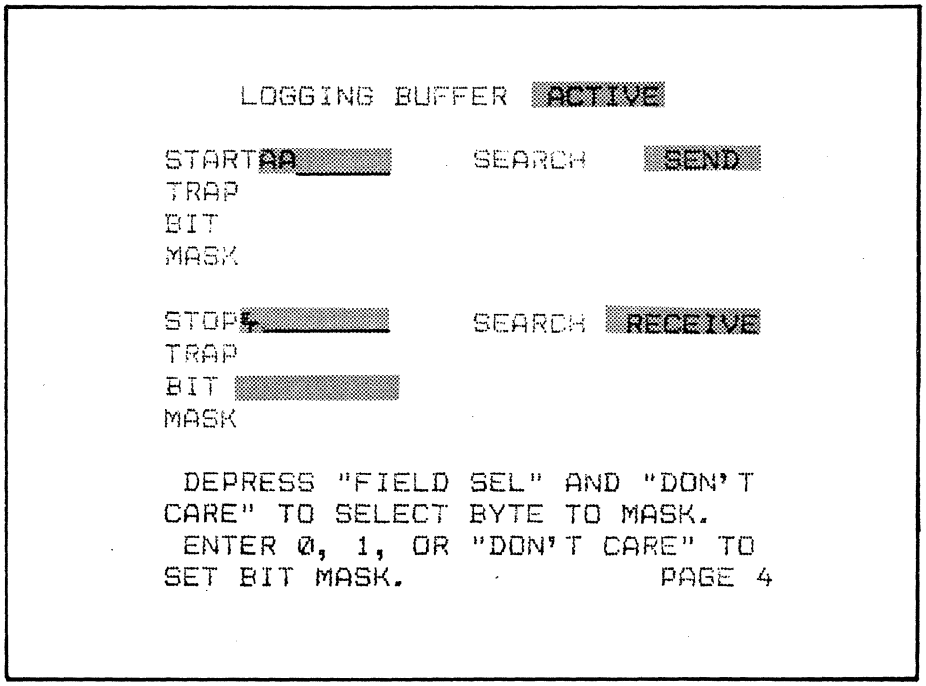


Figure 3-11. Menu Page 4: Logging Buffer Active

This menu can be used with the output menu. Suppose, for example, that a trap is set in the logging active mode, and that the DLM V is monitoring data on the line. Assume also that messages were defined in the output buffers. The DLM V could output a message set in a buffer upon the detection of the trap characters.

In the logging buffer active mode, the buffer contents (messages included) are transmitted sequentially; any data in the buffers is transmitted contiguously. Instructions on how to create messages in an output buffer are included in paragraph 3.5, Segmenting Variable Messages.

The start and stop traps can be used in conjunction with the counters and timers feature; for example, the number of times a specified trap has occurred in the data can be counted by setting one of the counters available on menu Page 5. Refer to paragraph 3.3.7 for details on menu Page 5.

Before a trap sequence can begin, characters must be identified to define where in the data the trap event will occur. The characters entered into this field, using the keyboard or the hexadecimal keypad, identify those characters on which the trap occurs.

The message **WAITING FOR TRAP** appears at the bottom of the data menu until the data specified in the trap fields is detected by the DLM V. When a trap sequence is detected in the run mode, the message **TRAP FOUND** is displayed on the data menu.

Six or fewer characters can be entered in a trap field, and the DON'T CARE key can be used to enter characters having no hexadecimal value. Character positions left empty in this field are treated as "don't care" characters.

If the trap feature is selected along with the display buffer "continue" (continuous) option, and the DLM V is capturing or transmitting data, then the DLM V will not halt until the RUN HALT key is pressed.

If the "trap" feature and "continue" option are both selected, the DLM V does not halt automatically when the trap sequence is detected; refer to paragraph 3.3.4, DISPLAY BUFFER.

However, if the display buffer "stop full" feature is selected along with the "trap" feature, the RUN HALT key does not have to be used to halt the DLM V. The DLM V halts automatically after the trap sequence is detected, after all the buffer storage locations are filled, and with the following three conditions present:

1. If the trap sequence occurs <u>before</u> the DLM V capture buffer is half full, less than approximately 6000 characters, <u>then</u> it halts after the buffer is completely loaded. In this case, it is possible for the trap sequence to appear near the beginning of the buffer storage locations.

2. If the trap sequence occurs <u>after</u> the capture buffer is more than half full, <u>then</u> the DLM V continues loading data into the capture buffer until the trap sequence appears in the middle of the buffer. In this case, the DLM V operates in a "continue" display buffer mode, and the captured trap sequence is followed by 6000 characters before halting automatically.

3. If the trap sequence occurs, and the display buffer's "stop imm" mode has been selected, <u>then</u> the DLM V halts immediately; the trap sequence appears near the end of the capture buffer.

The DLM V is not especially equipped to trap for codes that are <u>not</u> of eight bits; nevertheless, it can be set to trap other codes. Proceed as follows:

1. Set up menu Page 2 for the protocol code desired; e.g., EBCDIC, IPARS, XS-3. Refer to the Menu Setup Tables on the Code Charts in Appendix A.

2. Page through the menus until you get to the data screen. Set the cursor over the character to be trapped on.

3. Press the HEX/ALPHA key, and make note of the number(s) at the cursor position.

4. Go back to menu Page 2 and change the BITS field to "8".

5. Go to menu Page 4 (logging buffer active) and insert the hex number(s) noted in step 3 into START TRAP field.

6. Return to menu Page 2 and set BITS field back to original value.

7. Press the MENU SEL key and set the cursor to the "home" position in each menu page in sequence, including the data screen.

8. Press the RUN HALT key for the run mode.

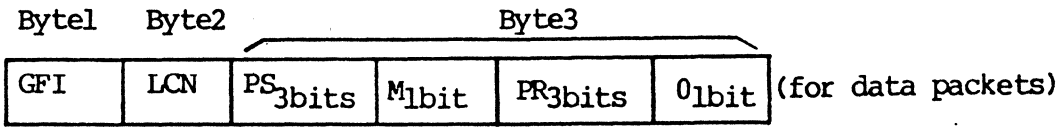
BIT MASK

The mask feature allows the operator to match against selected bits of a byte. In bit-oriented protocols (BOPs) such as SDLC, HDLC, and X.25, a character may have no meaning, but certain bits making up that particular character are important. With the match under mask feature, the operator can select out the bits to be viewed and mask out unnecessary bits.

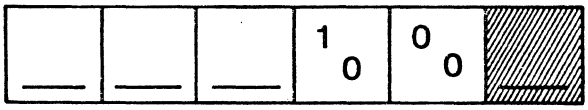
After the data to be trapped on is entered in a trap field, position the cursor over the specific byte to be examined and depress the FIELD SEL key; the byte appears underlined in reverse video. Press the DON'T CARE key.

With the cursor positioned in the BIT MASK field, enter the bits to be examined through the unit keypad or keyboard: entering a zero (0) corresponds to a false bit; entering a one (1) corresponds to a true bit. The most significant bit is entered at the first position in the field; the least significant bit is entered in the last position of the field. "Don't care" characters are used for any bit in any position. The following paragraphs provide an example of how this feature is used.

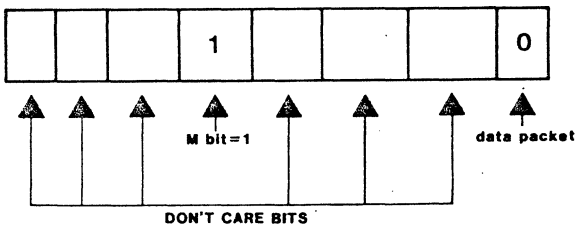
The operator may want to flag all data packets containing a "More Data" bit set (the "M" in the following diagram). After referring to the appropriate reference guide, the operator finds the format for such a packet to be:



Assuming that the Logical Channel Number (LCN) equals 0H, and the General Format ID (GFI) equals 10H, in order to find data packets with the M bit equal to "1," the operator would enter characters in the trap field as follows:



The bit masking would then be entered (using the hexadecimal keypad) as shown:



SEARCH

The DLM V initializes with this operating parameter set to "off" unless the configuration is changed in the EEPROM. The remaining selections are "send" and "receive". When this field is set to "off", characters can be entered into the "trap" field without a trap actually occurring.

3.3.6.2 Logging Buffer Inactive

The logging buffer inactive mode is another way of performing trap operations. In this mode, two different traps can be set, each one with a different response set in output buffers. For example, one trap could be set for the DLM V to respond to a poll sequence with an acknowledge sequence. The other trap could be set to respond to a device sequence with a negative acknowledge sequence. The following paragraphs describe this part of the menu, and its functions.

To access the logging buffer inactive state, place the cursor in the first field on the screen. The field should read ACTIVE. Press the FIELD SEL key; the INACTIVE option shows in the field. (See Figure 3-12.)

TRAP 1 AND TRAP 2

These fields function the same way as the TRAP fields in the logging buffer active mode. The operator enters data that is to be trapped on into these fields. However, in this case, they are used as two independent traps, not as a start trap and a stop trap.

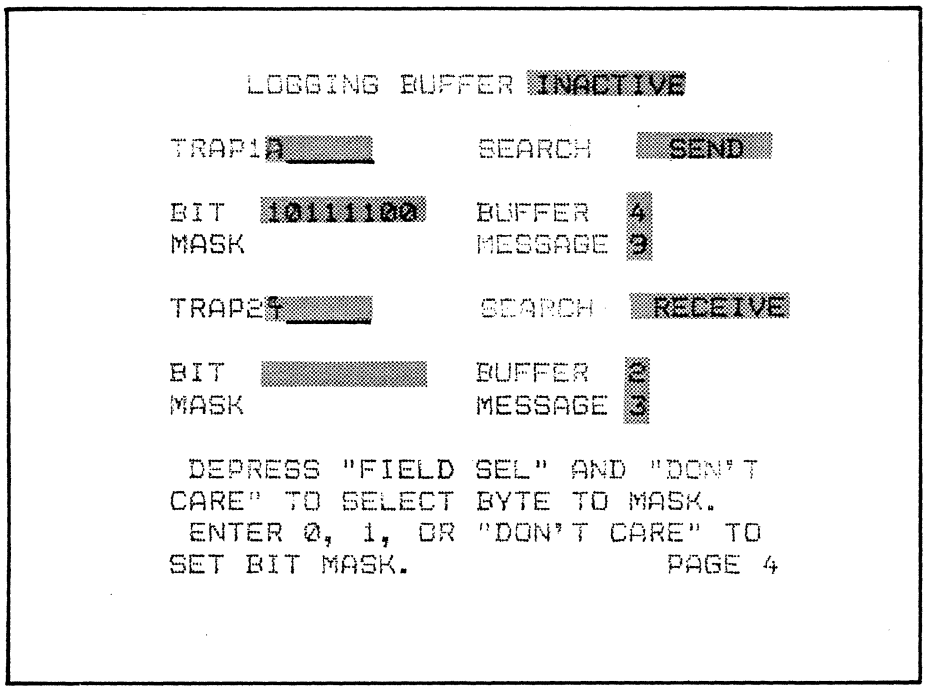


Figure 3-12. Menu Page 4: Logging Buffer Inactive

BIT MASK

The bit mask feature in the logging buffer inactive mode is used the same way as in the logging buffer active mode. This feature allows the operator to select out bits to be viewed, and to mask out unneeded bits. Refer to paragraph 3.3.6.1, BIT MASK, for more details.

SEARCH

This field determines which side of the data line is searched for a set trap sequence. The options are "off", "send", and "receive". Refer to paragraph 3.3.6.1, SEARCH, for more details on the SEARCH function.

BUFFER

Below the SEARCH field are one-character unprotected fields. Each field contains a number between one and four. That number represents an output buffer number. The buffer number selected in this field must coincide with the buffer number set in the output menu (refer to paragraph 3.3.8).

An output buffer can contain data in the form of operator-selected messages. The message can be transmitted upon receipt of trap characters set in the trap fields of this menu. Refer to paragraph 3.5 for instructions on how to delimit messages in an output buffer.

If a message is to be transmitted from a buffer, the MODE field in the output menu must be set to "buffer 1", "buffer 2", "buffer 3", or "buffer 4". The selection depends on which buffer contains the message. For example, if the message is in buffer 2 of the output menu, the selection made in the BUFFER field in this menu would be "2". The FIELD SEL key scrolls through the output buffer numbers.

In the logging buffer inactive mode, a message contained within the buffer can be specified by the contents of the MESSAGE field. The following paragraph provides information on how to select a message.

MESSAGE

Below the BUFFER fields are one-character unprotected fields. Each field can contain a number between one and nine. The number defines the message number in the buffer selected in the BUFFER field. BUFFER and MESSAGE are normally set together.

For example, suppose that a message is located in output buffer 3 (MODE field in output menu set to buffer 3). Suppose also that a message to be transmitted if trap characters are detected is the fourth one in buffer 3. The BUFFER field would be set to "3", and MESSAGE set to "4". The FIELD SEL key scrolls through the message numbers.

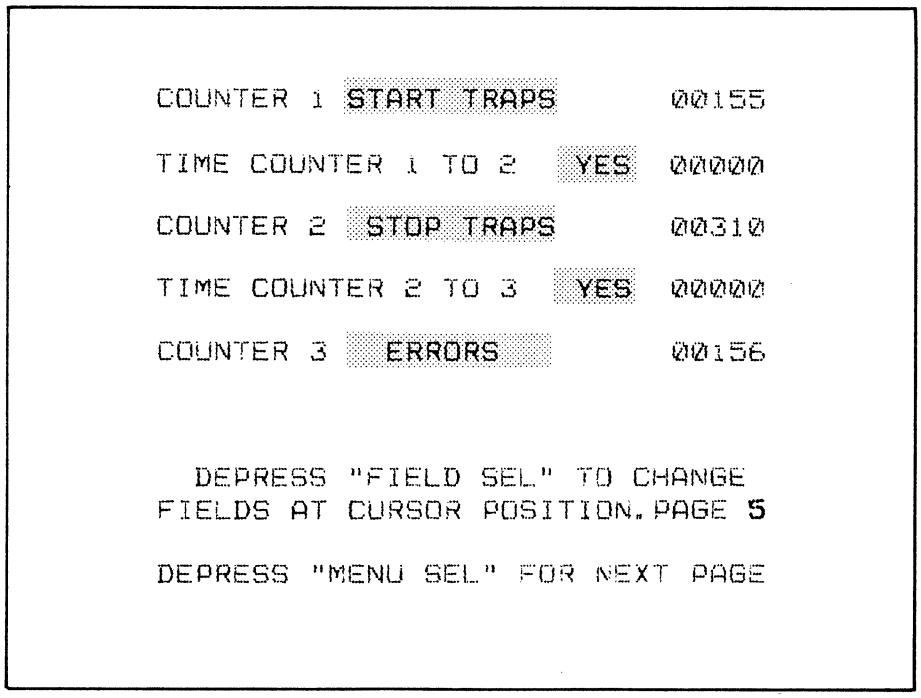


Figure 3-13. Menu Page 5: Representative Illustration

3.3.7 Menu Contents: Page 5

The DLM V uses the fifth page of its menu for counters and timers. Counters number trap and error occurrences as specified by the selection made in a "counter" field. The timers clock the timing between counts. Timer resolution is set at 10 msec. The options selected in the counter and timer fields are summarized on the parameter summary screen; refer to paragraph 3.8. Figure 3-13 illustrates menu Page 5.

COUNTERS

Each counter is set by positioning the cursor in a counter field and using the FIELD SELECT key to page through the options. Those options are "off", "errors", "start traps", "stop traps", and "programmed".

When "off" is selected, the counter is disabled. When initially powered on, the DLM V is set for this option.

If "errors" is selected in a counter field, the DLM V counts the number of parity or CRC errors found in the data. The number of errors found is displayed on the screen next to the counter's field.

If "start traps" is selected, the DLM V counts the number of times start trap characters have been found in the data; the total is displayed next to the trap set. When this option is chosen, defined trap characters must be present in either the start trap/trap 1 field of menu Page 4.

Finally, if "stop traps" is chosen, the DLM V counts and lists the number of stop trap characters found in the data. Again, trap characters must have been defined in either the stop trap/trap 2 field in menu Page 4. When set, the number of stop trap occurrences found in the data is displayed next to the counter's field. This is also true in the program mode. When INACTIVE logging buffer mode is selected on menu Page 4, "start traps" refers to "trap 1", and "stop traps" refers to "trap 2."

TIMERS

The timers clock the time between any event or pair of events selected by the operator. For example, a timer can be set to clock the timing between each occurrence of start traps set in the data. The options available for the timers are "yes" and "no". Setting the timers to "yes" enables the timing function; the timing is noted in milliseconds next to the timer option fields. The number listed reflects only the most recent timing detected by the DLM V. The DLM V defaults to the "no" option if the EEPROM is not programmed otherwise. This option disables the timer feature.

3.3.8 Menu Contents: Page 6

To access this menu page, press the MON OUT key; the OUT indicator next to the MON OUT key lights when the key is pressed. Page 6 of the menu, the output screen, is displayed following Pages 4 and 5. If the data screen is being viewed, the first five menu pages are seen again before Page 6 appears.

The parameter value shown in a field after the cursor leaves the field, or after either the MENU SEL or RUN/HALT key is pressed, is the DLM V operating parameter.

The following paragraphs describe the menu Page 6 output parameters, and Figure 3-14 illustrates menu Page 6.

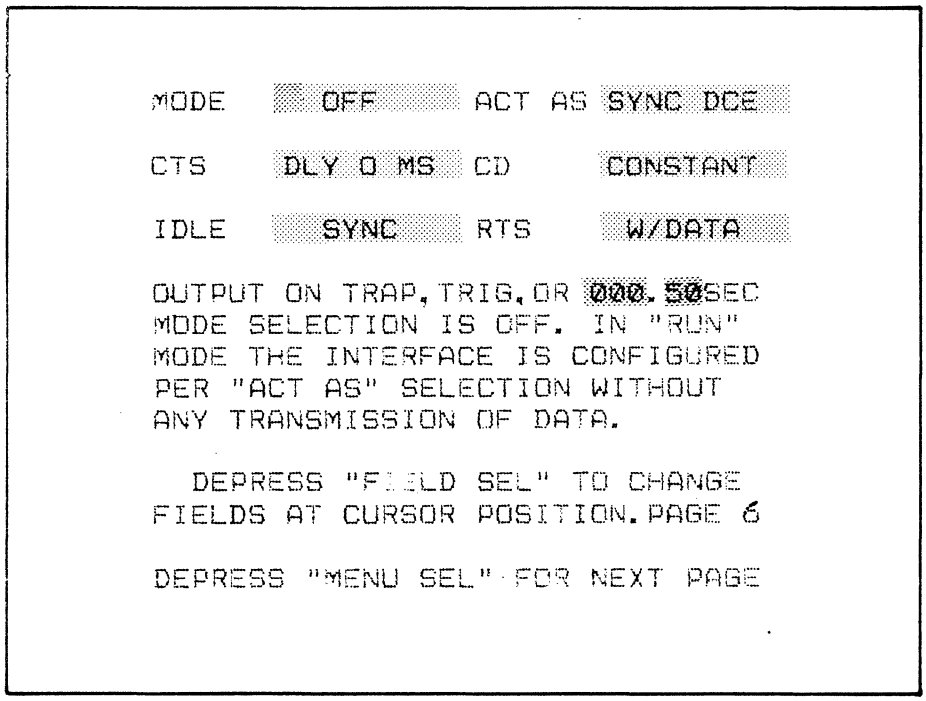


Figure 3-14. Menu Page 6: Representative Illustration

MODE

The DLM V initializes with this parameter set to "off", and no message is selected for transmission from the unit (if the EEPROM is not programmed differently). The message modes available are "OUT FOX", "BUFFER 1", "BUFFER 2", "BUFFER 3", "BUFFER 4", and "BERT 511".

When "off" is selected, the DLM V simulates the selection shown in field ACT AS; refer to subparagraph ACT AS in this paragraph. The unit supplies the appropriate EIA handshaking signals to the interface, but message transmission does not occur.

Selecting "OUT FOX" causes the FOX message to appear on the screen below the variable fields; see Figure 3-15, Part 1. The FOX message is contained in a protected field that has a 10-character, unprotected field ahead of it and a 6-character, unprotected field behind it. The 10-character field can be used for header data, and the 6-character field for trailer data.

The "BUFFER" options are available if the operator wishes to enter data into a non-volatile buffer area for later use. Four buffers are available; each buffer can contain a maximum 256 bytes of data.

The buffers are used when messages are transmitted. A total of nine segmented messages can be set up in a buffer. Any message(s) can be transmitted later, at a time specified by the contents of the related menus. This would apply to both the logging buffer active and the logging buffer inactive states.

To enter data in the fields, use the cursor control keys to position the cursor within the field, and enter data characters at the cursor position. The DON'T CARE key can be used to enter "don't care" characters, although character positions left blank are treated as "don't cares"; refer to paragraph 3.3.1.1.

- Buffer Transfer

  The data in the capture buffer can be taken and "dumped" into the output buffer. This feature eliminates the need for an ASCII keyboard and related program functions involved in selecting and editing data. The transmit data can be saved in the unit EEPROM. The following procedure is used to accomplish this type of data transfer.

  1. Position the cursor on the data screen over the first character of the message that is to be "dumped".

  2. Use the MENU SEL key to access the output menu, and select buffer 1, buffer 2, buffer 3, or buffer 4.

  3. Position the cursor in the output buffer at the point that you want to start loading data.

  4. Page back to the data screen, and press the CLEAR key. A prompt will appear on the screen.

  5. Press the MENU SEL key to begin data transfer. Press the ERROR RESET key to stop data transfer.

  6. Press the MENU SEL key to select menu Page 1, and press the DON'T CARE key to save the data. Refer to paragraph 3.3.2 for programming the EEPROM.

  Selection BERT 511 is chosen when the DLM V bit error-rate test is to be used for troubleshooting a modem or a telephone line.

ACT AS

The DLM V initializes to simulate a synchronous modem, and "sync DCE" appears in this field (if the EEPROM is not reprogrammed). The remaining selections are "async DCE", and "DTE". If "sync DCE" is selected, the DLM V supplies timing on interface pins 15 and 17.

If "async DCE" is selected, the DLM V acts as an asynchronous modem and does not provide clock pulses. If "DTE" is selected, the DLM V simulates a terminal or communications controller. If "DTE" is selected and the SPEED field shows "external", clock pulses must be present on interface pins 15 and 17 for the DLM V to operate properly; refer to paragraph 3.3.4, SPEED.

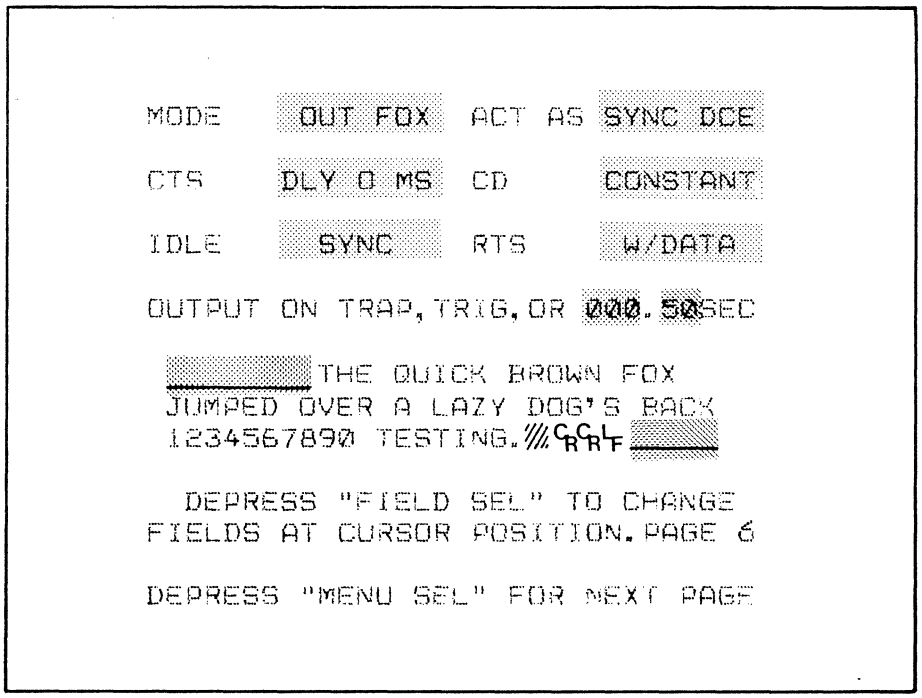


Figure 3-15. Selectable Operating Modes;
Part 1, Menu Page 6 (FOX)

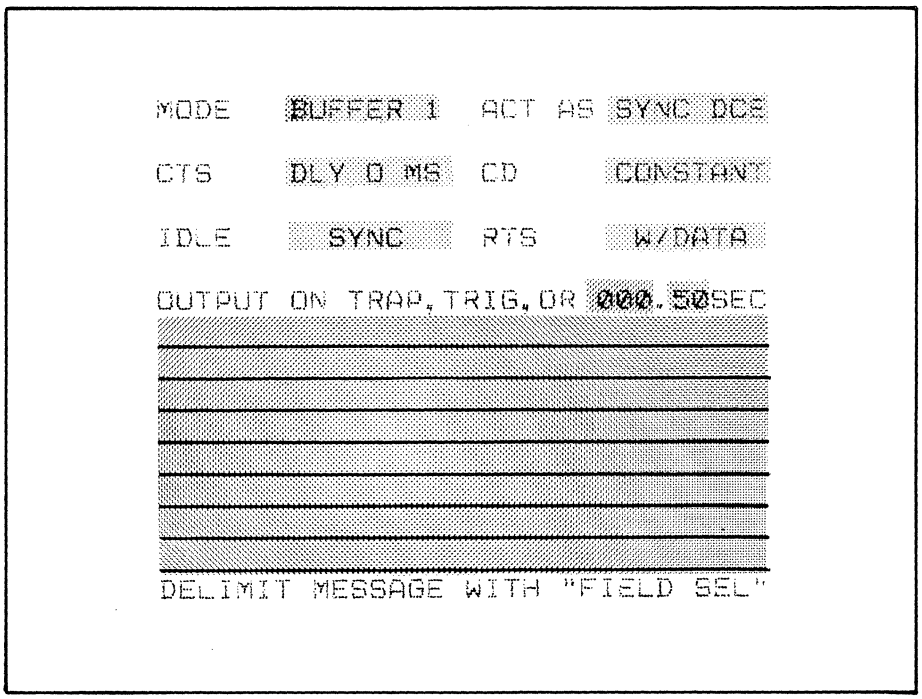


Figure 3-15. Selectable Operating Modes;
Part 2, Menu Page 6 (BUFFER 1)

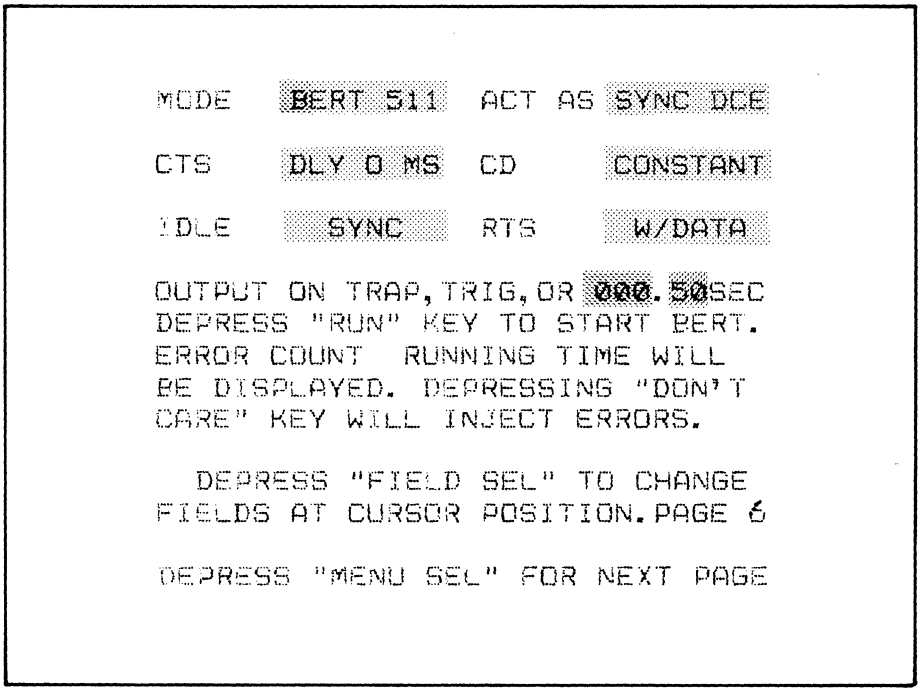


Figure 3-15. Selectable Operating Modes;
Part 3, Menu Page 6 (BERT 511)

Selecting BERT 511 causes a 511-bit per block, pseudorandom sequence code to be prepared for transmission from the DLM V; see Figure 3-15, Part 3. Selecting this test code causes a status message to appear at the bottom of the screen after the RUN HALT key is pressed:

RUN TIME XX MIN XX.X SEC TEST 511
BIT ERROR XXXX BLOCK ERROR XXXX

Errors can be inserted into this test code by pressing the DON'T CARE key while the test code is being transmitted. Errors are inserted into the test code to ensure that the DLM V bit error-rate (BERT) circuits are operational, as well as to ensure that the line has not completely opened.

CTS (Clear-To-Send) DELAY

The DLM V initializes to provide a 200 millisecond (200 msec) delay between receiving RTS (Request-To-Send) and sending CTS, when configured to act as a modem; ACT AS is set to either "sync dce" or "async dce". The remaining selections are "0 ms", "10 ms", and "50 ms". These options can be programmed into the unit's EEPROM.

CD (Carrier Detect)

The DLM V initializes to provide CD with receive data ("w/data") when configured to act as a modem. Selecting "constant" provides continuous CD.

IDLE

The DLM V is configured to initialize marking the line ("mark") while idling, and acting as either a modem or a terminal. Other parameters available are "sync" and "flag" (HEX 7E). A space hold is provided if the inverted data option is selected; refer to paragraph 3.3.5, INVERT DATA? If you select "mark" idle while using SDLC, FDC bytes are automatically added on to any messages sent from the DLM V.

RTS (Request-to-Send)

The DLM V initializes to provide RTS with send data ("w/data") when configured to act as a terminal. Selecting "constant" provides continuous RTS while the DLM V is waiting for CTS.

NOTE: To output on a trigger, trap or don't care, the timer must be cleared. Press the CLEAR key with the cursor in the timer field of this menu; refer to paragraph 3.6.3.

3.4 CALCULATING CRC AND LRC CHARACTERS

Remember the following facts when calculating a CRC/LRC character for a message that is to be sent from the DLM V:

1. The sync character(s), or any other characters shown in the menu Page 1 SYNC field, normally will not be included in the CRC/LRC calculation. If these characters are to be included, then the SYNC field has to be blank; that is, filled with video spaces entered by pressing either the DON'T CARE or CLEAR key while the cursor is at the character positions.

2. Generate the CRC/LRC character prior to segmenting the buffer because the same delimit character is used in both operations. Generating the CRC/LRC can be done after segmenting; however, the delimit characters must be returned to their original locations.

3. Identify the first and last characters included in the CRC/LRC calculation by placing the cursor over these characters and pressing the FIELD SEL key. This action inserts delimiters in the message.

The following paragraphs contain the procedure recommended for entering data and generating the correct CRC/LRC character for messages, or message segments, that are to be sent from the DLM V using the 1024-character buffer.

Enter characters that are going to be transmitted into the buffer's field. Note the prompt at the bottom of the screen:

DELIMIT MESSAGE WITH "FIELD SEL"

After all character data is entered, use the cursor control keys to move the cursor over the first character in the message that is to be entered into the calculation; usually the <u>first</u> data character after character STX or SOH. Press the FIELD SEL key while the cursor is over the character. The character is now displayed full intensity (highlighted) to identify it as the first character to be included in the CRC/LRC calculation; see Figure 3-15, Part 2.

Next, move the cursor over the last character to be included in the calculation, usually the ETX or EOT character. Press the FIELD SEL key again to identify the character as the last one to be included in the message's CRC/LRC calculation. Next, press the DON'T CARE key to initiate calculation of the CRC/LRC character. The full intensity delimiter is now positioned over the CRC/LRC character, the last character to be transmitted.

After the preceding steps are completed, move the cursor back to the message's first character. Press the FIELD SEL key to delimit the first character of the message to be transmitted.

Remove the delimiter from the first data character that was included in the CRC/LRC calculation by placing the cursor over the delimiter, and then pressing the FIELD SEL key.

NOTE: CRC/LRC calculations cannot be used when the DLM V is monitoring IPARS code or DDCMP. Set the option to "OFF".

3.5 SEGMENTING VARIABLE LENGTH MESSAGES

The buffer 1024-character unprotected fields can be used for variable length messages that are sent each time the DLM V transmits. The messages are sent sequentially in the logging buffer active mode. In the logging buffer inactive mode, the message number is field-selectable. Although impractical, the field contents can be segmented into a maximum 512 two-character messages. In the logging buffer inactive mode, the message number is field-selectable. In this case, up to nine messages with a total of 256 characters may be segmented in each buffer. Note the prompt shown at the bottom of the screen:

DELIMIT MESSAGE WITH "FIELD SEL"

When entering data into an unprotected field, use the cursor control keys to position the cursor at any character location within the field. Enter character data into the field at the cursor position.

Identify the individual messages using the FIELD SEL key to delimit the first and last characters of each message. This is done by positioning the cursor over the first character in an individual message and pressing the FIELD SEL key. The character under the cursor is shown full intensity after the FIELD SEL key is pressed. Next, position the cursor over the last character of the message and press FIELD SEL again. This second character is also shown full intensity and identifies the last character to be transmitted in the message; see Part 2 of Figure 3-15.

If the logging buffer active mode is selected, the procedure described can be used to delimit up to 512 messages; the third and fourth full intensity characters identify the second message; the fifth and sixth, the third message, and so on. If the logging buffer inactive mode is selected, nine messages may be delimited in each buffer, for a total of 36 messages.

3.6 TRANSMITTING MESSAGES

The DLM V transmits messages from the buffer when it is in the active (output) state and one of five events occurs:

1. A valid trap sequence is detected.
2. A selected trigger signal is detected.
3. A preset time delay has elapsed.
4. The DON'T CARE key is pressed.
5. A programmed output instruction is recognized (refer to Section 4).

The first three events are treated as OR conditions by the DLM V, because, if more than one of the three is selected, the buffer's contents are transmitted when any one of the events occurs. However, the DLM V always transmits the buffer contents when it is in the active state and the DON'T CARE key is pressed.

One of the buffer's delimited messages in the 1024-character field is transmitted when any one of the five events occurs (in the logging buffer active mode, up to 512 two-character messages; logging buffer inactive mode, a total of 36 messages).

Each message is sent sequentially. For example, if the buffer's first delimited message is sent when a trigger signal is detected, then the second message is sent when the next event occurs. The following paragraphs describe how each of the first four conditions (events) is used.

3.6.1 Trap

A delimited message is transmitted when one of the TRAP fields contains one or more characters, and the SEARCH fields show "send", "receive" or "both"; (refer to paragraph 3.3.6.1, TRAP). A trap occurs when the trap field contents match with data captured by the DLM V. When a trap occurs, the DLM V transmits the delimited message no later than 10 msec after matching the trap sequence with captured data (dependent on the logging buffer mode; if active, 512 two-character messages; if inactive, a total of 36 messages). When using the trap to output, the timer should first be cleared.

3.6.2 Trigger

A delimited message is transmitted when a signal that is jumpered from the breakout panel to a TRIG (+) or (-) connector occurs, and the EIA IND field shows "trig + & -"; refer to paragraph 3.3.5, EIA IND. For example, if field EIA IND shows "trig + & -", and the CTS signal is jumpered from the breakout panel to the TRIG connector (+), then the DLM V transmits no later than 10 msec after an occurrence and a positive transition of CTS. When using the trigger to output, the timer should first be cleared.

3.6.3 Time Option

A delimited message is transmitted according to the timing data entered in the output menu's SEC field. This field must contain numeric data for the "time" option to initiate transmission of the buffer's next contiguous message. If continuous transmission is desired, enter zeros (0's) into the field. Numbers shown in this field define the delay between the time an event occurs and the time the next buffer message is transmitted. Three selectable events cause messages to be sent:

1. Detection of a valid trap sequence.

2. Detection of a selected trigger signal.

3. Depression of the DON'T CARE key.

The preset "time" option works in the following way; if 001.00 is entered in the SEC field, then delimited messages are transmitted with a one second delay (intermessage time) between each contiguous message. The DLM V timing circuits reset to the value shown in the SEC field after each message is transmitted, regardless of what caused the message to be sent; e.g., trap, trig, or "don't care". The DLM V maximum intermessage time is 655 seconds, or 10.9 minutes.

3.6.4 DON'T CARE Key

Pressing the DON'T CARE key causes the immediate transmission of the buffer's next contiguous message, regardless of any output options used. In the RUN mode, pressing the DON'T CARE key, with the logging buffer in the active mode, transmits the buffer's next message. With the logging buffer in the inactive mode, only the message set up for TRAP 1 is transmitted.

When transmission is being controlled using the DON'T CARE key, the output menu's SEC field may contain video spaces. However, the buffer's next message is transmitted when the DON'T CARE key is pressed, regardless of any timing data entered in the field SEC. When using the DON'T CARE key to output, first clear the timer.

In the PROGRAM mode, the transmit feature of the DON'T CARE key is disabled; however, it may be needed to insert characters in the variable fields of the TRAP instruction.

3.7 PRINTER (HEX OUT) MENU

The printer menu appears on the screen when the DLM V is halted and the HEX OUT key is pressed. Menu parameters selected by the operator must agree with the operating parameters of the printer connected to the DLM V. The operator should verify the operational parameters of the printer before attempting any menu set-ups. Selections in the printer menu are made in the same manner as for the unit's main menu, and the DLM V operates according to the menu's final state.

Prompts below the menu's variable fields tell the operator the keying sequence to follow when performing a print operation. During the actual printing operation, the word **PRINTING** blinks until the operation is completed. While the message **PRINTING** is shown blinking on the screen, all keys except HALT are disabled, and pressing HALT will stop the printing operation upon printing of a receive line. All keys are again enabled after the buffer is empty, and the printer stops.

The HEX OUT connector mechanical and electrical characteristics are described in paragraph 2.5.2, and in Table 2-3.

The contents of the printer menu are:

SPEED.....Initial is 300 baud. Selections available are 50, 75, 110, 134.5, 150, 300, 600, 1050, 1200, 1800, 2000, 2400, 3600, 4800, 7200, 9600, and 19.2K bps.

COLUMNS.....Initial is 80 columns. Selections available are 40, 64. 8 and 132 columns.

CR/LF.....Initial carriage return/line feed (CR/LF) delay is 2 sec Selections available are DLY 0 ms, DLY 200 ms, DLY 1 sec, a DLY 2 sec.

PARITY.....Initial is NONE. Selections available are ODD, EVEN, ALL ON and ALL ZERO.

OUTPUT.....Initial is BUFFER. Alternate selection is SCREEN.

INFO.....Initial is DATA. Alternate is MENU.

PRINT.....Initial is HEX ONLY. Other selections are DATA ONLY and BOTH

Characters and data are sent to the printer in 7-bit ASCII code wit parity as specified in the DLM V. Stop marks are fixed at two per character. All data is converted to the appropriate ASCII hexadecimal code before bein sent to the printer.

Carriage return and line feed characters (CR/LF) are sent to the printer at count XX according to the COLUMNS field contents.

If the OUTPUT field shows "screen", data is sent to the printer beginning with the current cursor position, and ending with the character located at the end of the capture buffer. When the OUTPUT field shows "buffer", the entire contents of the capture buffer are sent to the printer.

When the menu is printed (field INFO shows "menu"), protected variable field data is printed in the ASCII format, and unprotected variable field data is printed in hexadecimal code.

All print operations are started by pressing the RUN/HALT key when the printer menu is shown on the video display. Pressing the RUN/HALT key a second time stops print operations. To return the DLM V to normal operations, press the HEX OUT key.

Each printed line begins with either letter T or R. The T indicates that the line contains transmit data, and the R indicates that the line contains receive data. Each transmit and receive data group is separated by a carriage return/line feed.

In the HEX ONLY mode, data is printed in its hexadecimal form. The top digit represents the most significant nibble; the bottom digit corresponds to the least significant nibble.

In the DATA ONLY mode, characters are printed in the data form.

In the BOTH mode, characters are printed both in hexadecimal form and in data form. See Figure 3-16, Parts 1, 2, and 3 for samples of each print menu.

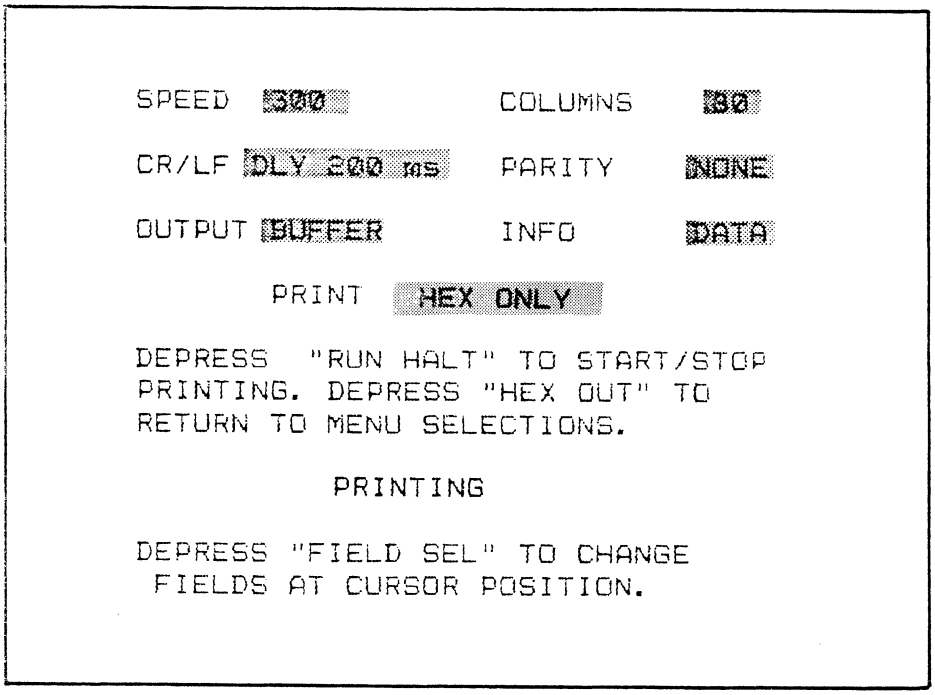


Figure 3-16. Printer Menu (HEX OUT): Part 1 (HEX ONLY)

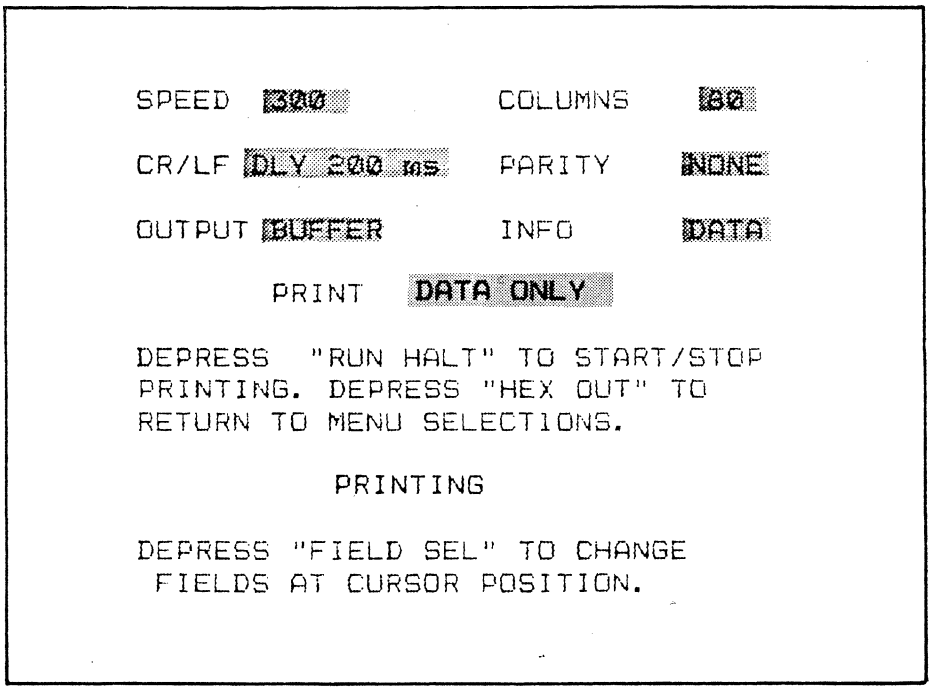


Figure 3-16. Printer Menu (HEX OUT): Part 2 (DATA ONLY)

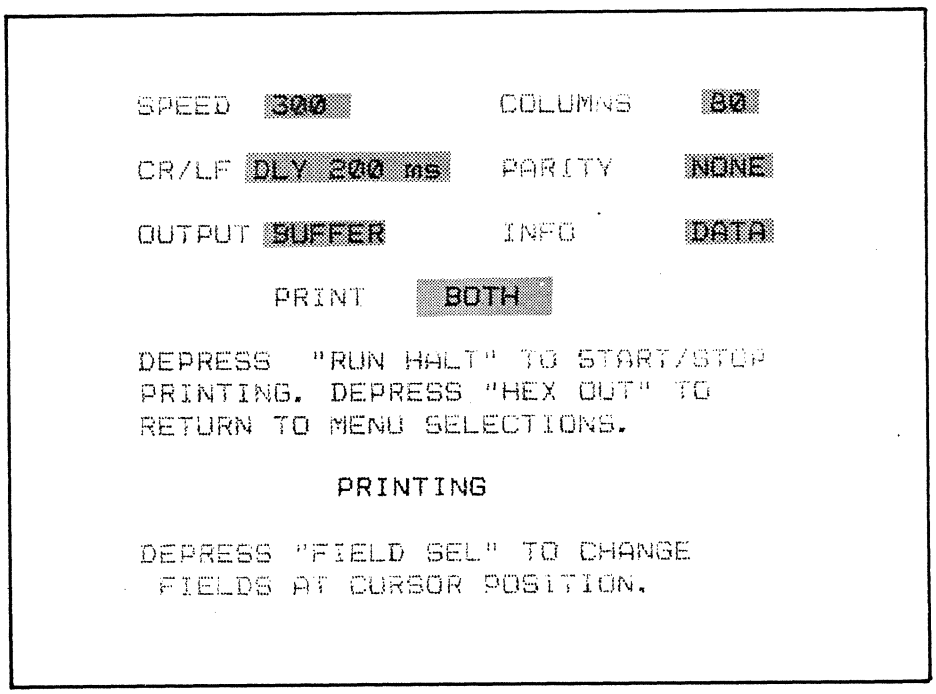


Figure 3-16. Printer Menu (HEX OUT): Part 3 (BOTH)

3.7.1 The Programmable EEPROM

The DLM V is equipped with a programmable EEPROM or E^2PROM (Electrically Eraseable Programmable Read-Only Memory). This EEPROM allows the operator to program the DLM V for two additional features; these features are discussed in the following paragraphs.

When the unit is powered on, it performs a test of the EEPROM to ensure reliability. If any fault is found in the EEPROM, it displays the message:

PROGRAMMING ERROR

This message flashes once on the screen, then disappears. This next message appears on the screen for approximately one second:

LOCATION = XXXXH

THE BITS READ BACK = XXXXXXXX

This message is then followed by the following blinking prompt:

ERROR IN DIAGNOSTICS

DEPRESS "MENU SEL" TO CONTINUE

When the MENU SEL key is pressed, the screen clears and the DLM V returns to menu Page 1. If an error condition occurs, the settings are not necessarily lost; however, it is recommended that operations be repeated as described. Repeated occurrences of the same error are an indication that the unit is malfunctioning.

If a problem still exists, fill out the Unit Failure Report provided at the back of the manual, and call the DIGILOG Customer Service Department for assistance. If the problem cannot be solved by phone, then complete the customer service sheet (also included in this manual), tape it to the top of the unit, and return the unit to the factory for service.

3.7.1.1 Programming the Options

The DLM V can be set up to be configured to the operator's particular needs when it is initially powered on. This is accomplished by storing the needed data in the EEPROM. Any of the options, available in any of the variable fields on the menus, can be permanently stored, including data stored in the output buffer. Refer to paragraph 3.3.2 for this procedure.

3.7.1.2 Programming an Optional Code

The operator also has the option of programming the DLM V with a code not available from the factory as a standard. This user-programmable code is also stored in the EEPROM.

To program an optional code, position the cursor in the menu Page 2 CODE field and select "optional". Then press the CLEAR key on the DLM V keypad to position the cursor in a variable field on the optional code screen.

Through the keypad, the operator keys in the code in either or both of the 128-byte buffer areas for a total of 256 bytes of data. This area is seen on the screen in reversed, reduced-intensity video highlight. All key functions remain as previously described. The DON'T CARE key generates a blank space on the screen. Figure 3-17 is a representative illustration of this screen.

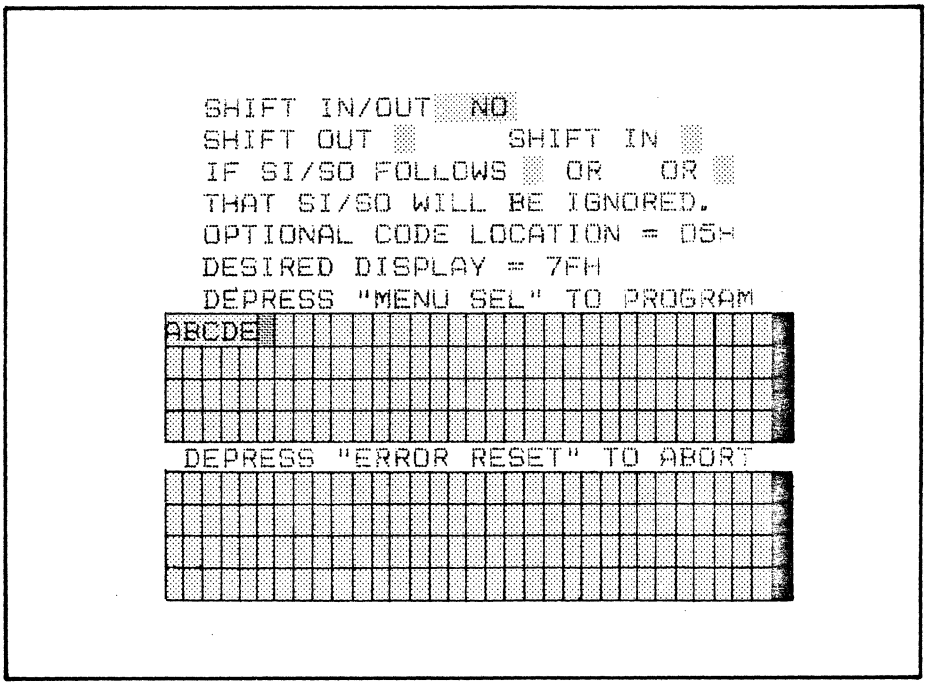


Figure 3-17. The Optional Code Screen

The first variable field on the screen is the SHIFT IN/OUT field. It is in this field that the operator selects whether the optional code will have shift in or shift out characters. By using the FIELD SELECT key, the operator can select either option available; the options are "no" and "yes". The DLM V is set at the factory to default to the "no" option. Selecting this option disables the programming of codes containing shift in and shift out characters.

If "yes" is selected in the SHIFT IN/OUT field, the operator must fill in the "shift out", "shift in", and the next three variable fields preceding the buffer area.

When the shift in/out option is chosen, the operator must enter the selected shift out character in the code in the "shift out" variable field. Shift in characters are entered in the "shift in" field.

There are three areas after the legend, "if si/so follows", that should also be filled in by the operator when the shift character option is chosen. These areas are used to enter characters to alert the DLM V of exceptions to the shift characters. In the run mode, any of the characters present, in any of the three fields followed by a shift character, signal the DLM V to ignore the shift function. ETX and ETB are examples of such characters.

The display screen area labeled OPTIONAL CODE LOCATION displays the cursor location in hexadecimal notation when it is in a buffer; the first location in a buffer (viewing from left to right) is 00, and the last position is FF.

The area on the screen listed as DESIRED DISPLAY displays the character upon which the cursor is positioned. The character is listed in hexadecimal notation. If no characters are present at the cursor location, the hexadecimal value for a blank character (20h) is shown in this area.

To program the optional code into the EEPROM, press the MENU SEL key. After a few seconds the code is programmed. To cancel any entries, press the ERROR RESET key; menu Page 2 reappears on the screen.

In the case of an error condition, the message PROGRAMMING ERROR is displayed; if this happens, the operator must repeat the operations previously described. Refer to paragraph 3.7.1.1 for details on error conditions when programming the EEPROM.

3.8 PARAMETER SUMMARY DISPLAY

The final screen seen on the DLM V is the parameter summary display screen. Pressing the MENU SEL key, when the unit is in the RUN (monitoring or outputting data) mode, displays this screen; pressing MENU SEL a second time returns control to the data screen. The parameter summary screen lists certain parameters chosen in menu Pages 2, 4, and 5. Parameters shown on this screen can only be modified by halting the run mode, returning to the specific menu, and changing the settings.

The parameter summary display screen lists the speed, the number of bits, the data type (for example, X.25 HDLC), and the code as selected in menu Page 2. Any options set through menu Page 4 (start and stop traps, search function, and bit masking) are also displayed on the screen. When INACTIVE logging buffer mode is selected, "start trap" refers to "trap 1", and "stop trap" refers to "trap 2."

The bottom portion of the screen is dedicated to the counter and timer options; the settings are listed next to the legends on the screen. If a counter was set in menu Page 5, the display parameter screen displays the data selected to be counted in one field. The number of occurrences found of that particular data is displayed in realtime, after the equal sign, on the same line. Figure 3-18 is an illustrative example of the parameter summary screen.

If a timer is set in menu Page 5, the timing between occurrences of the particular event being monitored is displayed on the screen. The timing is set for increments of ten milliseconds. To obtain a total, return to menu Page 5. The total found in menu Page 5 reflects only the <u>most recent</u> timing recorded by the DLM V.

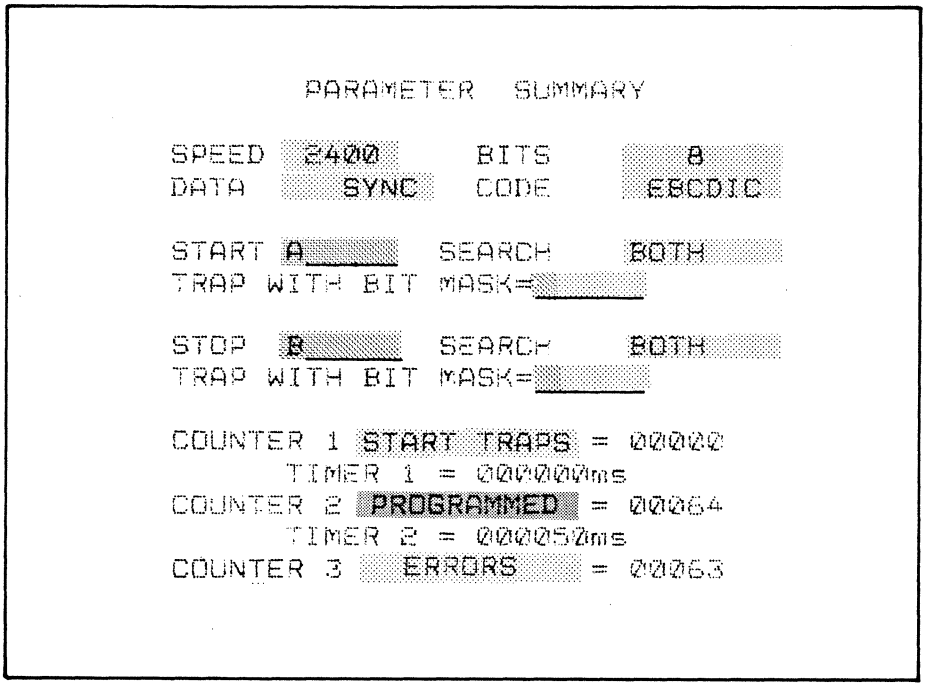


Figure 3-18. Parameter Summary Display: Representative Example

3.9 EXTERNAL VIDEO DISPLAY

Any external video display unit that uses a composite video input signal (RS-170 compatible) can be connected to the DLM V. The external video display is identical to the DLM V display.

Connect the external video display unit to the connector labeled VIDEO located on the DLM V rear panel; see Figure 2-1. Use a coaxial cable terminated with a standard male BNC connector.

3.10 EXTERNAL EVENT MARKER

Circuits in the DLM V provide a +5V, 5 msec, TTL-compatible output pulse when a parity or block check error is detected, when a trap occurs, and when the ERROR RESET key is pressed. The marker pulse is available at the TTL connector on the DLM V rear panel; see Figure 2-1. Use a coaxial cable terminated with a standard male BNC connector to route the marker pulse to external test equipment.

3.11 MASS STORAGE INTERFACE

The DLM V rear panel connector labeled MSU INTERFACE is provided for mass storage of line data, for viewing at a later time; see Figure 2-1. This connector is pin-to-pin compatible with the DIGILOG MSU (mass storage unit). The MSU can store up to 409,600 bytes of data.

The MSU INTERFACE connector mechanical and electrical characteristics are described in paragraph 2.5.2, and in Table 2-3.

The DLM V can be used to view data after it is stored on diskettes by the Mass Storage Unit. Place the DLM V in the halt mode, select the MSU read mode by pressing the MSU READ key, and follow the directions given in both this manual and the MSU Operator's Manual.

SECTION 4
PROGRAMMABILITY

4.1 INTRODUCTION

The DLM V programmability feature allows a user to design and store custom programs in the DLM V EEPROM. As many as ten individual programs can be designed, stored, recalled, and used at any time.

The DLM V program mode provides a means of controlling the existing features in the form of a program. This section of the manual gives complete information on the use of the programmability feature. Some examples of typical programs are included at the end of the section.

4.1.1 Preliminary Notes

The ensuing paragraphs include several references to "key sequence." This means pressing one key, then immediately pressing another key. In most cases, a key sequence applies to the FUNCTION key on the keyboard (FUNC), and the keys labeled F1 through F15, located on the top row of the keyboard. For example, a key sequence would appear as "FUNC F6". The space between "FUNC" and the "F" key does not represent a space bar depression or a "don't care" character.

To make the text easier to read, the "F" portion of the key legend, and the quotation marks, are not included in reference to function key sequences. For example, references are made to FUNC 6, FUNC 10, FUNC 3, and so on.

Note that there are legends on the dustcover, above the keyboard. These legends are abbreviations of program instructions and commands. Each legend involves the following:

The function key sequence (Example: F1)
The associated instruction (Example: Search)
A slash (/)
The associated command (Example: Ex Para Summary)

For example, FUNC 4 is a SET TRAP instruction, and a STEP command. The slash separates the instruction from the command. Explanation of the program instructions and commands begins with paragraph 4.2.

4.2 THE PROGRAM MODE SCREEN

Program mode instructions and file commands are entered and saved through the program mode screen. The program screen (see Figure 4-1) is accessed by typing FUNC 15.

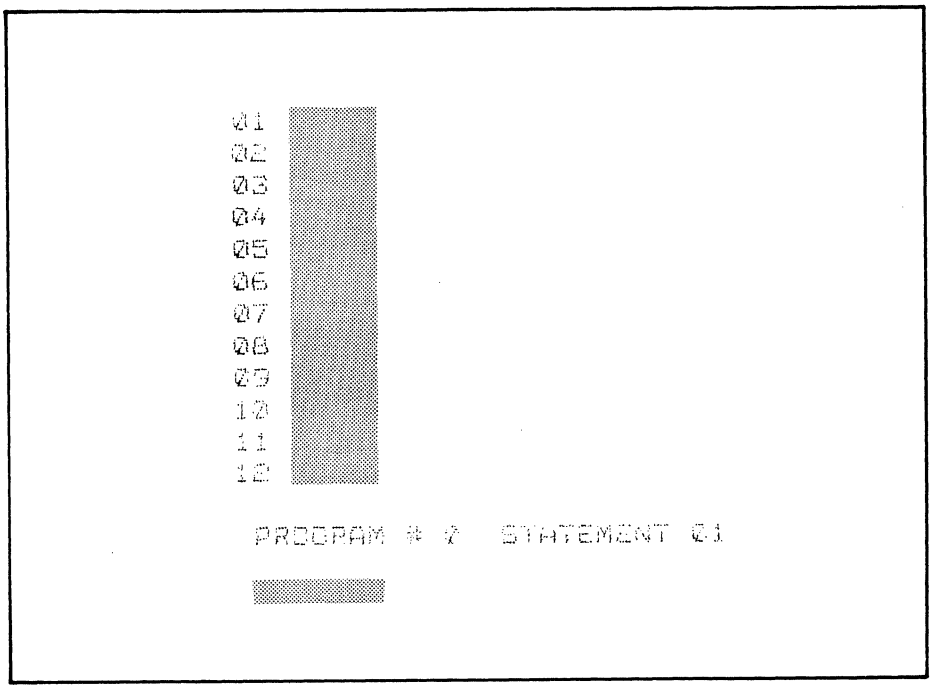


Figure 4-1. The Program Mode Screen Format

The program mode screen comprises a total of 16 lines. The first 12 lines are dedicated to program instructions; instruction line numbers are shown on the left-hand side of the screen (01-12). Line 14 is an identification line, which specifies the program and the line number. Line 16 (the last line) is the control line. It has a highlighted area in which file commands are entered. Refer to paragraph 4.3.1 and ensuing paragraphs for a discussion of the file commands.

The program mode allows the entry of up to 12 instructions per page (or screen), and a total program size of up to 72 lines. Pressing the MENU SEL key allows the user to page through a program in 12-line increments. However, a page must be full before the next page can be called up by pressing the MENU SEL key. Once the program reaches the end, the first 12 lines of the program are shown again.

The cursor up and down keys position the cursor at the beginning of any instruction line, the identification line, or on line 16. The cursor left and right keys position the cursor in instruction variable fields, and in the program number (PROGRAM #) field.

4.3 THE PROGRAM MODE

The programmability feature of the DLM V allows other DLM V features to be grouped logically in the form of programs. These programs may be used to store and recall standard test procedures; to set up custom on-sequence operations; to speed up and simplify diagnostic and interactive testing, and similar applications.

The parameters set in the variable fields of the DLM V menu pages cannot be changed in the program mode. These parameters include, for example, line speed, character code, or line protocol. Such setups can only be changed in the parameters' associated menu pages.

A program is executed only if the program mode screen is accessed, the program is valid (set up properly), and the unit is in the RUN mode. A program cannot be executed if any other screen is displayed.

For example, the screen may show the trap and bit mask menu, and data is entered. A program is also written for trapping and bit masking. If the menu is displayed on the screen and the unit is set in the RUN mode, the menu parameters are taken, and the functions are executed. If the program is displayed on the screen and the unit is in the RUN mode, the program is executed.

The DLM V is not preprogrammed from the factory. The program mode must be accessed, and valid instructions and data entered (up to 72 lines). The program may be saved in the EEPROM.

The DLM V data menu and the parameter summary display menu are associated with the program mode. In the program run mode, the data menu displays the capture buffer contents. The parameter summary display menu shows the current values for variables (speed, data, or counters and timers).

The data menu is displayed when program execution is initiated, either by entering the START or STEP commands, or by pressing the RUN/HALT key. The parameter display menu is displayed when the EXAMINE command is entered. Refer to paragraph 4.5.2 for information on these commands.

The FIELD SEL key is used, with the SAVE or the LOAD command, to sequence through program numbers (0-9). Where applicable, the FIELD SEL key is used to select options available as part of the program instructions. Any field in which the FIELD SEL key is used to sequence through options is called "field-selectable."

4.3.1 Introduction to Program Instructions and File Commands

Program instructions relate to the individual program statements that make up a program. Program statements are entered by pressing FUNC key sequences, when the cursor is between lines 01 and 72 of the program listing area. Included, for example, are instructions to set timers, to test an event, or to increment counters. In some cases, instructions contain both field-selectable and unprotected fields; e.g., SET COUNTER, IFEV, TRAP.

File commands are divided into two distinct groups; file management commands and file execution control commands. A file is another name given to a program.

File commands (e.g., LOAD, RUN, SAVE) manage entire program files. Commands are entered when the cursor is located in the variable field on line 16 of the program screen. A command is executed when the key sequence FUNC 10 is pressed.

File execution control commands perform functions such as RUN, HALT, or START. These commands carry out the functions set through the program instructions.

4.3.2 Program Editing

When the program mode is entered, the cursor appears at the first character position on the first line of the screen. This applies to both new and existing programs.

If a line is blank, the cursor does not exit the first character position within the line. The cursor up and down keys move the cursor from line to line, at the first character position of each line.

Cursor movement within an instruction or statement line is controlled by the cursor right and cursor left keys. Pressing the cursor right key at the end of a statement line, moves the cursor to the first column on the next line. Pressing the cursor left key at the beginning of a line moves the cursor to the last column of the previous line. The cursor can only move within the unprotected fields. When the cursor reaches the last line in the program area, it automatically wraps around to the first line of the program. To call up the next page for editing, press the MENU SEL key.

Instructions are numbered sequentially in one-line increments. The line numbers are automatically generated. To insert an instruction in a program (between already existing instructions), press FUNC 9. To delete an instruction, press FUNC 10. Line numbering in all subsequent instructions, and all GOTO commands to line numbers are adjusted automatically.

Program size is restricted to 72 lines. The following message, **TOO MANY STATEMENTS**, results if any attempt is made to insert or add an instruction which would increase the program size beyond the limit.

A program cannot contain any blank lines. If a line is left blank, no further commands can be entered until the blank line is filled.

4.4 PROGRAM INSTRUCTIONS

Before instructions are entered in a program, some precautions must be taken. These precautionary measures apply particularly to the available RAM and EEPROM storage space.

When a program is created or edited, it occupies space in the DLM V RAM area. The available space is 700 bytes. If the total number of instruction bytes in a program exceeds the limit, the error message **INSUFFICIENT RAM PROGRAM STORAGE** appears on the screen. Table 4-1 lists the storage requirements for each instruction.

Table 4-1. Instruction RAM Storage Requirements

INSTRUCTION	BYTES REQUIRED
Set Trap	26
Search	3
Wait	1
Halt	1
Set Counter/Timer	9
Interrupt After	7
Increment Counter	3
GoTo	4
Test Event	6
Compare Counter/Timer	12
Clear Event	2
Output Message	3

Another storage-related error condition may occur if the remaining EEPROM storage space is too small to save a program. This could happen if several large programs already exist in the EEPROM. The total EEPROM storage area is 2048 bytes. The error message **INSUFFICIENT EEPROM PROGRAM STORAGE** is displayed on the screen if the EEPROM space is not sufficient enough to hold another program.

To avoid an error condition, it is advisable to write out a program on paper, before it is entered and saved in the EEPROM. Use the figures supplied in Table 4.1 to estimate the amount of RAM and EEPROM space required for a program. Make a list of the contents of the EEPROM, for reference.

Parameters such as counter and timer settings, traps and bit masks, can be defined through the menus, or through the program mode. It is important to remember that, in the program mode, the parameters set in the program instructions override the menu parameter settings (with the exception of Logging Buffer Active/Inactive; refer to paragraphs 3.3.6.1 and 3.3.6.2).

4.4.1 Syntax and Functional Descriptions

Program instructions are entered in the program screen by placing the cursor in a program line, and pressing the desired FUNCTION key sequence. When the key sequence is completed, the instruction mnemonic (abbreviation) appears in the highlighted instruction area on the screen.

It is good practice to use line 01 to enter the statement describing the program to be written. Press the CTRL and C keys simultaneously; the mnemonic **REM** (for REMarks) will appear in the leftmost highlighted area of the screen. Position the cursor at the beginning of the remarks area; then type in a brief descriptive phrase, using no more than 24 characters: For example, **TEST POLL RESPONSE TIME.** (See Figure 4-2.)

The following paragraphs give the instruction mnemonic, the related FUNCTION key sequence, and the instruction syntax. The instruction syntax is followed by a functional description, and any other relevant information. The term "syntax" refers to how the instructions are structured.

The unprotected, reverse video fields into which the user can enter variable data are shown as square brackets ([ ]). The half-intensity video fields, which are field-selectable, are shown as braces ({ }). Multiple entries within the braces indicate field values. The following codes represent the types of entries required in unprotected fields.

a Alphabetic or hexadecimal characters; includes "don't care" characters.

b Binary digits or "don't care" characters.

n Decimal digits (leading blanks allowed).

The following is an example of the format used to represent instructions in this manual (this sample instruction is used for trap operations):

```
TRAP {1} [aaaaaa] BMASK [bbbbbbbb]
     {2}
```

TRAP is the name of the instruction. This legend appears when the function key is pressed. The variable field next to the legend requires a selection; 1 or 2. The braces indicate that the selection is made by pressing the FIELD SEL key.

[aaaaaa] indicates that six alphabetic or hexadecimal characters can be entered, including "don't care" characters.

BMASK, if used, must contain either 8 binary digits, or "don't care" characters, or both.

The setting of the HEX/ALPHA key determines whether the characters can be entered in hexadecimal or encoded alphabetic format. This key also determines the field display format.

4.4.1.1 Search

Function Key: F1

Mnemonic: SRCH

Syntax: SRCH {1} MODE {OFF}
{2} {SEND}
{RECEIVE}

Description: Performs the SEARCH field function of menu Page 4. Refer to paragraph 3.3.6.1. Tells the unit to begin searching for the trap data specified on the specific line; e.g., SEND, RECEIVE. Note that actual trap recognition does not occur until both a TRAP and a SRCH instruction are executed.

4.4.1.2 GoTo

Function Key: F2

Mnemonic: GOTO

Syntax: GoTo [nn] (nn = range 01-72)

Description: Gives control to a specified line number. If a line is inserted or deleted, this statement number is automatically adjusted. The error message **ILLEGAL STATEMENT NUMBER** appears if the line number is not within the valid range (01-72).

NOTE

A GOTO statement, in any instruction where it occurs, cannot be written to reference its own line number; otherwise, the error message, **INVALID GOTO COMMAND**, will appear briefly on the screen when the program is run.

4.4.1.3 Halt

Function Key: F3

Mnemonic: HALT

Syntax: HALT

Description: This statement stops program execution. Execution is continued by the commands STEP or START (refer to paragraphs 4.5.2.5 and 4.5.2.6).

4.4.1.4 Set Up Trap

Function Key: F4

Mnemonic: TRAP

Syntax: TRAP {1} [aaaaaa] BMASK [bbbbbbbb]
{2}

Description: Functions the same as the trap feature of menu Page 4. Refer to paragraph 3.3.6.1. The message **BIT MASK IS ALL DON'T CARES** appears on the screen if no binary entries are made, and a "FIELD SEL" highlight exists in the TRAP field. If the TRAP field contains too many bytes to be masked, the message **TOO MANY BYTES MASKED** appears on the screen.

4.4.1.5 Set Up Interrupt Timer

Function Key: F5

Mnemonic: INTR AFTER

Syntax: INTR AFTER [nnnnnn]0 ms

Description: This is an interrupt timer (time-out feature), that is decremented in 10 millisecond intervals. When zero (0) is reached, the program goes to the next instruction after a WAIT statement. This feature can be used to continue program execution if a trap character is not detected within 50 msec.

4.4.1.6 Output Message

Function Key: F6

Mnemonic: OUTM

Syntax: OUTM BUFFER {1} MESSAGE {1}
{2} {2}
{3} {3}
{4} {4}
{5}
{6}
{7}
{8}
{9}

Description: Transmits segmented messages defined in an output buffer (output menu). The message **OUTM - FOX, BERT, OR OFF SELECTED** appears on the screen if the MODE field in the output menu contains "fox", "bert 511", or "off"; the BERT test is not executed.

4.4.1.7 Clear Event

Function Key: F7

Mnemonic: CLR

Syntax:
```
CLR {     TI}
    {  TRAP1}
    {  TRAP2}
    { PARITY}
    {CRC/LRC}
    {    ALL}
```

Description: Used to clear interrupt timer, traps, parity, CRC/LRC, or all event flags. If an event occurs and is not cleared, the next WAIT statement finds a pending event, and does not perform the desired WAIT.

4.4.1.8 Test Event Type and GoTo

Function Key: F8

Mnemonic: IFEV

Syntax:
```
IFEV {     TI} {THEN} GOTO [nn]
     {  TRAP1} {ELSE}
     {  TRAP2}
     {    PAR}
     {    CRC}
```

Description: This instruction is used to test for the occurrence of a particular event after a WAIT statement. If the event has occurred, and the statement is followed by the "THEN" case, the GOTO statement will be executed; otherwise, the program flow will go to the next statement. If the event has occurred, and the statement is followed by the "ELSE" case, the program flow will be to the next statement; otherwise, GOTO will be executed.

4.4.1.9 Set Counter/Timer

Function Key: F11

Mnemonic: SET

Syntax:
```
SET {COUNTER} {1} TO [nnnnn]
              {2}
              {3}
              {ALL}

    { TIMER}  {1}    { ON}
              {2}    {CLR}
              {BOTH} {OFF}
```

Description: This instruction functions in the same way as the contents of menu Page 4. Refer to paragraph 3.3.6.

4.4.1.10 Compare Counter/Timer and GoTo

Function Key: F12

Mnemonic: IF COUNTER , IF TIMER

Syntax:
```
IF {COUNTER} {1} >=[nnnnn] GOTO [nn]
             {2}
             {3}

   { TIMER}  {1}
             {2}
```

Description: This instruction allows the programmer to test (compare) the value of counters or timers, and to alter program flow if the conditions of the statement are met. Note that timers or counters must be enabled. If the counter is set to 65535 or above, the message **INVALID INTEGER** appears on the screen.

4.4.1.11 Increment Counters

Function Key: F13

Mnemonic: INC COUNTER

Syntax:
```
INC COUNTER {  1} BY {+} 1
            {  2}    {-}
            {  3}
            {ALL}
```

Description: This instruction is used to count events or to program statement occurrences, such as TIMERS, TRAPS, PARITY, and CRC/LRC errors.

4.4.1.12 Wait

Function Key: F14

Mnemonic: WAIT

Syntax: WAIT

Description: This instruction stops execution until an event occurs; i.e., the interrupt timer reaches zero (0 msec), a successful search is completed, or an error condition is found.

4.4.2 Related Functions

The following subparagraphs explain the functions of three key sequences in the program mode that are not instructions. The first two are used in program editing, and the third is used to enter or exit the program mode.

4.4.2.1 Insert

Function Key: F9

Description: This key sequence inserts a program line at the cursor position. Subsequent line numbers and GOTO line numbers are automatically readjusted. When the key function is executed, the legend **NOP** appears on the screen; it indicates the line insertion.

4.4.2.2 Delete

Function Key: F10

Description: This key sequence deletes a program line at the cursor position. Subsequent line numbers and GOTO line numbers are automatically readjusted.

4.4.2.3 Menu Mode

Function Key: F15

Description: This function key sequence is executed to enter into the program mode. When in the program mode, the key sequence returns control to the menu mode.

4.5 FILE COMMANDS

The commands are split into two major groups; file management commands, and file execution control commands. These command types are described in the following paragraphs.

4.5.1 File Management Commands

The file management commands relate to the content or to the location of a program file. Each command is initiated by pressing a FUNCTION key sequence, when the cursor is positioned in the highlighted area on line 16 of the screen. Some file management commands have variable fields into which data is entered, field-selectable fields, or both.

Most file management commands are executed by pressing the desired key sequence, and following with the EXECUTE key sequence (Function 10). For example, to clear a program, press FUNC 9 followed by FUNC 10. When a command is executed, the message **COMMAND EXECUTED** is displayed on the screen. The commands that do not use this type of key sequence are noted.

The paragraphs that follow provide information on each command. The information is presented in the same way as the instructions listed in previous paragraphs. FUNCTION keys 10 through 14 are not assigned to any commands.

4.5.1.1 Load Program

Function Key: F7

Syntax: LOAD PROGRAM # {0} (0-9)

Description: This command is used to load a program which has been saved in the EEPROM. Only one program can be loaded at a time.

4.5.1.2 Save Program

Function Key: F5

Syntax: SAVE PROGRAM # {0} (0-9)

Description: This command saves the specified program in the EEPROM. If there is not enough room in the EEPROM, the message **INSUFFICIENT EEPROM PROGRAM STORAGE** is displayed on the screen.

An edited program can be saved under a different program number, using this command, by changing the program number present in the variable field.

4.5.1.3 Print Program

Function Key: F6

Syntax: PRINT

Description: The loaded program is transmitted to the HEX OUT connector on the rear panel of the DLM V. Printer parameters must be set in the HEX OUT menu, with the exception of the PRINT field. A program does not have to be saved before it is printed.

4.5.1.4 Clear Program

Function Key: F9

Syntax: CLEAR

Description: This command clears a program from the screen. To clear a program in the EEPROM, either clear and save the program, or overwrite and save another program under the same program number.

4.5.1.5 Clear Program Directory

Function Key: F8

Syntax: DIRCLR

Description: This command clears all programs from the EEPROM. Whenever DIRCLR is entered, the following message will appear on the screen:

CLEAR DIRECTORY (Y/N)?

To verify that the command is correct, press the "Y" key; to exit the command, press the "N" key. Pressing "N" prevents the accidental erasure of all programs in memory.

CAUTION: CARE SHOULD BE TAKEN WHEN USING THIS COMMAND! DO NOT USE THIS COMMAND IF ANY PROGRAMS ARE TO BE SAVED IN MEMORY.

4.5.2 Execution Control Commands

These commands carry out the instructions set in the programs. The RUN and HALT commands are executed by pressing the RUN/HALT key on the keyboard. The LED on the front panel indicates the operating state. When this key is pressed and a valid program is entered, no mnemonics are presented on line 16 of the screen.

4.5.2.1 Run Program

Key: RUN/HALT on Keyboard

Description: This command begins continuous execution of the program, if in the program mode, starting at the first instruction of the program. This command does not display a mnemonic on line 16. The run state is indicated by the lighted LED on the front panel. Information on baud rate, bits set, and code is presented at the bottom of the screen.

4.5.2.2 Halt Program

Key: RUN/HALT on Keyboard

Description: This command stops the execution of a program (see RUN). It is the equivalent of the HALT instruction.

4.5.2.3 Set Program Counter

Function Key: F2

Syntax: SETPC STATEMENT [nn] nn = 01-72

Description: This command sets the program counter to a specified instruction number, to begin executing the program at a location other than 01. Statement numbers are entered into the unprotected field using the numeric keys on either the keyboard or the front panel keypad.

4.5.2.4 Examine Parameter Display Menu

Function Key: F1

Syntax: EXAM

Description: This command is used to examine the parameter display menu; this menu shows the values set for all variables. This menu can be viewed in the run and the halt states. The MENU SEL key restores command to the program screen.

4.5.2.5 Start Execution

Function Key: F3

Syntax: START

Description: This command begins program execution at the specified program statement, or restarts program execution at the first instruction after a HALT is detected.

4.5.2.6 Step and Halt

Function Key: F4

Syntax: STEP

Description: This command gives control to the first instruction after the last HALT is detected, and stops program execution. If the program is not being executed, control is given to the first instruction in the program.

4.6 PROGRAMMING THE DLM V

The first page of the program edit mode screen is displayed by pressing the FUNCTION key, followed by pressing the PROGRAM-MENU key (F15). This may be done from the halt mode, and with any menu screen displayed (see Figure 4-1).

Before discussing how to write a program, there are some points to consider concerning data flow within the DLM V, and its architecture.

Data is seen as a serial bit stream on pins 2 and 3 of the interface. The data is clocked into the unit using either an internal clock, or an external clock. The clock source depends on the selection made in menu Page 2, SPEED.

Once an entire character is received by the unit, the DLM V handles it as an 8-bit character. This is true even for codes of less than eight bits (e.g., BAUDOT); these are entered as an 8-bit field, and then right-justified. When a full character is received, the hardware "passes" it to the capture buffer. This process occurs every character time with data being received, stored, and displayed on the data screen as it arrives.

Another component involved in this process is the DLM V microprocessor. The microprocessor detects the data between the time it is received, and the time it is stored in the capture buffer. At this point, tests such as traps are made on the data. If the logging buffer is active (menu Page 4), the test is made to either capture the data (trap satisfied), or not. Also at this time, the unit determines if the data meets the trap requirements of a program trap instruction.

NOTE

If the Logging Buffer is ACTIVE, only the data between the start/stop traps is displayed. If it is INACTIVE, all data is displayed. This entry is NOT overridden by the program, so it must be set to the proper choice.

4.6.1 Program Example 1

In the program mode, an instruction sequence used to perform a trap would appear as follows (Figure 4-2):

```
01 REM   PERFORM A TRAP SEARCH
02 TRAP  1 ABCD
03 SRCH  1 MODE RECEIVE
04 WAIT
05 IFEV  TRAP1 ELSE GOTO 07
06 HALT
07 CLR   ALL
08 GOTO  04
```

Figure 4-2. Program Example 1

The remarks statement on line 01 was inserted by pressing CTRL and C simultaneously (refer to paragraph 4.4.1). The first operational statement (line 02), TRAP 1 ABCD, instructs the microprocessor to search for data arriving in the sequence specified (ABCD).

The second statement, SRCH 1 MODE RECEIVE, instructs the microprocessor that a search is to be performed only on the receive side of the data line (pin 2). Each receive character is sampled for the first trap character, which in this case is A. When this character is found, the character immediately following is checked to see if it equals B. If it does, the character after A and B is checked to see if it equals C.

This process continues until one of two events occurs:

1. If a character is not equal to the next character in the trap sequence, the microprocessor begins searching for the first character (A). For example, if the data arrived as ABACDABCD, the trap is not satisfied until the last four characters are received.

2. The trap is successful. A flag is set in the microprocessor indicating that the trap data was found.

The arrival sequence must match the sequence in the trap instruction, or no trap occurs.

NOTE

The character-matching trap function runs in a "background format". This means that no matter what other functions it is performing (e.g., counting, timing, or outputting), the microprocessor is always searching for trap data. The program can handle other functions without missing any data.

The order in which the first two operational instructions are used is not important; however, a trap will not begin until both the TRAP and the SRCH instructions have been executed. The unit must have information on what data to search for and which side of the line to search for the data.

Once a trap has been set up, by executing both the TRAP and SRCH instructions (press the F10 key), the unit searches for the specified sequence. The program can delay performance of the next operation while this search is being executed. The WAIT statement instructs the unit to delay until an event occurs before continuing to the next statement.

There are many events that will cause a WAIT condition to be satisfied. Refer to paragraph 4.4.1.12. The program example, however, concerns itself only with a successful trap. To ensure that a trap has occurred, an IFEV (IF EVENT) instruction is executed.

IFEV, as shown in Figure 4-2 (line 05), instructs the program that, if the event is TRAP 1, it is to fall through to the next step; if the event is anything else, the program is to go to the CLR ALL statement. This instruction clears the unwanted event, and the program returns to the WAIT statement.

NOTE

This sequence of instructions (TRAP, SRCH, WAIT) should be utilized whenever a program is used to identify a character sequence. Basically, even the most complex program is merely a series of traps, awaiting either a response or a command sequence, followed by an action (e.g., outputting a message), followed by another TRAP.

In Program Example 1 (Figure 4-2), if a sequence equal to ABCD is found on the receive side of the line, the program will halt.

4.3.2 Program Example 2

Program Example 1 (Figure 4-2) is a simplified version of a program. An example of the expanded program is as follows:

```
01 TRAP  1 ABCD
02 TRAP  2 XYZ
03 SRCH  1 MODE RECEIVE
04 SRCH  2 MODE SEND
05 WAIT
06 IFEV  TRAP1 THEN GOTO 10
07 IFEV  TRAP2 THEN GOTO 12
08 CLR   ALL
09 GOTO  05
10 INC   COUNTER 1  +1
11 GOTO  08
12 INC   COUNTER 2  +1
13 GOTO  08
```

Figure 4-3. Program Example 2

NOTE: The last instruction (line 13) would be written on the first line of page 2 of the PROGRAM screen; each page consists of only 12 lines.

This example counts the number of times ABCD is seen on the receive side, and the number of times XYZ is seen on the send side. A flowchart illustrating execution of this program follows:

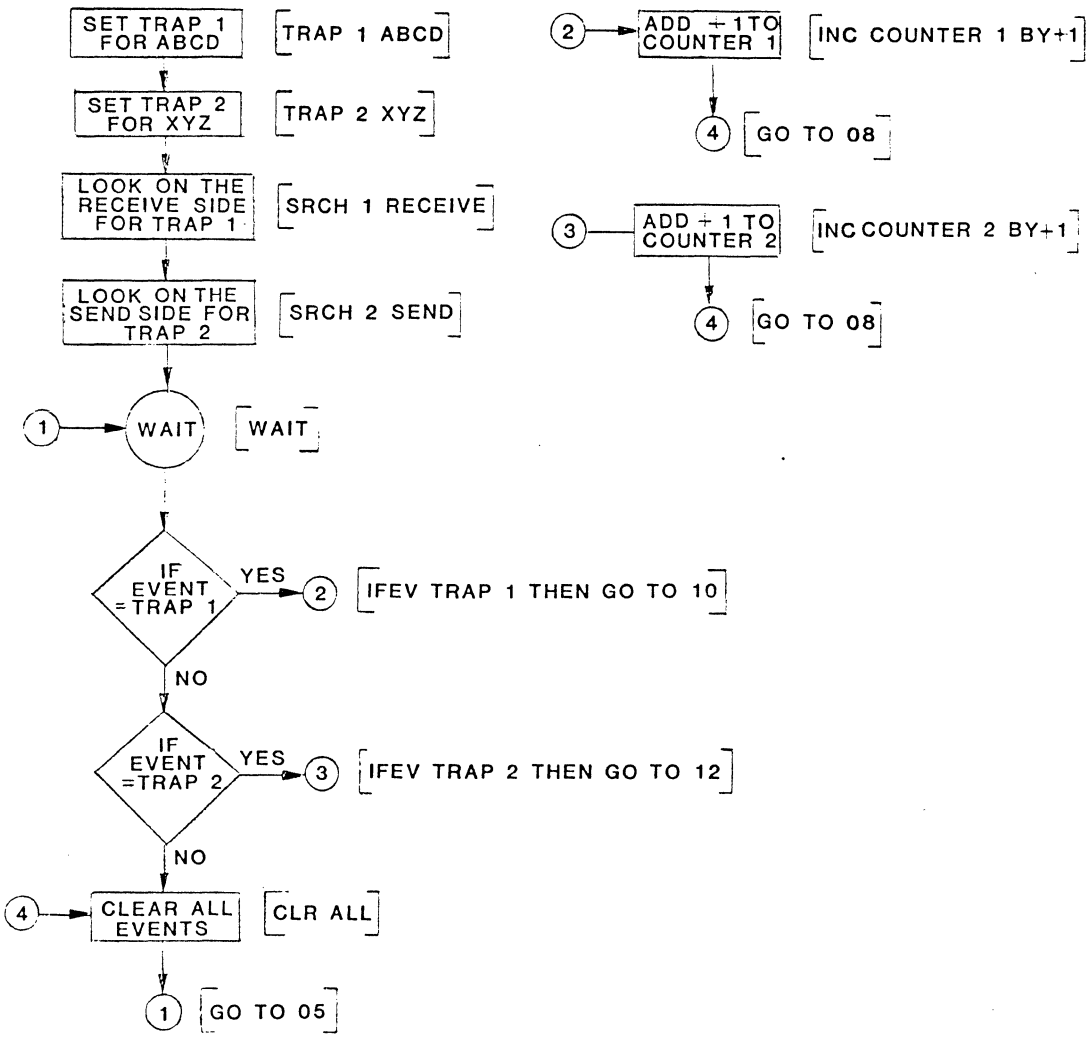


Figure 4-4. Flowchart of Program Example 2

Note the setup of two traps to search for different sequences on different sides of the line (Figure 4-4). Two traps can also be set up for different sequences on the same side of the line.

After the WAIT instruction is satisfied, check to see what EVENT has occurred. If it is TRAP 1, increment counter 1; if TRAP 2, increment counter 2 (see Figure 4-3).

As seen in the previous program (Figure 4-2), an event "flag" is set whenever the processor "sees" an event. Find out which event occurred, and act on it. The event flags must then be cleared before returning for a new check. The CLR instruction, already described (refer to paragraph 4.6.1, and see Figure 4-2), is used to clear the flags.

This program may be converted to an actual protocol test

1. by changing the ABCD to $^{S_Y}\ ^{S_Y}\ ^{4_0}\ ^{4_0}\ ^{7_F}\ ^{7_F}\ ^{2_D}$, and

2. by changing the XYZ to $^{S_Y}\ ^{S_Y}\ E_T$.

These two functions enable the user to count the number of polls received by the terminal, and the number of EOT (no traffic) responses. They also provide information as to whether the number of productive polls (polls received when text was waiting) is high enough to justify adding terminals.

4.6.3 Program Example 3

An interactive program with the DLM V acting as a host computer, written to poll a terminal one time, and to wait for an EOT response, would look like the following example:

```
01 OUTM  BUFFER 1 MSG 1      (MSG 1 = SY SY 40 40 7F 7F 2D)
02 TRAP  1 SY SY ET
03 SRCH  1 MODE RECEIVE
04 WAIT
05 IFEV  TRAP1 THEN GOTO 08
06 CLR   ALL
07 GOTO  04
08 HALT
```

Note that, after step 01, the program is similar to Program Example 1 (see Figure 4-2). Although the DLM V is being utilized as a host computer, the program is no more complex than a simple trap program.

4.6.4 Program Example 4

In the following example, a time-out check has been added to the polling program:

```
01 OUTM  BUFFER 1 MSG 1      (MSG 1 = SY SY 40 40 7F 7F 2D)
02 TRAP  1 SY SY ET
03 SRCH  1 MODE RECEIVE
04 INTR  AFTER 001000 ms
05 WAIT
06 IFEV  TRAP1 THEN GOTO 12
07 IFEV  TI THEN GOTO 10
08 CLR   ALL
09 GOTO  05
10 CLR   ALL
11 GOTO  01
12 HALT
```

The program polls the terminal every one second until it gets an $^{S_Y}\ ^{S_Y}\ E_T$ response.

> **NOTE**
>
> The sequence of IFEV instructions (after WAIT) controls the priority of events. In the example, a check is made for a good response before checking for the interrupt timer. Even if the two events occurred simultaneously, the DLM V would only recognize the good response.

In order to check the response time to the poll, a SET TIMER 1 ON instruction must be inserted between steps 01 and 02. When the DLM V halts after receiving a valid response, TIMER 1 contains the response.

Appendix D (Program Library) contains programming examples. They are only samples, given to illustrate to the user how to program the DLM V for various applications. Each program has a description, a listing, and a flowchart.

DLM V OPERATOR'S INSTRUCTION MANUAL

APPENDIX A - CODE CHARTS

DLM MENU SETUP

Speed: Ext
Bits: 8
Code: ASCII
Idle Sup's: Mark
Data: Sync
Sync: "16""16" or "96""96"
Out Sync: FF
Order: LSB 1st

ASCII CODE CHART

b7 →	0	0	0	0	1	1	1	1
b6 →	0	0	1	1	0	0	1	1
b5 →	0	1	0	1	0	1	0	1
1st HEX★ b8=0	0	1	2	3	4	5	6	7
DIGIT★ b8=1	8	9	A	B	C	D	E	F
2nd HEX DIGIT								
b4 b3 b2 b1								
0 0 0 0	0	NU	DL		0	@	P	\	p
0 0 0 1	1	SH	D1	!	1	A	Q	a	q
0 0 1 0	2	SX	D2	"	2	B	R	b	r
0 0 1 1	3	EX	D3	#	3	C	S	c	s
0 1 0 0	4	ET	D4	$	4	D	T	d	t
0 1 0 1	5	EQ	NK	%	5	E	U	e	u
0 1 1 0	6	AK	SY	&	6	F	V	f	v
0 1 1 1	7	BL	EB	'	7	G	W	g	w
1 0 0 0	8	BS	CN	(	8	H	X	h	x
1 0 0 1	9	HT	EM	)	9	I	Y	i	y
1 0 1 0	A	LF	SB	*	:	J	Z	j	z
1 0 1 1	B	VT	EC	+	;	K	[	k	{
1 1 0 0	C	FF	FS	,	<	L	\	l	|
1 1 0 1	D	CR	GS	-	=	M	]	m	}
1 1 1 0	E	SO	RS	.	>	N	↑	n	~
1 1 1 1	F	SI	US	/	?	O	←	o	DT

★ Dependent on Parity

CONTROL CHARACTERS

NU -NULL Character
SO -Shift Out
SH -Start of Header
SX -Start of Text
EX -End of Text
EQ -Enquiry
AK -Acknowledge
BL -Bell
SI -Shift In
RS -Record Separation
ET -End of Transmission
FS -File Separator
NK -Negative Ack.
SY -Synchronous Idle
EM -End of Medium
SB -Substitute
EC -Escape
GS -Group Separator
DI -Device Control I
D2-Device Control 2
D3-Device Control 3
D4-Device Control 4
DL-Data Link Escape
FF-Form Feed
CR-Carriage Return
EB-End Transmission Block
CN-Cancel
SB- Substitute
BS-Backspace
HT-Horizontal Tab
VT-Vertical Tab
LF-Line Feed
US-Unit Separator
DT-Delete

DLM MENU SETUP

Speed: Ext
Bits: 8
Code: EBCDIC
Idle Sup,s: Mark
Data: Sync
Sync: 32 32
Out Sync: FF
Order: LSB 1st

EBCDIC CODE CHART

b8 → b7 → b6 → b5 →		0 0 0 0	0 0 0 1	0 0 1 0	0 0 1 1	0 1 0 0	0 1 0 1	0 1 1 0	0 1 1 1	1 0 0 0	1 0 0 1	1 0 1 0	1 0 1 1	1 1 0 0	1 1 0 1	1 1 1 0	1 1 1 1
1st HEX DIGIT		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
2nd HEX DIGIT																	
b4 b3 b2 b1																	
0 0 0 0	0	NU	DL	DS	30		&	-	70	80	90	A0	B0	C0	D0	E0	0
0 0 0 1	1	SH	D1	SS	31	41	51	/	71	a	j	A1	B1	A	J	E1	1
0 0 1 0	2	SX	D2	FS	SY	42	52	62	72	b	k	s	B2	B	K	S	2
0 0 1 1	3	EX	D3	23	33	43	53	63	73	c	l	t	B3	C	L	T	3
0 1 0 0	4	PF	RE	BP	PN	44	54	64	74	d	m	u	B4	D	M	U	4
0 1 0 1	5	HT	NL	LF	RS	45	55	65	75	e	n	v	B5	E	N	V	5
0 1 1 0	6	LC	BS	EB	UC	46	56	66	76	f	o	w	B6	F	O	W	6
0 1 1 1	7	DT	IL	EC	ET	47	57	67	77	g	p	x	B7	G	P	X	7
1 0 0 0	8	08	CN	28	38	48	58	68	78	h	q	y	B8	H	Q	Y	8
1 0 0 1	9	09	EM	29	39	49	59	69	79	i	r	z	B9	I	R	Z	9
1 0 1 0	A	MM	CC	SM	3A	¢	!	70	:	8A	9A	AA	BA	CA	DA	EA	FA
1 0 1 1	B	VT	1B	2B	3B	.	$	,	#	8B	9B	AB	BB	CB	DB	EB	FB
1 1 0 0	C	FF	1F	2C	D4	<	*	%	@	8C	9C	AC	BC	CC	DC	EC	FC
1 1 0 1	D	CR	IG	EQ	NK	(	)	—	'	8D	9D	AD	BD	CD	DD	ED	FD
1 1 1 0	E	SO	IR	AK	3E	+	;	>	=	8E	9E	AE	BE	CE	DE	EE	FE
1 1 1 1	F	SI	US	BL	SB	|	¬	?	"	8F	9F	AF	BF	CF	DF	EF	FF

CONTROL CHARACTERS

NU-Null Character
PN-Punch On
RS-Reader Stop
LC-Lower Case
ET-End of Transmission
NL-New Line
BP-Bypass
LF-Line Feed
EB-End Transmission Block
CN-Cancel
MM-Start Manual Message
CR-Carriage Return
BS-Back Space
PF-Punch Off
HT-Horizontal Tab
DS-Digit Select
DT-Delete
SO-Shift Out
SH-Start of Header
SX-Start of Text
EX-End of Text
EQ-Enquiry
AK-Acknowledge
BL-Bell
SI-Shift In
VT-Vertical Tab
RE-Restore
FS-Field Separator
NA-Negative Acknowledge
SY-Synchronous Idle
EM-End of Medium
SB-Substitute
EC-Escape
SS-Start of Significance
FF-Form Feed
DL-Data LINK Escape
D1-Device Control 1
D2-Device Control 2
D3-Device Control 3
D4-Device Control 4
UC-Upper Case
SM-Set MADE
IL-Idle
CC-Cursor Control
IF-Info. Field Sep.
IG-Info. Group Sep.
IR-Info. Record Sep.
US-Info. Unit Sep.

CCITT #2
BAUDOT INTERNATIONAL CODE CHART

DLM MENU SETUP

Speed : Match Line Speed
Bits : 5
Code : Baudot
Idle Sup's : Mark
Data : Async
Sync : Not Used
Out Sync : Not Used
Order : LSB 1st
Invert : No

S→ 0→ 0→ 5→	0 0 0 0 0	0 0 0 0 1	1 0 0 0 0	1 0 0 0 1
1st HEX DIGIT	0	1	0	1
2nd HEX DIGIT				
4 3 2 1				
0 0 0 0	0	NU	E	NU	3
0 0 0 1	1	T	Z	5	+
0 0 1 0	2	CR	D	CR	92
0 0 1 1	3	0	B	9	?
0 1 0 0	4		S		/
0 1 0 1	5	H	Y	85	6
0 1 1 0	6	N	F	,	96
0 1 1 1	7	M	X	.	/
1 0 0 0	8	LF	A	LF	-
1 0 0 1	9	L	W	)	2
1 0 1 0	A	R	J	4	BL
1 0 1 1	B	G	SO	8B	SO
1 1 0 0	C	I	U	8	7
1 1 0 1	D	P	Q	Ø	1
1 1 1 0	E	C	K	:	(
1 1 1 1	F	V	SI	=	SI

CONTROL CHARACTERS

NU -Null
CR -Carriage Return
LF -Line Feed
SO -Figs. Shift
SI -Ltrs. Shift
BL -Bell

Display Is Blank For Space

IPARS AIRLINE RESERVATIONS

SYSTEM CODE CHART

DLM MENU SETUP

Speed: Ext
Bits: 6
Code: Ipars
Idle Sup's: Space
Data: Sync
Sync:
SY-1: 'FO' or 'FF'
SY-2: 7F
Out Sync: 00
Order: MSB 1st
Invert: Yes

Forced to zero-must be set to six bits (B, A)				0 0 0 0	0 0 0 1	0 0 1 0	0 0 1 1
1st HEX DIGIT				0	1	2	3
2nd HEX DIGIT							
8	4	2	1				
0	0	0	0	0	00	01	@	$
0	0	0	1	1	1	/	J	A
0	0	1	0	2	2	S	K	B
0	0	1	1	3	3	T	L	C
0	1	0	0	4	4	U	M	D
0	1	0	1	5	5	V	N	E
0	1	1	0	6	6	W	O	F
0	1	1	1	7	7	X	P	G
1	0	0	0	8	8	Y	Q	H
1	0	0	1	9	9	Z	R	I
1	0	1	0	A	0.	-	:	?
1	0	1	1	B	★	#	<	.
1	1	0	0	C	★★◿		+	%
1	1	0	1	D	EOM I	EOM C	EOM U	EOM PB
1	1	1	0	E	=	★▷	)	SY-2
1	1	1	1	F	★★ GA	.	(	SY-1

CONTROL CHARACTERS

★ SY-1 1st Sync Character
3F Error Address Nonmux
★ SY-2 2nd Sync Character
GA -Go Ahead
OF -Start of Boot
OF -Error Address Mux
IF Rem. GA
EOM-I End of Message Incomplete
OD End of Boot
EOM-C End of Message Complete
EOM-U End of Message Unsolicited
EOM-PB End of Message Push Button
37 Next Interchange Address
(Line Reset
▷ Start of Message
. Interchange Address Reset
/ Erase/Write Line Address
◿ Print New Line
S Blind Password Mode
SY-1 Hex 3F Before Inversion
SY-2 Hex 3E Before Inversion
OUT SYNC=Hex 00 or ID
CCC -CYCLIL Check Character

★ SY-1 should be put in as a HEX 'FO' or 'FF' and SY-2 should be a HEX '7F'

★★ Will Display in HEX

DLM MENU SETUP

Speed : Line Speed
Bits : 7
Code : EBCD 2740
Idle Sup's : Off
Data : Async 1
Sync : "Don't Care"
Out Sync : "Don't Care"
Order : LSB 1st
Invert : No
Parity : Odd

2740/2741 EBCD CODE CHART
7 LEVEL CODE

b8 b7 b6 b5 →	0 0 0 0	0 0 0 1	0 0 1 0	0 0 1 1	0 1 0 0	0 1 0 1	0 1 1 0	0 1 1 1	1 0 0 0	1 0 0 1	1 0 1 0	1 0 1 1	1 1 0 0	1 1 0 1	1 1 1 0	1 1 1 1
1st HEX DIGIT	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
2nd HEX DIGIT b4 b3 b2 b1																
0 0 0 0	0	SPACE	2	1	3	SPACE	2	1	3	SPACE	<	=	;	SPACE	<	=	;
0 0 0 1	1	-	k	j	1	-	k	j	7	—	K	J	L	—	K	J	L
0 0 1 0	2	@	S	/	32	@	s	/	72	@	S	?	T	@	S	?	T
0 0 1 1	3	&	b	a	C	&	b	a	c	t	B	A	C	+	B	A	C
0 1 0 0	4	8	0	9	#	8	0	9	#	*	)	(	"	*	)	(	"
0 1 0 1	5	q	15	r	$	q	55	r	$	Q	15	R	!	Q	55	R	!
0 1 1 0	6	y	16	z	,	y	56	66	,	Y	16	Z	,	Y	56	Z	,
0 1 1 1	7	h	HT	i	.	h	HT	i	.	H	HT	I	.	H	HT	I	.
1 0 0 0	8	4	6	5	7	4	6	5	7	:	,	%	>	:	'	%	>
1 0 0 1	9	m	o	n	p	m	o	n	p	M	O	N	P	M	O	N	P
1 0 1 0	A	u	w	v	x	u	w	v	x	U	W	V	X	U	W	V	X
1 0 1 1	B	d	f	e	g	d	f	e	g	D	F	E	G	D	F	E	G
1 1 0 0	C	0C	US	2C	ET	4C	US	6C	ET	0C	US	2C	ET	4C	US	6C	ET
1 1 0 1	D	0D	BS	CR	3D	4D	BS	CR	3D	0D	BS	CR	7D	4D	BS	CR	7D
1 1 1 0	E	0E	EB	LF	3E	4E	EB	LF	3E	0E	EB	LF	7E	4E	EB	LF	7E
1 1 1 1	F	0F	DS	2F	DL	4F	DS	6F	DL	0F	DS	2F	DL	4F	DS	6F	DL

CONTROL CHARACTERS

US-Info Unit Separator
ET-End of Transmission
LF-Line Feed
EB-End Transmission Block
CR-Carriage Return
BS-Back Space
HT-Horizontal Tab
DL-Delete
BS-Back Space
DS-Digit Select
* (D) Positive Answer (inquiry)
ET (C)
EB (B)
. (Y) Positive Response (Yes)
- (N) Negative Response } NO
— (N) Response
, (S) Start of Address

DLM MENU SETUP

Speed : Line Speed
Bits : 7
Code : 2740 Cor
Idle Sup's : Off
Data : Async 1
Sync : "Don't Care"
Out Sync : "Don't Care"
Order : LSB 1st
Invert : No
Parity : Odd

2740/2741 CORRESPONDENCE CODE CHART
7 LEVEL CODE

b8	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
b7	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
b6	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
b5	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
1st HEX DIGIT	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
2nd HEX DIGIT b4 b3 b2 b1																
0 0 0 0	0	SPACE	2	1	;	SPACE	2	1	;	@	<	1	;	@	<	1	;
0 0 0 1	1	-	.	m	v	-	.	m	v	—	.	M	V	—	.	M	V
0 0 1 0	2	j	n	x	u	j	n	x	u	J	N	X	U	J	N	X	U
0 0 1 1	3	+	b	g	f	+	b	g	f	+	B	G	F	+	B	G	F
0 1 0 0	4	4	z	c	"	4	z	c	"	☆	Z	)	#	☆	Z	)	#
0 1 0 1	5	o	15	s	!	o	55	s	!	O	15	S	$	O	55	S	$
0 1 1 0	6	1	16	h	,	1	56	h	,	L	16	H	&	L	56	H	&
0 1 1 1	7	/	17	y	.	/	57	y	.	?	17	Y	.	?	57	Y	.
1 0 0 0	8	5	18	%	>	5	58	%	>	:	18	%	>	:	58	%	>
1 0 0 1	9	09	19	29	39	49	59	69	79	09	19	29	39	49	59	69	79
1 0 1 0	A	t	w	2A	3A	t	w	6A	7A	T	W	2A	3A	T	W	6A	7A
1 0 1 1	B	p	1B	2B	3B	p	5B	6B	7B	P	1B	2B	3B	P	5B	6B	7B
1 1 0 0	C	0C	US	2C	ET	4C	US	6C	ET	0C	US	2C	ET	4C	US	6C	ET
1 1 0 1	D	0D	BS	CR	3D	4D	BS	CR	7D	0D	BS	CR	3D	4D	BS	CR	7D
1 1 1 0	E	0E	EB	LF	3E	4E	EB	LF	7E	0E	EB	LF	3E	4E	EB	LF	7E
1 1 1 1	F	F	HT	2F	DL	4F	HT	6F	DL	0F	HT	2F	DL	4F	HT	6F	DL

CONTROL CHARACTERS

US-Info Unit Separator
ET-End of Transmission
LF-Line Feed
EB-End Transmission Block
CR-Carriage Return
BS-Back Space
HT-Horizontal Tab
DL-Delete
BS-Back Space
DS-Digit Select
Ⓓ Positive Answer (Inquiry)
ET Ⓒ
EB Ⓑ
. Ⓨ Positive Response (Yes)
- Ⓝ Negative } NO
— Ⓝ Response }
, Ⓢ Start of Address

DLM MENU SETUP

Speed : Line Speed
Bits : 7
Code : EBCD 1050
Idle Sup's : Off
Data : Async 1
Sync : "Don't Care"
Out Sync : "Don't Care"
Order : LSB 1st
Invert : No
Parity : Odd

EBCD 1050 CODE CHART
7 LEVEL CODE

b8 / b7 / b6 / b5 →	0 0 0 0	0 0 0 1	0 0 1 0	0 0 1 1	0 1 0 0	0 1 0 1	0 1 1 0	0 1 1 1	1 0 0 0	1 0 0 1	1 0 1 0	1 0 1 1	1 1 0 0	1 1 0 1	1 1 1 0	1 1 1 1
1st HEX DIGIT	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
2nd HEX DIGIT b4 b3 b2 b1																
0 0 0 0	0	SPACE	2	1	3	SPACE	2	1	3	SPACE	<	=	:	SPACE	<	=	;
0 0 0 1	1	-	k	j	1	-	k	j	7	—	K	J	L	—	K	J	L
0 0 1 0	2	@	s	/	32	@	s	/	72	02	S	?	T	42	S	?	T
0 0 1 1	3	&	b	a	c	&	b	a	C	+	B	A	C	+	B	A	C
0 1 0 0	4	8	Ø	9	*	8	Ø	9	*	•	)	(	"	•	)	(	"
0 1 0 1	5	q	15	r	$	q	55	r	$	Q	15	R	!	Q	55	R	!
0 1 1 0	6	y	16	z	,	y	56	z	,	Y	16	Z	36	Y	56	Z	76
0 1 1 1	7	h	HT	i	.	h	HT	i	.	H	HT	I	.	H	HT	I	.
1 0 0 0	8	4	6	5	7	4	6	5	7	:	'	%	"	:	'	%	"
1 0 0 1	9	m	o	n	p	m	o	n	p	M	O	N	P	M	O	N	P
1 0 1 0	A	y	w	v	x	y	w	v	x	U	W	V	X	U	W	V	X
1 0 1 1	B	d	f	e	g	d	f	e	g	D	F	E	G	D	F	E	G
1 1 0 0	C	PN	US	RS	ET	PN	US	RS	ET	PN	US	RS	ET	PN	US	RS	ET
1 1 0 1	D	RE	BS	CR	3D	RE	BS	CR	7D	RE	BS	CR	3D	RE	BS	CR	7D
1 1 1 0	E	BP	EB	LF	3E	BP	EB	LF	7E	PF	EB	LF	3E	PF	EB	LF	7E
1 1 1 1	F	0F	DS	2F	DL	4F	DS	6F	DL	OF	DS	2F	DL	4F	DS	6F	DL

CONTROL CHARACTERS

PN-Punch On
RS-Reader Stop
US-Info. Unit Seperato
ET-End of Transmission
BP-Bypass
LF-Line Feed
EB-End Transmission Block
RE-Restart
CR-Carriage Return
BS-Back Space
PF-Punch Off
HT-Horizontal Tab
DS-Digit Select
DL-Delete
* (D) Positive Answer (inquiry)
ET (C)
EB (B)
. (Y) Positive Response (Yes)
- (N) Negative Response } No
— (N) Response
, (S) Start of Address

DLM MENU SETUP

Speed : Ext
Bits : 7
Code : XS-3
Idle Sup's : Mark
Data : Sync
Sync : "D7" "6A"
Out Sync : FF
Order : LSB 1st
* Parity : None

* Data characters are odd parity and control characters are even parity.

XS-3 (Univac)
CODE CHART

b8 b7 b6 b5 →	0 0 0 0	0 0 0 1	0 0 1 0	0 0 1 1	0 1 0 0	0 1 0 1	0 1 1 0	0 1 1 1	1 0 0 0	1 0 0 1	1 0 1 0	1 0 1 1	1 1 0 0	1 1 0 1	1 1 1 0	1 1 1 1
1st HEX DIGIT	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
2nd HEX DIGIT																
b4 b3 b2 b1																
0 0 0 0	0	SH	+	@	30	SPACE	50	60	—							
0 0 0 1	1	]	11	21	%	41	:	*	71							
0 0 1 0	2	-	12	22	,	42	.	$	72							
0 0 1 1	3	(	?	!	33	Ø	53	63	&							
0 1 0 0	4	I	14	24	/	44	A	J	74							
0 1 0 1	5	05	B	K	SY	2	EX	65	S							
0 1 1 0	6	06	C	L	36	3	56	66	P							
0 1 1 1	7	4	17	27	U	47	D	M	77							
1 0 0 0	8	5	18	28	V	48	E	N	78							
1 0 0 1	9	09	F	O	39	6	59	69	W							
1 0 1 0	A	0A	G	P	3A	7	5A	6A	X							
1 0 1 1	B	8	IB	2B	Y	4B	H	Q	7B							
1 1 0 0	C	0C	I	R	0C	9	5C	6C	Z							
1 1 0 1	D	\	ID	2D	)	4D	:	%	7D							
1 1 1 0	E	;	IE	26	>	4E	<	'	76							
1 1 1 1	F	0F	↑	↑	3F	[	5F	6F	"							

CONTROL CHARACTERS

SY- Synchronous Idle
EX- End of Text
SH- Start of Header

DLM MENU SETUP

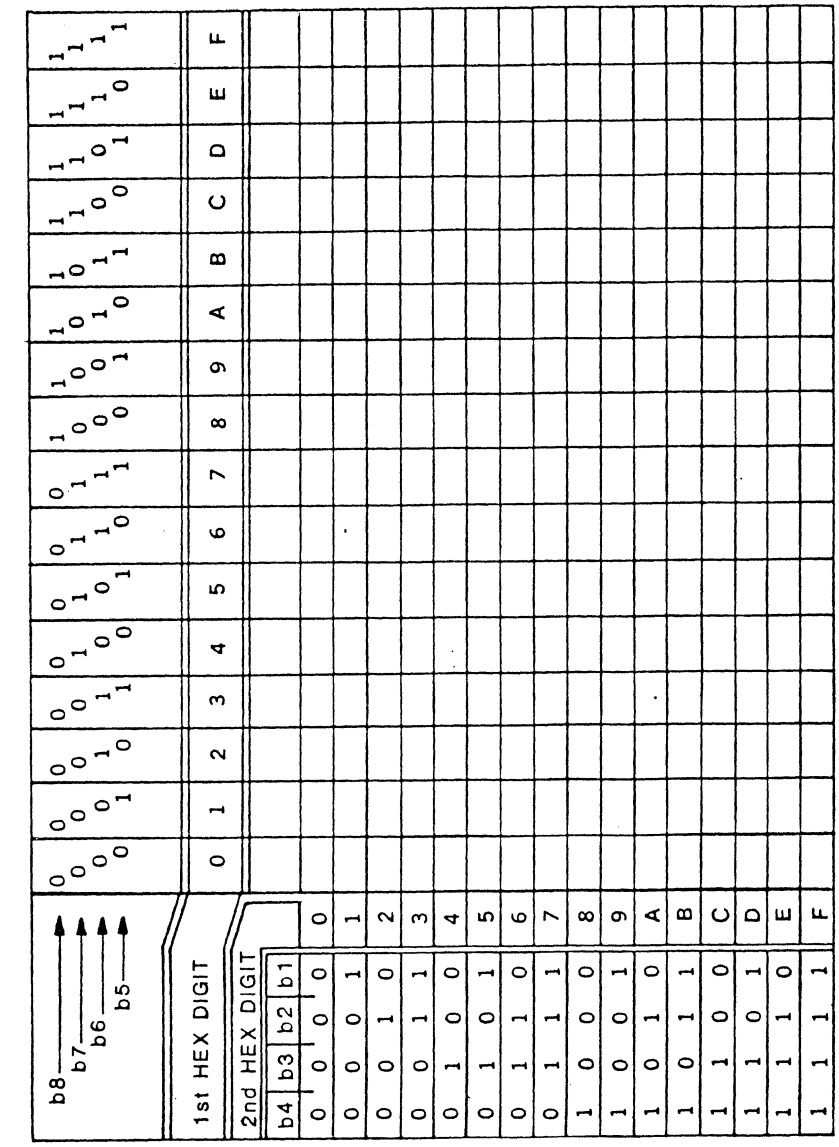
Speed: Line Speed
Bits: 8
Code: 200 UT
Idle Sup,s: Mark
Data: Async 1
Sync: "Don,t Care"
Out Sync: "Don't Care"
Order: LSB 1st
Invert: No
Parity: None

HEX TO UNIVAC 200 USER TERMINAL CODE CHART

b8	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
b7	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
b6	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
b5	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
1st HEX DIGIT	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
2nd HEX DIGIT b4 b3 b2 b1																
0 0 0 0	0	SO	DI	-	SPACE	:	+	SO	DI	-	+	:	SPACE				
0 0 0 1	1	SH	FS	J	A	1	/	SH	FS	J	A	1	/				
0 0 1 0	2	SX	CLEAR WRITE	K	B	2	S	SX	CLEAR WRITE	K	B	2	S				
0 0 1 1	3	EX	READ	L	C	3	T	EX	READ	L	C	3	T				
0 1 0 0	4		WRITE	M	D	4	U		WRITE	M	D	4	U				
0 1 0 1	5	EQ	NK	N	E	5	V	EQ	NK	N	E	5	V				
0 1 1 0	6	AK	SY	O	F	6	W	AK	SY	O	F	6	W				
0 1 1 1	7	BL		P	G	7	X	BL		P	G	7	X				
1 0 0 0	8		REJECT	Q	H	8	Y		REJECT	Q	H	8	Y				
1 0 0 1	9		EM	R	I	9	Z		EM	R	I	9	Z				
1 0 1 0	A	SI	SB	V	<	¢	]	SI	SB	V	<	¢	]				
1 0 1 1	B		EC	$	.	=	!	RS	EC	$	.	=	!				
1 1 0 0	C	RS	FS	*	)	#	(		FS	*	)	#	(				
1 1 0 1	D		GS	u	}	{	r		GS	u	}	{	r				
1 1 1 0	E			d	EC	%	~			d	EC	%	~				
1 1 1 1	F			>	;	[	^			>	;	[	^				

CONTROL CHARACTERS

RID -First Level of Addressing
SID -Second Level of Addressing
DID -Terminal Address
SO -Shift Out
SH -Start of Header
SX -Start of Text
EX -End of Text
EQ -Enquiry
AK -Acknowledge
BL -Bell
SI -Shift In
RS -Record Separation
DI -Device Control I
FS -File Separator
NK -Negative Ack.
SY -Synchronous Idle
EM -End of Medium
SB -Substitute
EC -Escape
GS -Group Separator


b8
b7
b6
b5
1st HEX DIGIT
2nd HEX DIGIT
b4 b3 b2 b1
0 1 2 3 4 5 6 7 8 9 A B C D E F
DLM MENU SETUP
Speed:
Bits:
Code:
Idle Sup'n:
Data:
Sync:
Out Sync:
Order:
Invert:
Parity:

BINARY TO HEXADECIMAL CONVERSION CHART	
BINARY	HEXADECIMAL
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

DLM V OPERATOR'S INSTRUCTION MANUAL

APPENDIX B - 3270 PROTOCOL

APPENDIX B - 3270 PROTOCOL

While 3270 Protocol provides for asynchronous transmission and point-to-point operation, the dominant protocol application is for synchronous transmission on multidrop data links. In this configuration, a central Host controls all transmissions by polling or selecting remote stations and their attached devices.

All transmission activity obeys a predetermined set of rules, the protocol, which governs

a. polls or selects

b. commands from the Host

c. Data-Link Control sequences

d. messages.

POLLS incorporate station poll addresses (SPA) and device addresses (GDA or DA), to invite transmission from any station device (GENERAL POLL), or a specific device (SPECIFIC POLL). The polled station responds with a message or "No Traffic Response" (EOT data-link control sequence).

SELECTS incorporate station select addresses (SSA) and device address (DA) to request permission to send a command or message to the addressed station/device. Either permission is granted (ACK0) or a reason is given (WACK or RVI).

COMMANDS are used to write a message to the device, read a message from the device, or control the device (for example, copy the CRT buffer to the printer). Commands are defined by ESC sequences, and may contain special "command characters", "orders", and text.

MESSAGES from the station/device incorporate their addresses (SPA and DA), as well as text and special characters; for example, AID, SENSE and STATUS, AC, and BUFFER or CURSOR addresses. Messages are used to keep the Host informed of device status, ask for help, and respond to the Host request for job-related information.

DATA-LINK CONTROL SEQUENCES are used to ensure that all stations and devices are being understood properly, so that communications may continue. They are also used to warn that something is not going according to plan, and to provide a means of recovery.

ERROR DETECTION

3270 PROTOCOL supports transmission using either 7-bit ASCII or 8-bi EBCDIC codes. Commands and messages (but not data-link contro sequences) make use of a special BCC character (or characters) t verify that the transmission has been error-free. BCC is calculate beginning with the first character following the first SOH or ST character of the transmission and concludes the transmission with th ETB or ETX character. SYN characters may be inserted into the messag as it is being sent and after the BCC is computed. For this reason, SYN is ignored when checking BCC for transmission errors.

ASCII

An eighth bit is appended to the 7-bit character as an error chec (VRC). (This bit makes character parity ODD for synchronou transmission, or EVEN for asynchronous transmission.)

The BCC is a single character (parity as previously mentioned) calle the LRC. Each LRC bit value is set to make the corresponding bits of all checked characters, taken as a group, of even parity.

Note that VRC and LRC together permit detection and correction of any single-bit error. However, it is not unusual that parity is ignored, and LRC is used alone to detect errors.

EBCDIC

Since all eight bits are used for characters, no VRC or parity is employed. The BCC consists of two characters calculated using the CRC/16 polynomial, which makes undetected transmission errors virtually impossible.

DLM V OPERATOR'S INSTRUCTION MANUAL

APPENDIX C - X.25 INDUSTRY STANDARD ABBREVIATIONS

ABBREVIATION	MEANING
ADR	Frame Level Address Field
BCUG	Bilateral Closed User Group
BMTI	Block Mode Terminal Interface
BSC	Bisync
CMDR (LAP FORMAT)*	Command Reject
CRC	Cyclic Redundancy Check
CTL	Frame Level Control Field
CUG	Closed User Group
D	Delivery Confirmation Bit
DCE (NODE or STE)	Data Communication Equipment
DISC	Disconnect
DM	Disconnected Mode (not found in LAP format)
DTE (USER)	Data Terminal Equipment
FCS	Frame Check Sequence (CRC)
FRMR	Frame Reject
GFI	Packet General Format ID
HDLC	High Level Data Link Control
I	Information Transfer Frame
ITI	Interactive Terminal Interface
LAP	Link Access Procedure (frame level)

* LAP FORMAT cannot be displayed

ABBREVIATION	MEANING
LAP B	Link Access Procedure, Balanced (frame level)
LCN	Logical Channel Number
LCGN	Logical Channel Group Number
M	More Data Indication
MOD	Modulo
NR "$N_{(R)}$"	Transmitter Receive Sequence Count next expected frame
NS "$N_{(S)}$"	Transmitter Send Sequence Count
PAD	Packet Assembler/Disassembler
PDN	Public Data Network
P/F	Poll Final Bit
PR "$P_{(R)}$"	Packet Receive Sequence
PS "$P_{(S)}$"	Packet Send Sequence
PSE	Packet Switch Exchange
PVC	Permanent Virtual Circuit
Q	Data Qualifier Bit
REJ	Reject
RNR	Receiver Not Ready
RR	Receiver Ready
RST	Reset
S	Supervisory Format

ABBREVIATION	MEANING
SABM	Set Asynchronous Balance Mode
SARM (LAP FORMAT)*	Set Asynchronous Response Mode
STE	Station Terminal Equipment (special DCE)
SVC	Switched Virtual Circuit
U	Unnumbered Format
UA	Unnumbered Acknowledge
VS	Send State Variable
VR	Receive State Variable

* LAP FORMAT cannot be displayed

DLM V OPERATOR'S INSTRUCTION MANUAL

APPENDIX D - PROGRAM LIBRARY

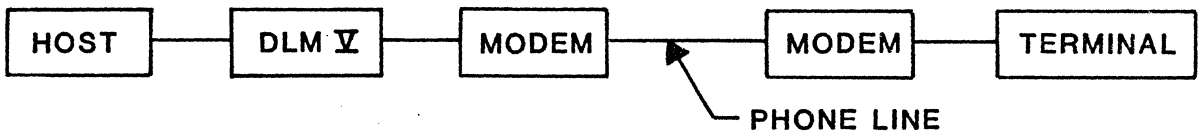
INTRODUCTION

Objective

Appendix C is designed to give the user a more application-oriented view of the DLM V. It is written with the understanding that the user has read the DLM V Operator's Instruction Manual, and is familiar with the operation of the front panel and the keyboard.

The idea is to give the user an understanding of how to organize program instructions and monitoring functions in a logical sequence, to perform a particular test. Please note the following conditions:

1. All tests are written with the DLM V connected on the digital side of the modem, at the host location.



   If the DLM V is connected directly to the terminal device, the following changes should be made to all programs:

   a. All SRCH and RECEIVE instructions should be changed to SRCH and SEND.

   b. All SRCH and SEND instructions should be changed to SRCH and RECEIVE.

2. All of the polls and responses are given for a 3270 Protocol running EBCDIC code. If another protocol or code is used, all output messages and trap sequences must be changed.

3. These programs should be used as training aids to direct the development of the user's own programs. They do not cover every test that may be run using the DLM V, but they are representative of the kinds of tests which can be accomplished.

4. All timeouts are set for 500 ms. If this should be different, change the INT AFTER 500 ms. instructions.

DLM V PROGRAM LIBRARY INDEX

PROGRAM NO.	DESCRIPTION
DLM 1.0	Trap on a selected character string.
DLM 2.0	Trap and stop on a selected response to a poll.
DLM 3.0	Measure the response time to a poll.
DLM 4.0	Test a response time against a pre-set limit.
DLM 5.0	Count the number of BCC errors in one hour.
DLM 6.0	Count the number of good messages vs. BCC errors.
DLM 7.0	In SDLC/HDLC, count the number of INFO frames vs. NON-INFO.
DLM 8.0	Count the number of productive polls vs. non-productive polls.
DLM 9.0	Poll a 327X terminal and wait for a response.
DLM 10.0	Poll a 327X terminal and calculate response time.
DLM 11.0	Poll a 327X terminal every 1 second.
DLM 12.0	327X Start-up test.
DLM 13.0	Poll a 327X and respond to text messages.
DLM 14.0	Poll a 327X and count the number of polls vs. responses.
DLM 15.0	Poll a 327X 10 times, then send a text message.
DLM 16.0	Poll a 327X waiting for a specific text message, then send a text message to the terminal.
DLM 17.0	Calculates average response time.
DLM 18.0	Calculates line utilization based upon time.

APPENDIX C - PROGRAM LIBRARY
PROGRAM: DLM 1.0

DESCRIPTION

This program may be used to trap on any significant character sequence.

APPLICATION

An intermittent or important sequence of data can easily be located and identified using this program.

HOW TO USE

1. Put the character sequence in STEP 01.

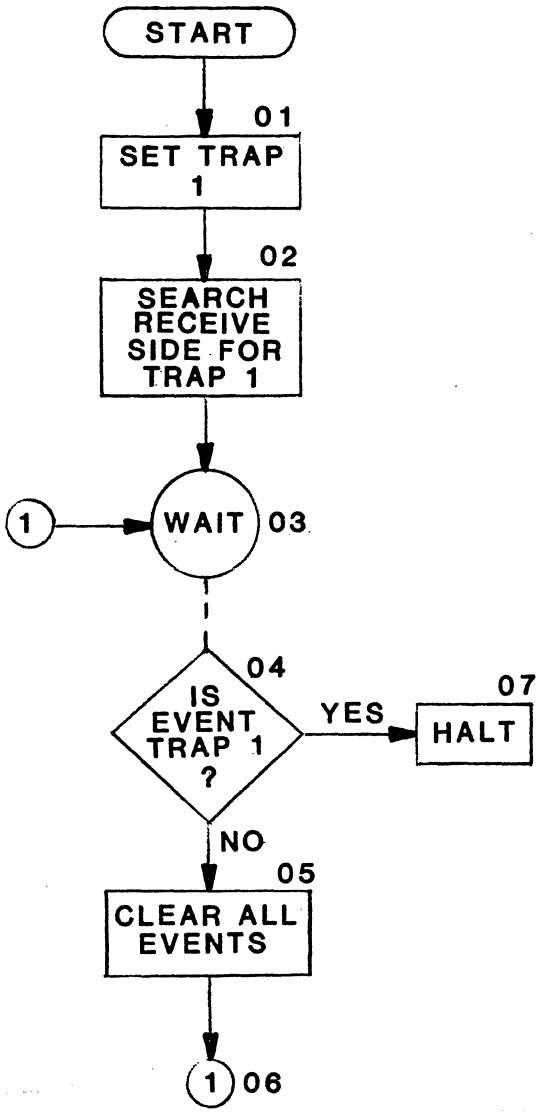
2. Set the side of the line to be tested in STEP 02.

3. Run the program. When it halts, the sequence tested for will be close to the end of the capture buffer.

DLM 1.0

LISTING

STEP	INST	OPERAND
01	TRAP	1 %%%%%BIT MASK
02	SRCH	1 SEND
03	WAIT	
04	IFEV	TRAP1 THEN GOTO 07
05	CLR	ALL
06	GOTO	03
07	HALT	
08		
09		
10		


START
01
SET TRAP 1
02
SEARCH RECEIVE SIDE FOR TRAP 1
1
WAIT
03
04
IS EVENT TRAP 1 ?
YES
07
HALT
NO
05
CLEAR ALL EVENTS
1
06

APPENDIX C - PROGRAM LIBRARY
PROGRAM: DLM 2.0

DESCRIPTION

This program will trap and stop on a specified response to a poll.

APPLICATION

This program will identify whether or not a polled device is responding correctly to its poll.

HOW TO USE

1. Put poll to be checked in STEP 01.

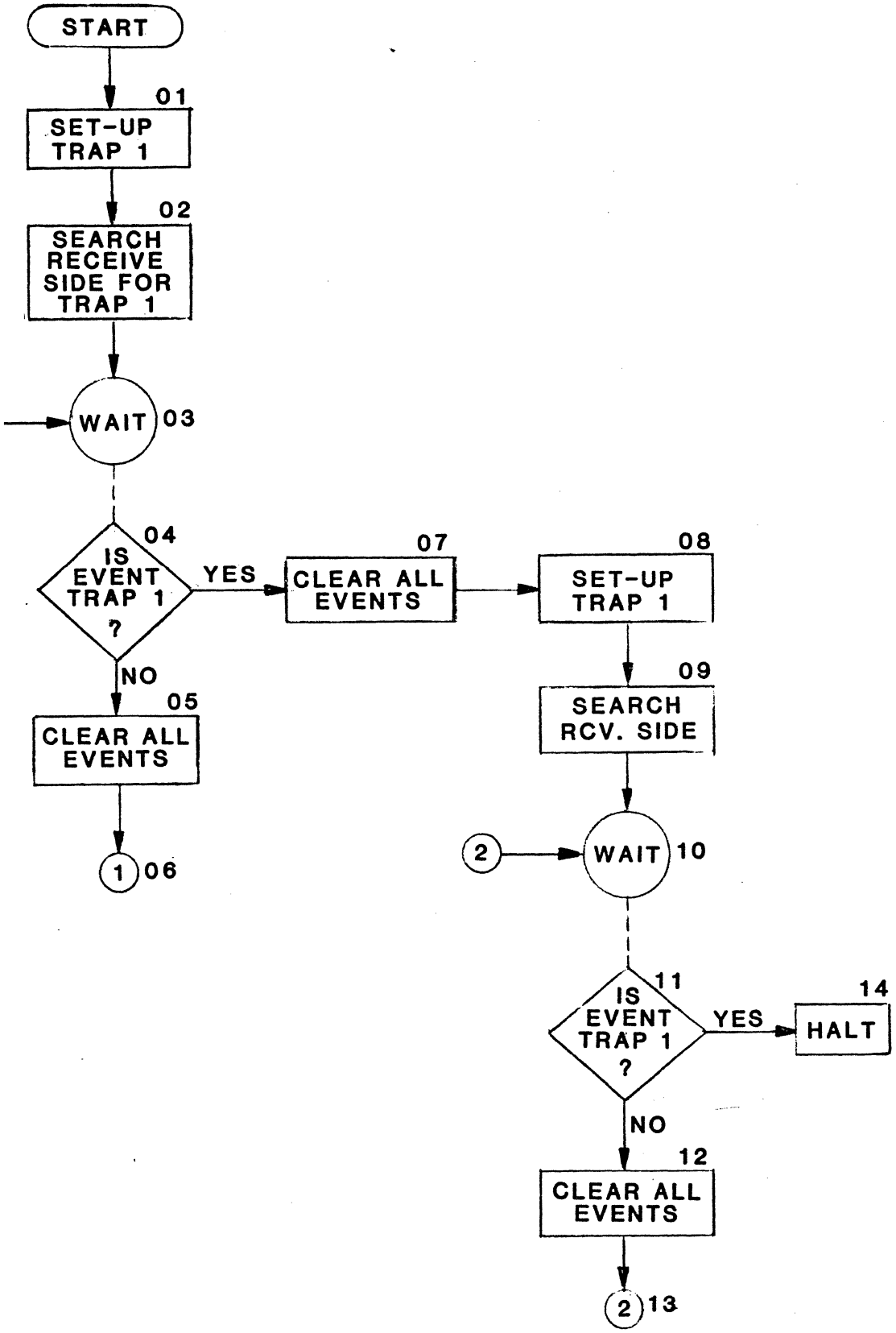
2. Put the expected response in STEP 08.

DLM 2.0

LISTING

STEP	INST	OPERAND
01	TRAP	1 [illegible] BIT MASK
02	SRCH	1 SEND
03	WAIT	
04	IFEV	TRAP1 THEN GOTO 07
05	CLR	ALL
06	GOTO	03
07	CLR	ALL
08	TRAP	1 [illegible] BIT MASK
09	SRCH	1 RECEIVE
10	WAIT	
11	IFEV	TRAP1 THEN GOTO 14
12	CLR	ALL

STEP	INST	OPERAND
13	GOTO	10
14	HALT	


START
01
SET-UP TRAP 1
02
SEARCH RECEIVE SIDE FOR TRAP 1
WAIT
03
04
IS EVENT TRAP 1 ?
YES
07
CLEAR ALL EVENTS
08
SET-UP TRAP 1
09
SEARCH RCV. SIDE
NO
05
CLEAR ALL EVENTS
1
06
2
WAIT
10
11
IS EVENT TRAP 1 ?
YES
14
HALT
NO
12
CLEAR ALL EVENTS
2
13

DESCRIPTION

This program will calculate the response time to a poll.

APPLICATION

Using this program will give the user an indication of response time to a poll.

HOW TO USE

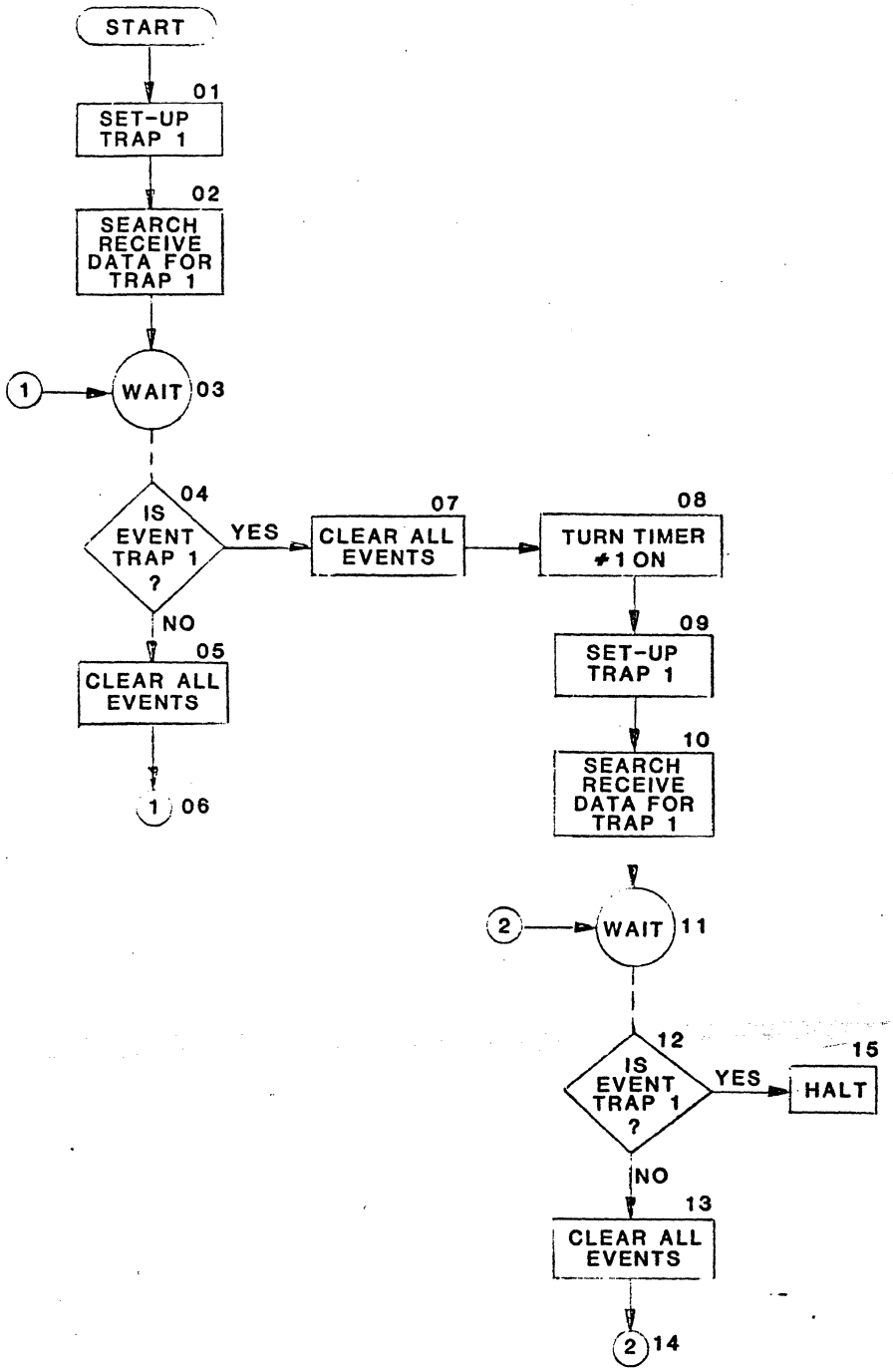
1. Set poll to be tested in STEP 01.
2. Set expected response in STEP 09.
3. After execution, the response time is in TIMER 1.

DLM 3.0

LISTING

STEP	INST	OPERAND
01	TRAP	1 ₆₆₇₇₂₀ BIT MASK
02	SRCH	1 SEND
03	WAIT	
04	IFEV	TRAP1 THEN GOTO 07
05	CLR	ALL
06	GOTO	03
07	CLR	ALL
08	SET	TIMER 1 ON
09	TRAP	1 ₅₅₅ BIT MASK
10	SRCH	1 RECEIVE
11	WAIT	
12	IFEV	TRAP1 THEN GOTO 15

STEP	INST	OPERAND
13	CLR	ALL
14	GOTO	11
15	HALT	


START
01
SET-UP TRAP 1
02
SEARCH RECEIVE DATA FOR TRAP 1
1
WAIT
03
04
IS EVENT TRAP 1 ?
YES
07
CLEAR ALL EVENTS
08
TURN TIMER #1 ON
09
SET-UP TRAP 1
10
SEARCH RECEIVE DATA FOR TRAP 1
NO
05
CLEAR ALL EVENTS
1
06
2
WAIT
11
12
IS EVENT TRAP 1 ?
YES
15
HALT
NO
13
CLEAR ALL EVENTS
2
14

PROGRAM: DLM 4.0

DESCRIPTION

This program measures the response time to a poll. It then compares the response time to a pre-set limit. If the response time is greater, the program will halt.

APPLICATION

Very useful program to identify intermittent timeouts.

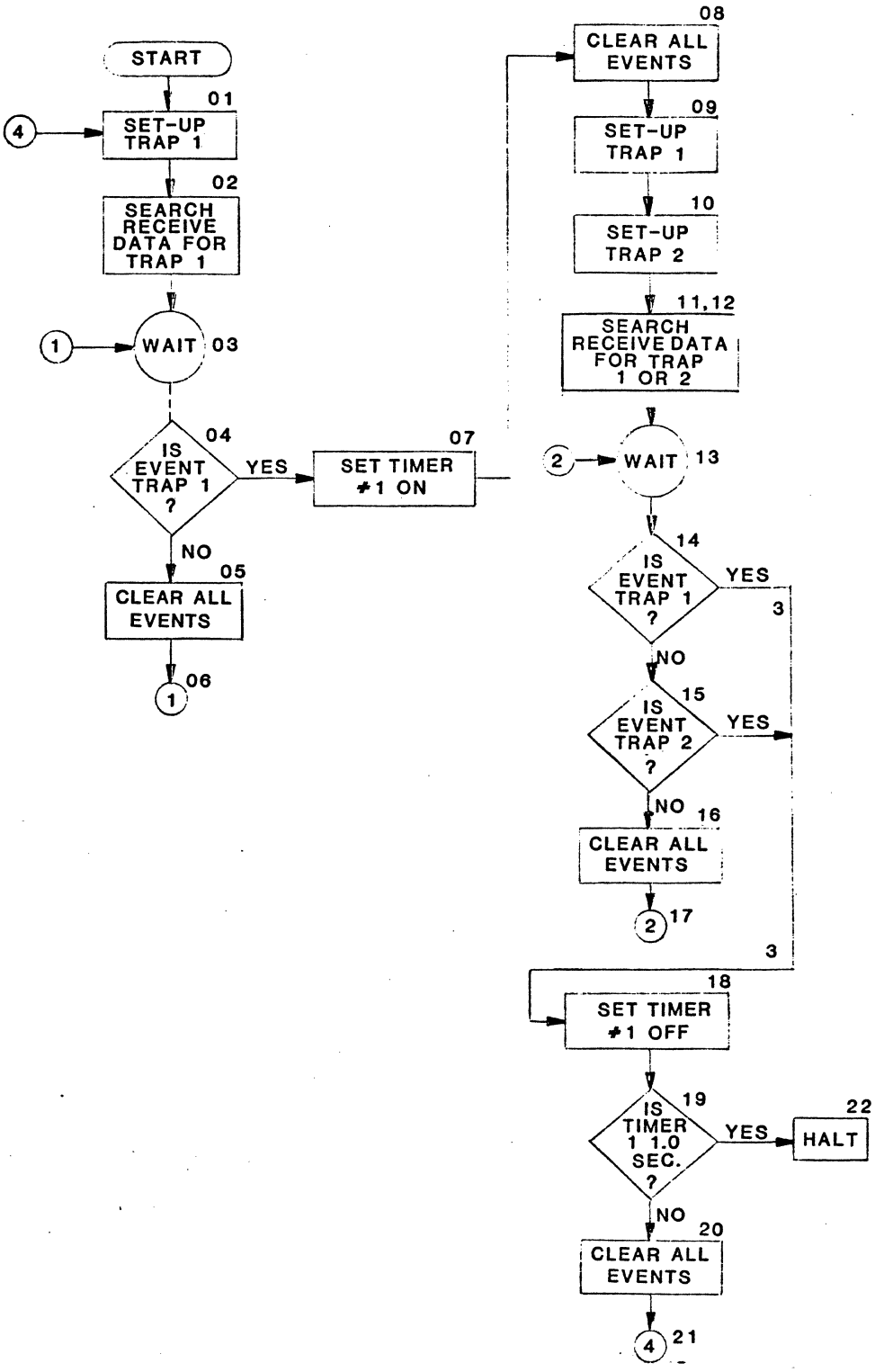
HOW TO USE

1. Put poll to be tested in STEP 01.
2. Put expected responses in STEP 09 and STEP 10.
3. Put response time limit in STEP 19.

DLM 4.0

STEP	INST	OPERAND
01	TRAP	1 %%%%% BIT MASK
02	SRCH	1 SEND
03	WAIT	
04	IFEV	TRAP1 THEN GOTO 07
05	CLR	ALL
06	GOTO	03
07	SET	TIMER 1 ON
08	CLR	ALL
09	TRAP	1 %%% BIT MASK
10	TRAP	2 %%% BIT MASK
11	SRCH	1 RECEIVE
12	SRCH	2 RECEIVE

STEP	INST	OPERAND
13	WAIT	
14	IFEV	TRAP1 THEN GOTO 18
15	IFEV	TRAP2 THEN GOTO 18
16	CLR	ALL
17	GOTO	13
18	SET	TIMER 1 OFF
19	IF	TIMER 1 =>001000ms GOTO 22
20	CLR	ALL
21	GOTO	01
22	HALT	


START
01
SET-UP TRAP 1
02
SEARCH RECEIVE DATA FOR TRAP 1
WAIT 03
04
IS EVENT TRAP 1 ?
YES
07
SET TIMER #1 ON
NO
05
CLEAR ALL EVENTS
06
08
CLEAR ALL EVENTS
09
SET-UP TRAP 1
10
SET-UP TRAP 2
11,12
SEARCH RECEIVE DATA FOR TRAP 1 OR 2
WAIT 13
14
IS EVENT TRAP 1 ?
YES
3
NO
15
IS EVENT TRAP 2 ?
YES
NO
16
CLEAR ALL EVENTS
17
3
18
SET TIMER #1 OFF
19
IS TIMER 1 1.0 SEC. ?
YES
22
HALT
NO
20
CLEAR ALL EVENTS
21

APPENDIX C - PROGRAM LIBRARY
PROGRAM: DLM 5.0

DESCRIPTION

This program counts the number of BCC errors on either side of the line within 60 minutes.

APPLICATION

This program can be used to identify high error count lines.

HOW TO USE

1. Run the program.

2. After halt, COUNTER 1 = Number of CRC/LRC errors.
   COUNTER 2 = Minutes program has run.

3. If the program is to run longer than or less than 60 minutes, change STEP 10.

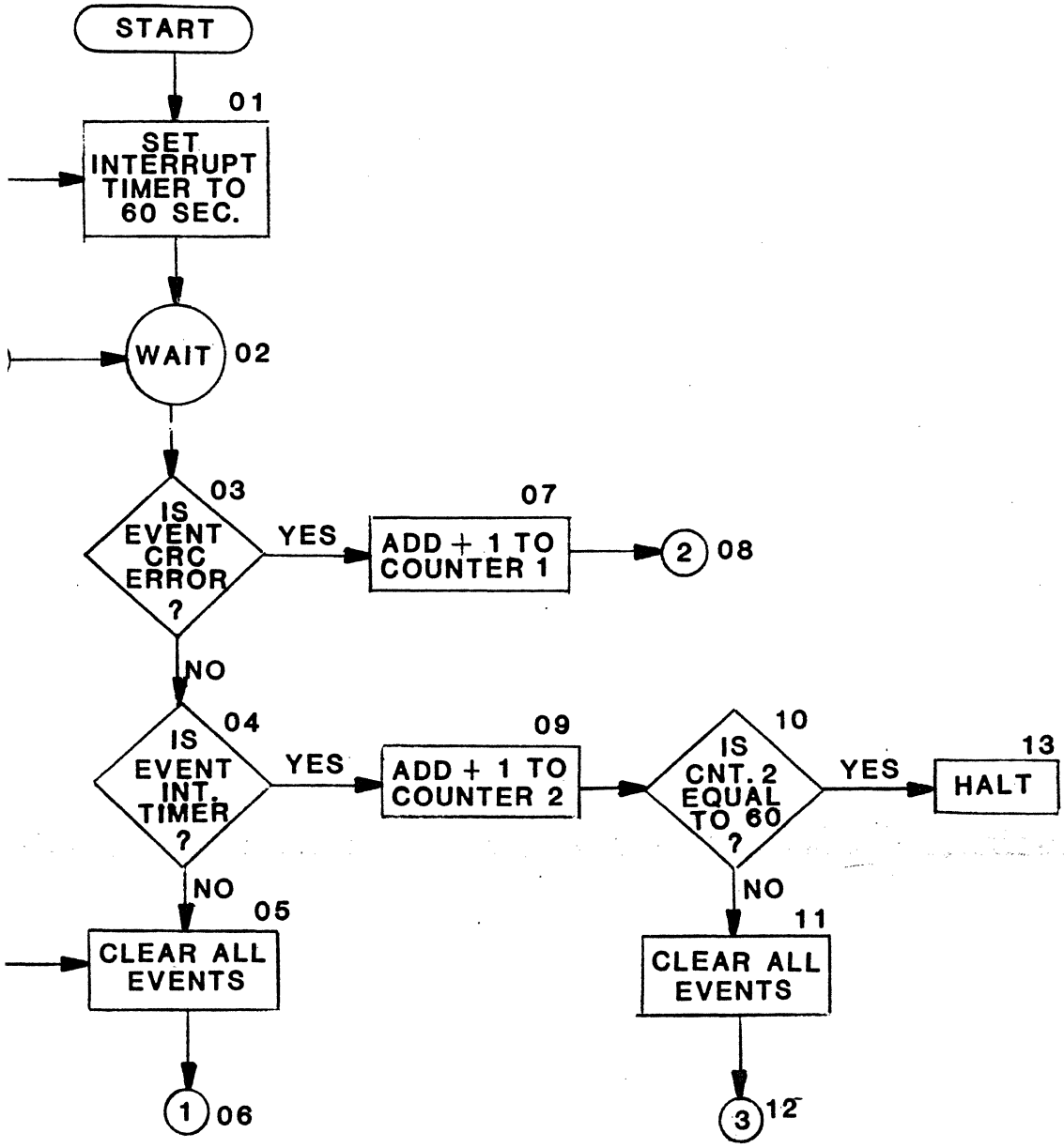
DLM 5.0

LISTING

STEP	INST	OPERAND
01	INTR	AFTER 60000ms
02	WAIT	
03	IFEV	CRC/LRC THEN GOTO 07
04	IFEV	TI THEN GOTO 09
05	CLR	ALL
06	GOTO	02
07	INC	COUNTER 1 BY +1
08	GOTO	05
09	INC	COUNTER 2 BY +1
10	IF	COUNTER 2 = 60 GOTO 13
11	CLR	ALL
12	GOTO	01

STEP	INST	OPERAND
13	HALT	

WHERE COUNTER #1 = NUMBER OF CRC/LRC ERRORS.
COUNTER #2 = MIN. COUNTER OF PROG. RUN TIME.


START
01
SET INTERRUPT TIMER TO 60 SEC.
WAIT
02
03
IS EVENT CRC ERROR ?
YES
07
ADD + 1 TO COUNTER 1
2
08
NO
04
IS EVENT INT. TIMER ?
YES
09
ADD + 1 TO COUNTER 2
10
IS CNT. 2 EQUAL TO 60 ?
YES
13
HALT
NO
05
CLEAR ALL EVENTS
1
06
NO
11
CLEAR ALL EVENTS
3
12

DESCRIPTION

This program counts the total number of messages received vs. the number with BCC errors.

APPLICATION

This program gives the user an indication of the number of line hits, and their effect on data messages.

HOW TO USE

1. Run the program.

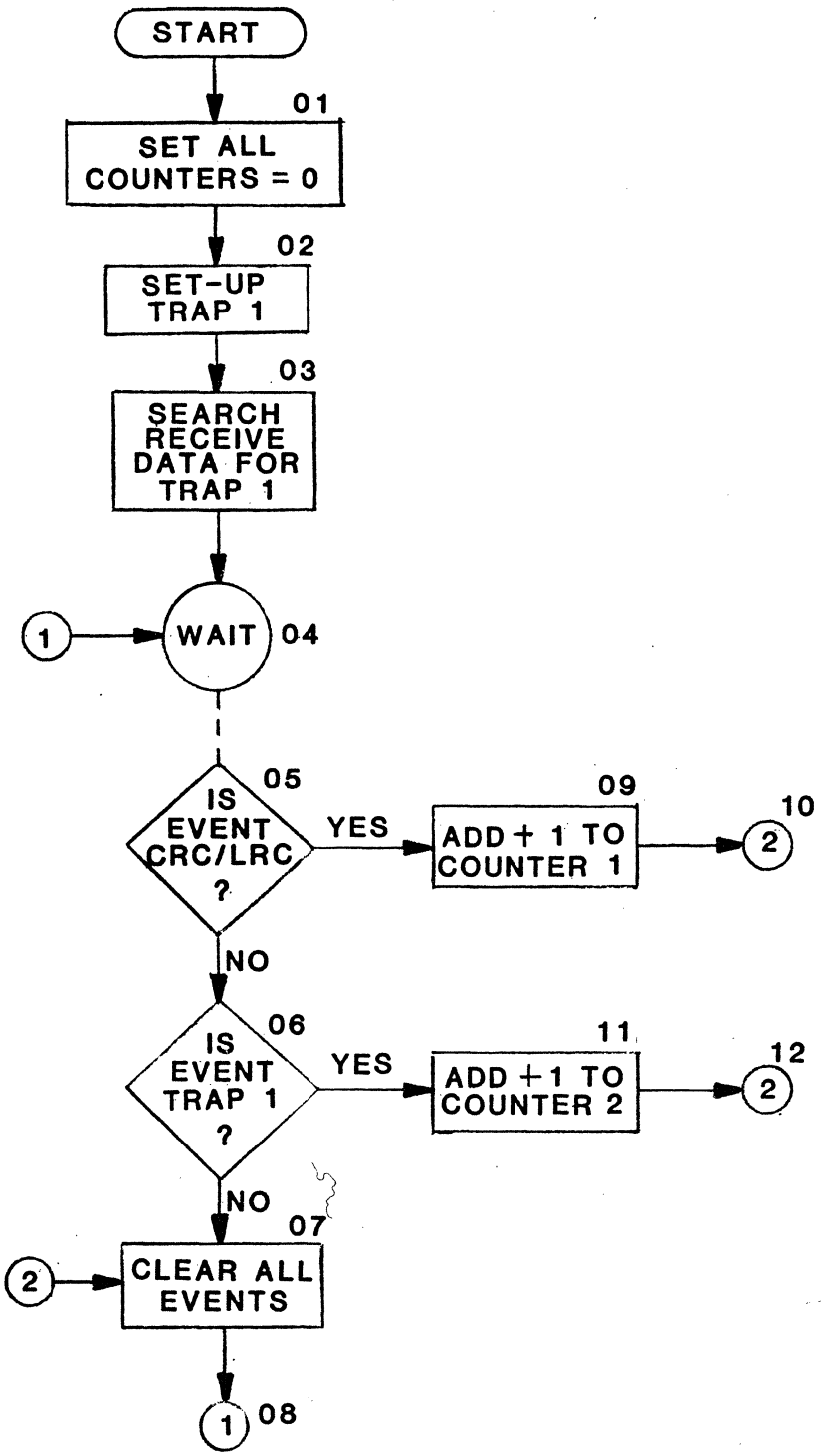
2. When halted, COUNTER 1 = Number of bad messages received.
   COUNTER 2 = Number of good messages received.

DLM 6.0

LISTING

STEP	INST	OPERAND
01	SET	COUNTER ALL 00000
02	TRAP	1 [illegible] BIT MASK
03	SRCH	1 RECEIVE
04	WAIT	
05	IFEV	CRC/LRC THEN GOTO 09
06	IFEV	TRAP1 THEN GOTO 11
07	CLR	ALL
08	GOTO	04
09	INC	COUNTER 1 BY +1
10	GOTO	07
11	INC	COUNTER 2 BY +1
12	GOTO	07

WHERE COUNTER #1 = NUMBER OF BAD
CRC'S RECEIVED.
COUNTER #2 = NUMBER OF GOOD
CRC'S RECEIVED.


START
01
SET ALL COUNTERS = 0
02
SET-UP TRAP 1
03
SEARCH RECEIVE DATA FOR TRAP 1
1
WAIT
04
05
IS EVENT CRC/LRC ?
YES
09
ADD + 1 TO COUNTER 1
10
2
NO
06
IS EVENT TRAP 1 ?
YES
11
ADD +1 TO COUNTER 2
12
2
NO
07
2
CLEAR ALL EVENTS
1
08

DESCRIPTION

This program, when used on an SDLC or an HDLC link, calculates the number of information frames vs. link control frames, and the number of FCS errors.

APPLICATION

This program gives an indication of protocol overhead, and FCS errors.

HOW TO USE

1. Run the program.

2. When halted, COUNTER 1 = Number of information frames.
   COUNTER 2 = Total number of all types of frames.
   COUNTER 3 = Number of FCS errors.

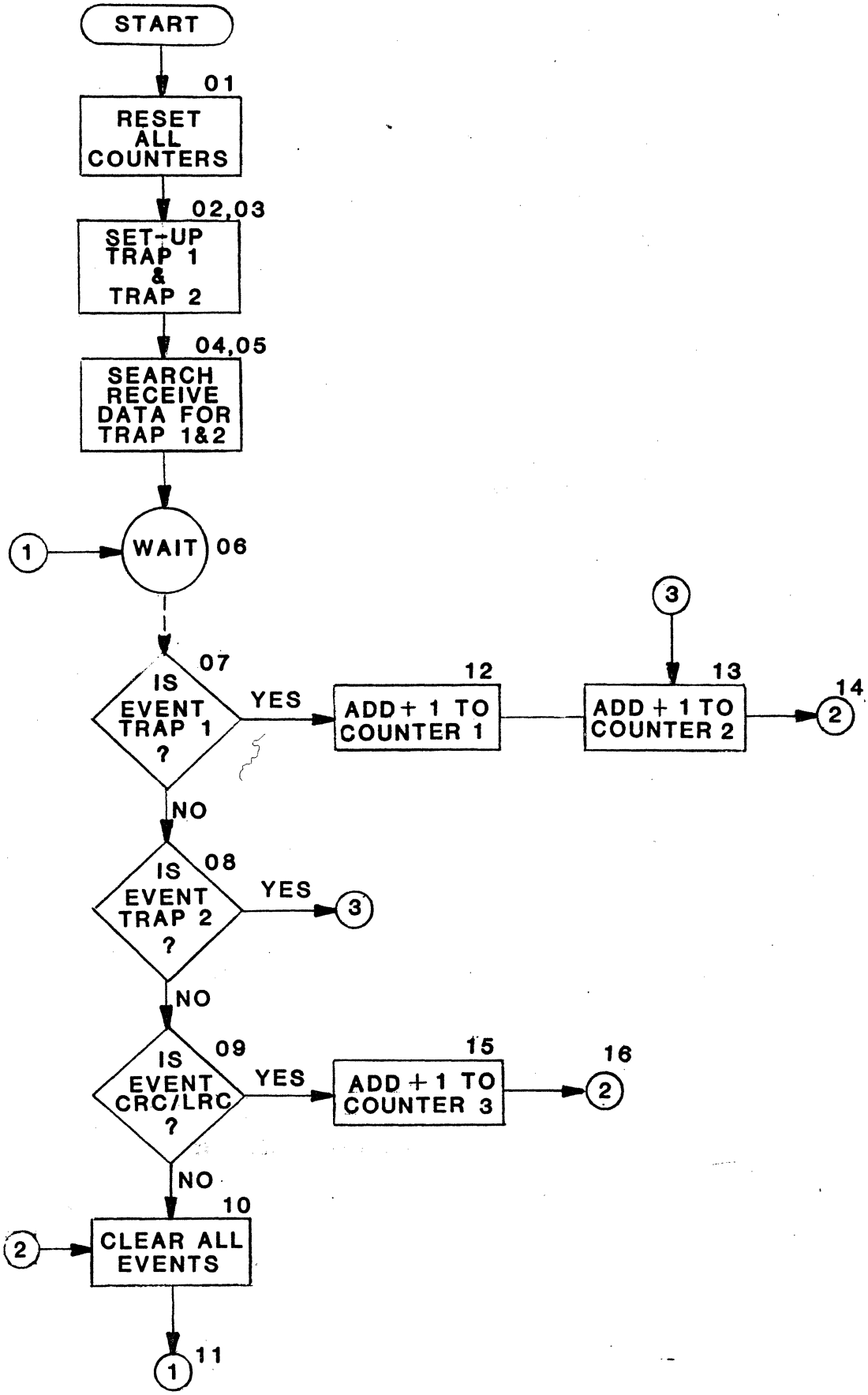
DLM 7.0

LISTING

STEP	INST	OPERAND
01	SET	COUNTER ALL 00000
02	TRAP	1 ☜ ☟ □ BIT MASK: ☜ ☜ ☜ ☜ ☜ ☜ 0
03	TRAP	2 ☜ ☟ ☜ BIT MASK:
04	SRCH	1 BOTH
05	SRCH	2 BOTH
06	WAIT	
07	IFEV	TRAP1 THEN GOTO 12
08	IFEV	TRAP2 THEN GOTO 13
09	IFEV	CRC/LRC THEN GOTO 15
10	CLR	ALL
11	GOTO	06
12	INC	COUNTER 1 BY +1

STEP	INST	OPERAND
13	INC	COUNTER 2 BY +1
14	GOTO	10
15	INC	COUNTER 3 BY +1
16	GOTO	10

WHERE COUNTER #1 = NUMBER OF INFO. FRAMES.
COUNTER #2 = TOTAL NUMBER OF FRAMES.
COUNTER #3 = FCS ERRORS.


START
01
RESET ALL COUNTERS
02,03
SET-UP TRAP 1 & TRAP 2
04,05
SEARCH RECEIVE DATA FOR TRAP 1&2
1
WAIT
06
07
IS EVENT TRAP 1 ?
YES
12
ADD + 1 TO COUNTER 1
3
13
ADD + 1 TO COUNTER 2
14
2
NO
08
IS EVENT TRAP 2 ?
YES
3
NO
09
IS EVENT CRC/LRC ?
YES
15
ADD + 1 TO COUNTER 3
16
2
NO
2
10
CLEAR ALL EVENTS
1
11

DESCRIPTION

This program calculates the percentage of productive polls.

APPLICATION

This program shows the effectiveness of the line under test. It indicates the polls being responded to with text data vs. those that respond with no traffic.

HOW TO USE

1. Put poll sequence to be tested in STEP 02.

2. Run the program.

3. When halted, COUNTER 1 = Number of polls sent.
   COUNTER 2 = Number of EOT responses.
   COUNTER 3 = Number of TEXT responses.

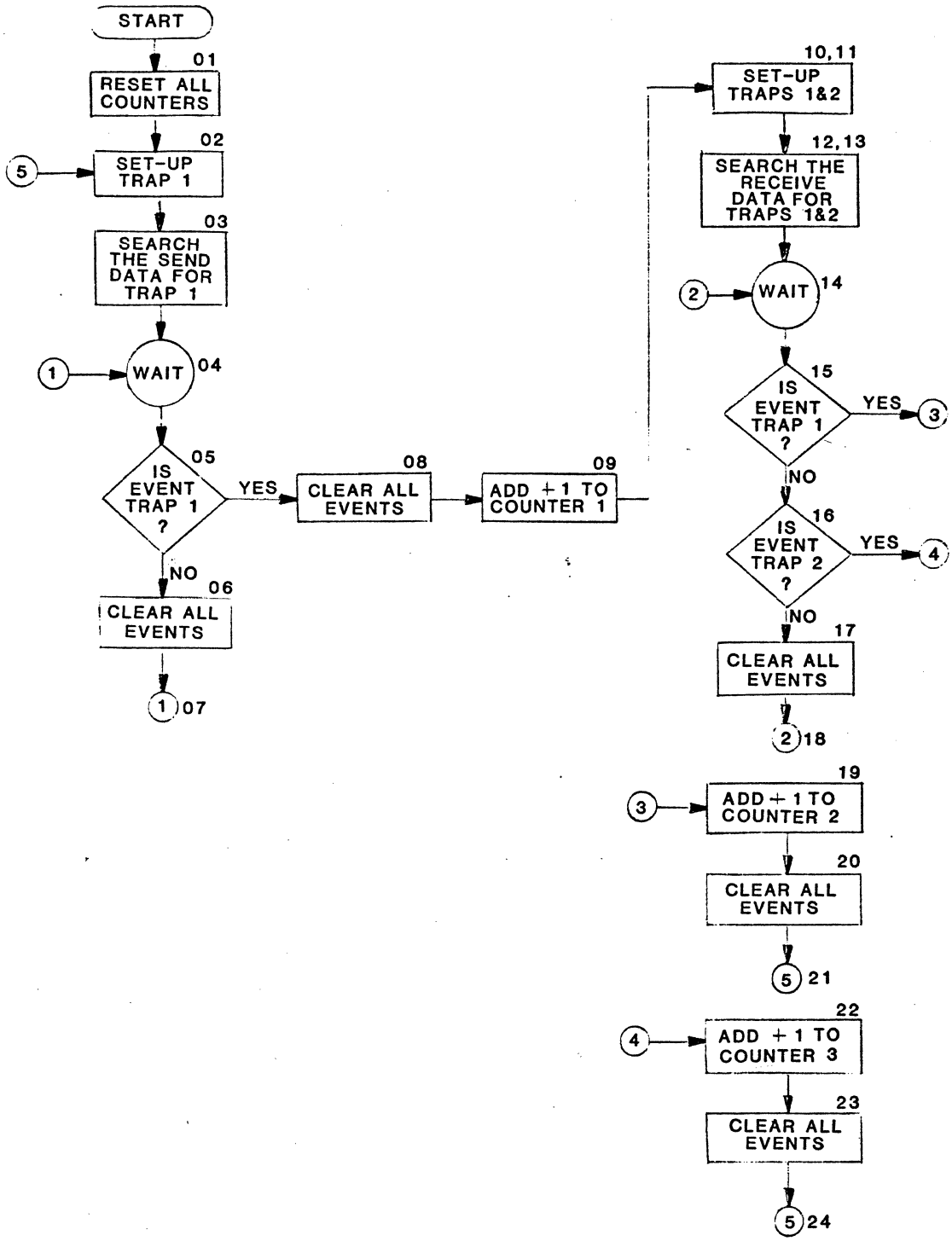
DLM 8.0

LISTING

STEP	INST	OPERAND
01	SET	COUNTER ALL 00000
02	TRAP	1 [illegible] BIT MASK
03	SRCH	1 SEND
04	WAIT	
05	IFEV	TRAP1 THEN GOTO 08
06	CLR	ALL
07	GOTO	04
08	CLR	ALL
09	INC	COUNTER 1 BY +1
10	TRAP	1 [illegible] BIT MASK
11	TRAP	2 [illegible] BIT MASK
12	SRCH	1 RECEIVE

STEP	INST	OPERAND
13	SRCH	2 RECEIVE
14	WAIT	
15	IFEV	TRAP1 THEN GOTO 19
16	IFEV	TRAP2 THEN GOTO 22
17	CLR	ALL
18	GOTO	14
19	INC	COUNTER 2 BY +1
20	CLR	ALL
21	GOTO	02
22	INC	COUNTER 3 BY +1
23	CLR	ALL
24	GOTO	02

WHERE COUNTER #1 = NUMBER OF POLLS
COUNTER #2 = NUMBER OF EOT'S
COUNTER #3 = NUMBER OF
TEXT MSG'S


START
01
RESET ALL COUNTERS
02
5
SET-UP TRAP 1
03
SEARCH THE SEND DATA FOR TRAP 1
1
WAIT
04
05
IS EVENT TRAP 1 ?
YES
08
CLEAR ALL EVENTS
09
ADD +1 TO COUNTER 1
NO
06
CLEAR ALL EVENTS
1
07
10,11
SET-UP TRAPS 1&2
12,13
SEARCH THE RECEIVE DATA FOR TRAPS 1&2
2
WAIT
14
15
IS EVENT TRAP 1 ?
YES
3
NO
16
IS EVENT TRAP 2 ?
YES
4
NO
17
CLEAR ALL EVENTS
2
18
19
3
ADD + 1 TO COUNTER 2
20
CLEAR ALL EVENTS
5
21
22
4
ADD + 1 TO COUNTER 3
23
CLEAR ALL EVENTS
5
24

DESCRIPTION

This program polls a 327X device, and waits for a response.

APPLICATION

This program can be used to give a go/no go answer about the device answering polls.

HOW TO USE

1. Set poll to be sent in BUFFER 1, MSG 1.

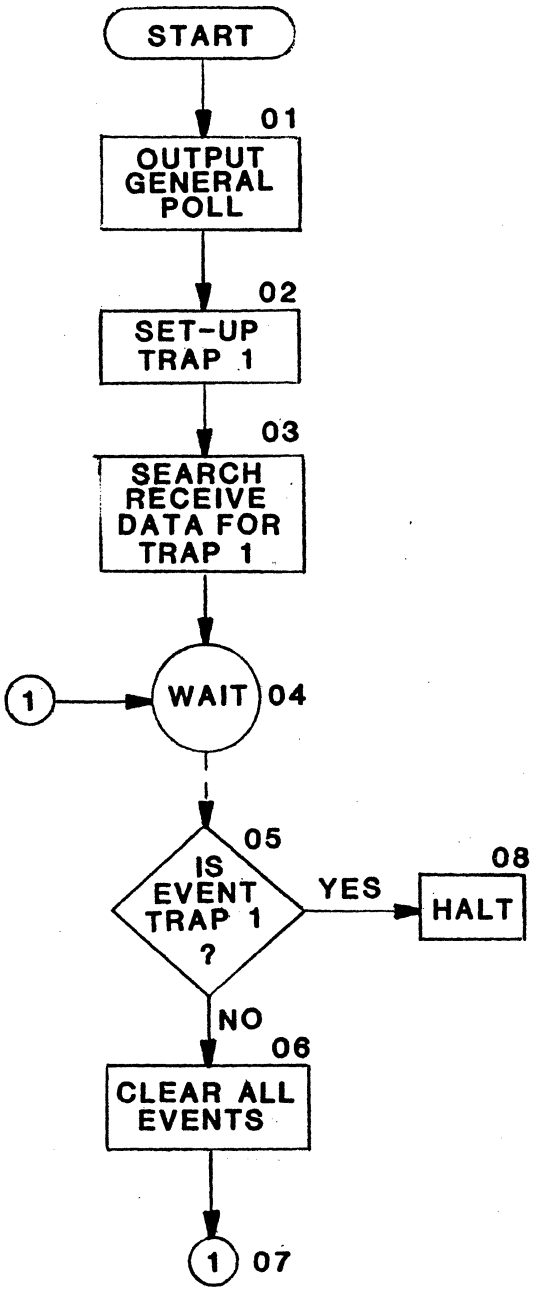
2. Put expected response in STEP 02.

DLM 9.0

LISTING

STEP	INST	OPERAND
01	OUTM	BUFFER 1 MSG.1
02	TRAP	1 %%% BIT MASK
03	SRCH	RECEIVE
04	WAIT	
05	IFEV	TRAP1 THEN GOTO 08
06	CLR	ALL
07	GOTO	04
08	HALT	
09		
10		

WHERE MSG.1 = %%%%%%%%


START
01
OUTPUT GENERAL POLL
02
SET-UP TRAP 1
03
SEARCH RECEIVE DATA FOR TRAP 1
1
WAIT
04
05
IS EVENT TRAP 1 ?
YES
08
HALT
NO
06
CLEAR ALL EVENTS
1
07

APPENDIX C - PROGRAM LIBRARY
PROGRAM: DLM 10.0

DESCRIPTION

This program polls a 327X device, and calculates the response time.

APPLICATION

Simple test of terminal poll response time.

HOW TO USE

1. Set up output BUFFER 1.

   MSG 1 = S_Y S_Y 4_0 4_0 7_F 7_F 2_D (EBCDIC general poll)

2. Put expected response in STEP 03.

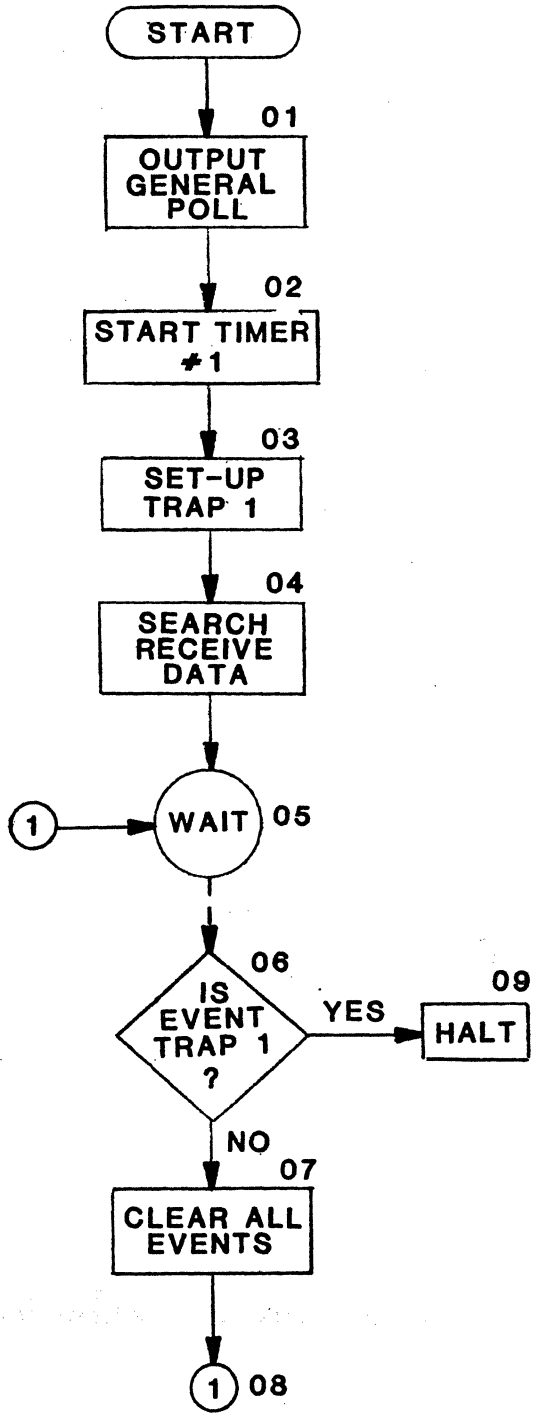
3. At test completion, TIMER 1 will have the response time.

DLM 10.0

LISTING

STEP	INST	OPERAND
01	OUTM	BUFFER 1 MSG.1
02	SET	TIMER 1 ON
03	TRAP	1 [illegible] BIT MASK
04	SRCH	1 RECEIVE
05	WAIT	
06	IFEV	TRAP1 THEN GOTO 09
07	CLR	ALL
08	GOTO	05
09	HALT	

WHERE MSG.1 = [illegible]


START
01
OUTPUT GENERAL POLL
02
START TIMER #1
03
SET-UP TRAP 1
04
SEARCH RECEIVE DATA
1
WAIT
05
06
IS EVENT TRAP 1 ?
YES
09
HALT
NO
07
CLEAR ALL EVENTS
1
08

DESCRIPTION

This program polls a 327X device. It then waits up to 1 second for a response. If the response is seen, another poll is issued immediately; if there is no response, the device will be polled again.

APPLICATION

This is a repetitive poll/response test. It can be used when troubleshooting a non-responsive terminal.

HOW TO USE

1. Set up output BUFFER 1.

   MSG 1 = S_Y S_Y 4_0 4_0 7_F 7_F 2_D (EBCDIC general poll)

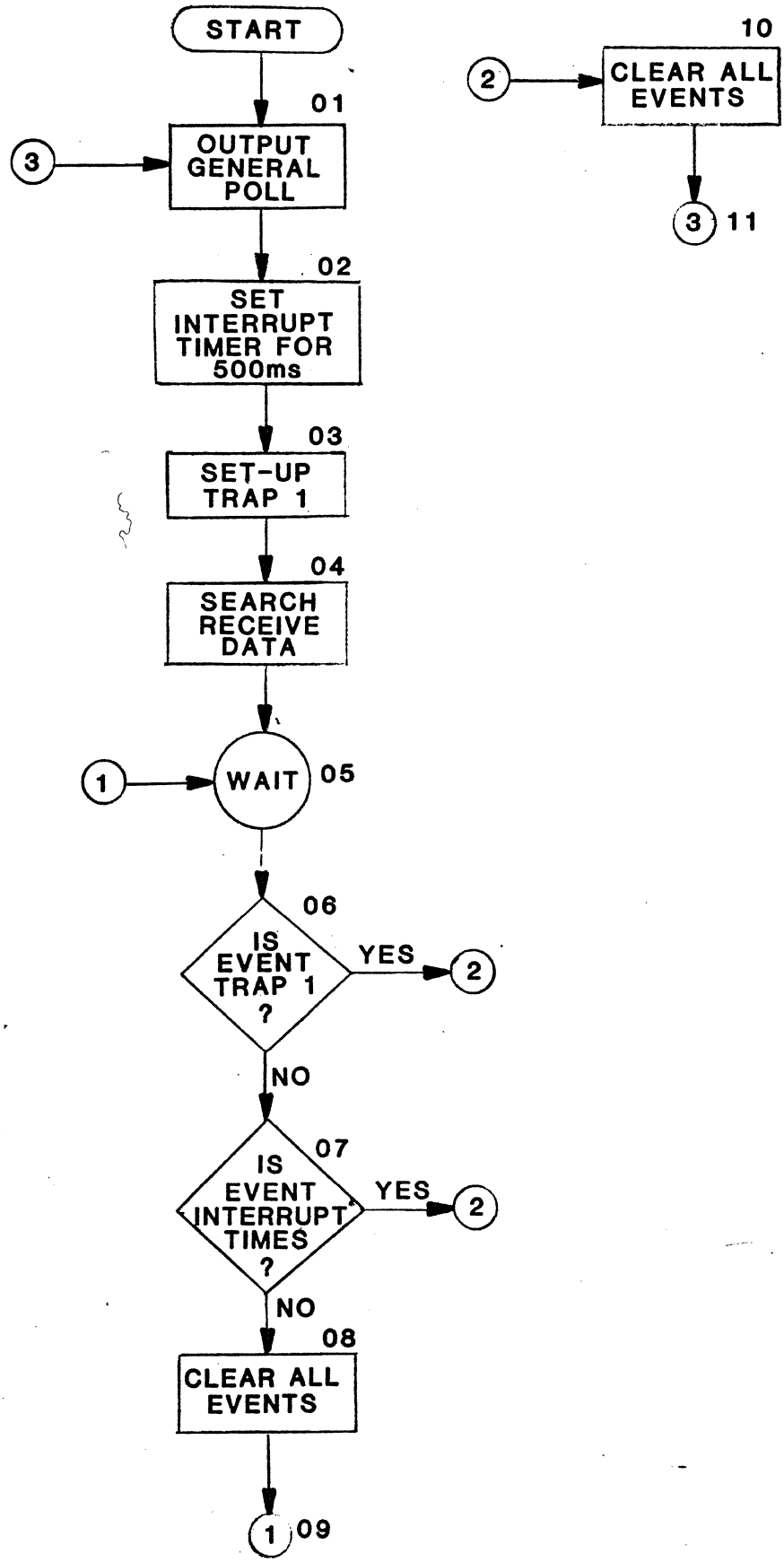
2. Put expected response in STEP 03.

DLM 11.0

LISTING

STEP	INST	OPERAND
01	OUTM	BUFFER 1 MSG.1
02	INT	AFTER 1000 ms
03	TRAP	1 S_Y S_Y E_T BIT MASK
04	SRCH	1 RECEIVE
05	WAIT	
06	IFEV	TRAP1 THEN GOTO 10
07	IFEV	TI THEN GOTO 10
08	CLR	ALL
09	GOTO	05
10	CLR	ALL
11	GOTO	01

WHERE MSG.1 = S_Y S_Y 4_0 4_0 7_F 7_F 2_D


START
01
OUTPUT GENERAL POLL
3
02
SET INTERRUPT TIMER FOR 500ms
03
SET-UP TRAP 1
04
SEARCH RECEIVE DATA
1
WAIT
05
06
IS EVENT TRAP 1 ?
YES
2
NO
07
IS EVENT INTERRUPT TIMES ?
YES
2
NO
08
CLEAR ALL EVENTS
1
09
10
2
CLEAR ALL EVENTS
3
11

PROGRAM: DLM 12.0

DESCRIPTION

This program goes through a complete 327X power-up sequence. It polls the device, checks for good response, then selects the device, and sends it a text message.

APPLICATION

This program can be used when installing a new terminal, or when checking a terminal. Any error condition causes the program to halt.

HOW TO USE

1. Set up output BUFFER 1.

MSG 1 = $S_Y\ S_Y\ E_T\ F_F\ F_F\ F_F$ (Line De-Select) $S_Y\ S_Y\ 4_0\ 4_0\ 7_F\ 7_F\ 2_D$ (General Poll)

2 = $S_Y\ S_Y\ 1_0\ 6_1$ (ACK1)

3 = $S_Y\ S_Y\ 6_0\ 6_0\ 4_0\ 4_0\ 2_D$ (Select Poll)

4 = $S_Y\ S_Y\ 4_0\ 4_0\ 4_0\ 4_0\ 2_D$ (Specific Poll)

5 = $S_Y\ S_Y\ S_X\ E_C$ 5 7 DIGILOG TEST E_X (Text Message)

6 = $S_Y\ S_Y\ 3_D$ (NAK)

2. Change STEP 36 if using on a 3275 device.

3271 = TRAP 2 3_D (NAK)
3275 = TRAP 2 3_7 (EOT)

DLM 12.0

LISTING

STEP	INST	OPERAND
01	SET	COUNTER ALL 0
02	OUTM	BUFFER 1 MSG.1
03	TRAP	1
04	TRAP	2
05	SRCH	1 RECEIVE
06	SRCH	2 RECEIVE
07	INT	AFTER 500ms
08	CLR	ALL
09	WAIT	
10	IFEV	TI THEN GOTO 02
11	IFEV	TRAP1 THEN GOTO 17
12	IFEV	TRAP2 THEN GOTO 15

STEP	INST	OPERAND
13	IFEV	CRC/LRC THEN GOTO 46
14	GOTO	08
15	OUTM	BUFFER 1 MSG.2
16	GOTO	03
17	INC	COUNTER 1 BY +1
18	IF	COUNTER = 10 GOTO 20
19	GOTO	02
20	OUTM	BUFFER 1 MSG.3
21	TRAP	1 % %
22	TRAP	2 % %
23	INT	AFTER 500ms
24	SRCH	1 RECEIVE

DLM 12.0

LISTING

STEP	INST	OPERAND
25	SRCH	2 RECEIVE
26	CLR	ALL
27	WAIT	
28	IFEV	TI THEN GOTO 48
29	IFEV	TRAP1 THEN GOTO 34
30	IFEV	TRAP2 THEN GOTO 32
31	GOTO	26
32	OUTM	BUFFER 1 MSG.4
33	GOTO	03
34	OUTM	BUFFER 1 MSG.5
35	TRAP	1 1_0 6_1
36	TRAP	2 3_D

STEP	INST	OPERAND
37	INT	AFTER 500ms
38	SRCH	1 RECEIVE
39	SRCH	2 RECEIVE
40	CLR	ALL
41	WAIT	
42	IFEV	TI THEN GOTO 49
43	IFEV	TRAP1 THEN GOTO 01
44	IFEV	TRAP2 THEN GOTO 34
45	GOTO	40
46	OUTM	BUFFER 1 MSG.6
47	GOTO	03
48	HALT	

STEP	INST	OPERAND
49	HALT	

(GENERAL POLL)

WHERE: MSG.1 = 3_y 5_y E_T F_F F_F F_F 8_y 5_y 4_0 4_0 7_F 7_F 2_D

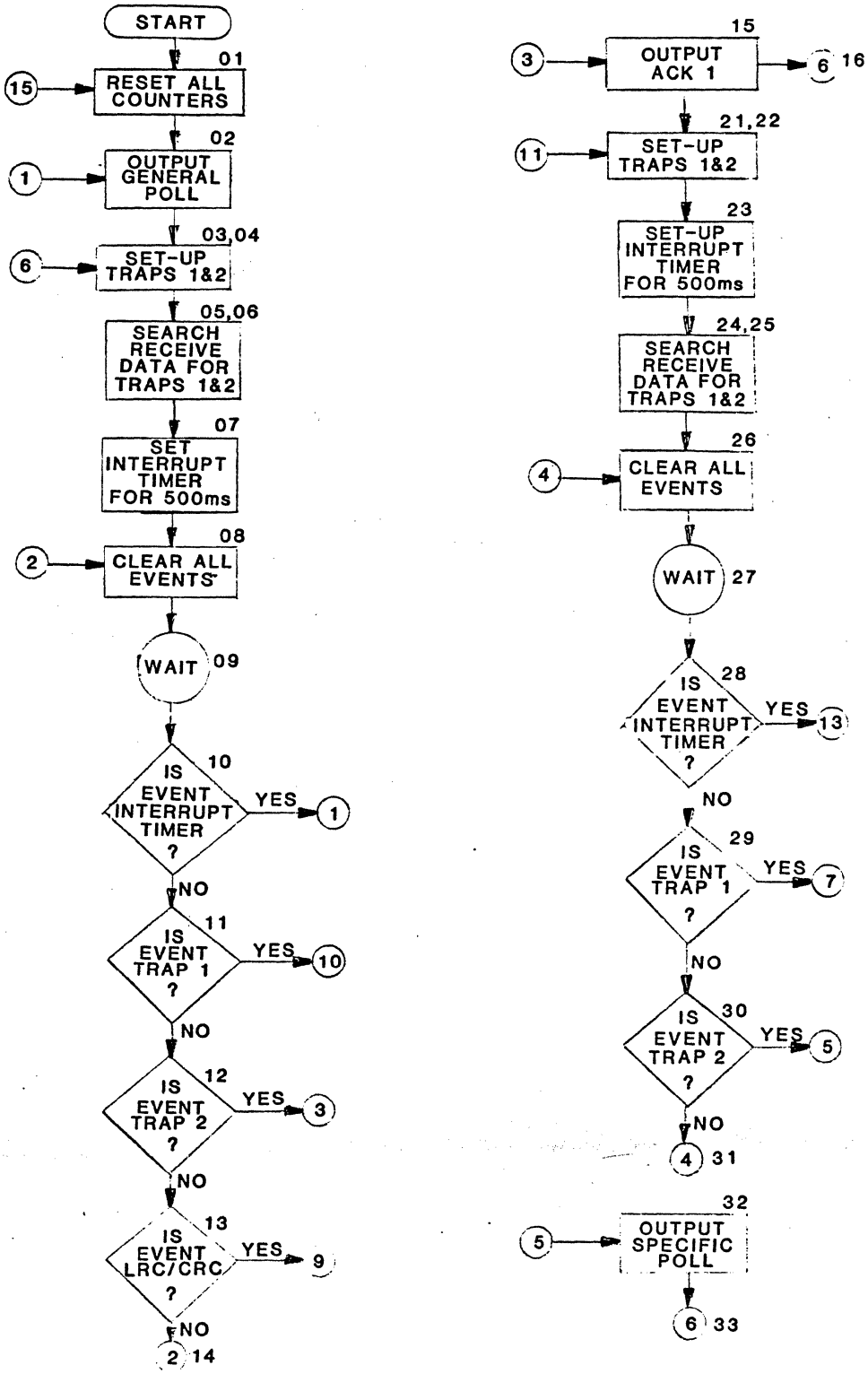
MSG.2 = 8_y 5_y 1_0 4_1 (ACK 1)

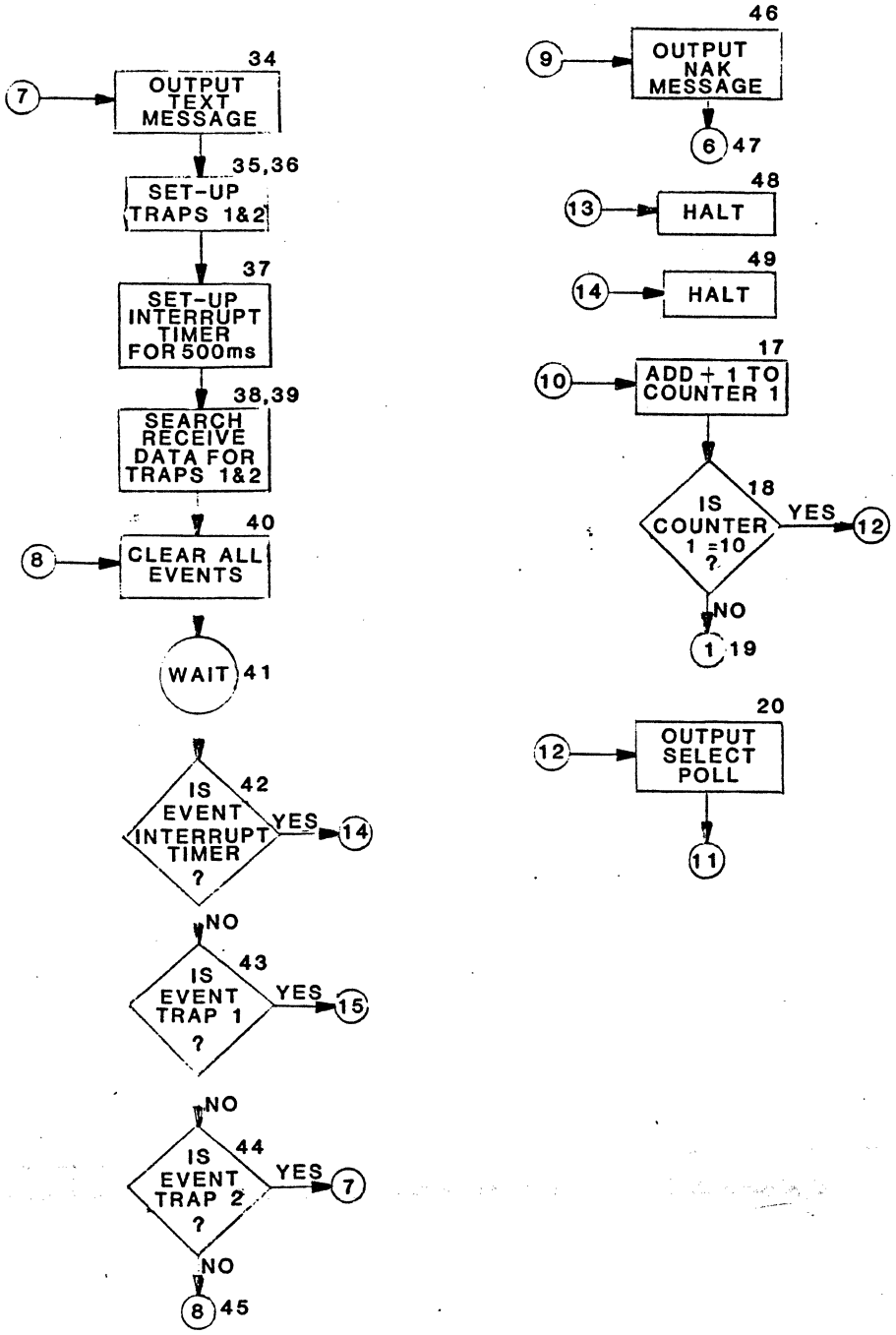
MSG.3 = 5_y 5_y 6_0 6_0 4_0 4_0 2_D (SELECT POLL)

MSG.4 = 5_y 5_y 4_0 4_0 4_0 4_0 2_D (SPECIFIC POLL)

MSG.5 = 5_y 5_y 0_2 F_5 F_7 DIGILOG TEST^{03} (TEXT)

MSG.6 = 6_y 5_y 3_D (NAK)


START
01
RESET ALL COUNTERS
02
OUTPUT GENERAL POLL
03,04
SET-UP TRAPS 1&2
05,06
SEARCH RECEIVE DATA FOR TRAPS 1&2
07
SET INTERRUPT TIMER FOR 500ms
08
CLEAR ALL EVENTS
WAIT 09
10
IS EVENT INTERRUPT TIMER ?
YES
NO
11
IS EVENT TRAP 1 ?
YES
NO
12
IS EVENT TRAP 2 ?
YES
NO
13
IS EVENT LRC/CRC ?
YES
NO
14
15
OUTPUT ACK 1
16
21,22
SET-UP TRAPS 1&2
23
SET-UP INTERRUPT TIMER FOR 500ms
24,25
SEARCH RECEIVE DATA FOR TRAPS 1&2
26
CLEAR ALL EVENTS
WAIT 27
28
IS EVENT INTERRUPT TIMER ?
YES
NO
29
IS EVENT TRAP 1 ?
YES
NO
30
IS EVENT TRAP 2 ?
YES
NO
31
32
OUTPUT SPECIFIC POLL
33


7
34
OUTPUT TEXT MESSAGE
35,36
SET-UP TRAPS 1&2
37
SET-UP INTERRUPT TIMER FOR 500ms
38,39
SEARCH RECEIVE DATA FOR TRAPS 1&2
8
40
CLEAR ALL EVENTS
WAIT
41
IS EVENT INTERRUPT TIMER ?
42
YES
14
NO
IS EVENT TRAP 1 ?
43
YES
15
NO
IS EVENT TRAP 2 ?
44
YES
7
NO
8
45
9
46
OUTPUT NAK MESSAGE
6
47
13
48
HALT
14
49
HALT
10
17
ADD + 1 TO COUNTER 1
IS COUNTER 1 =10 ?
18
YES
12
NO
1
19
12
20
OUTPUT SELECT POLL
11

DESCRIPTION

This program is a simple test that polls the device and responds with ACK or NAK to text messages from the terminal.

APPLICATION

This test checks the ability of the terminal to send text messages.

HOW TO USE

1. Set up output BUFFER 1.

MSG 1 = $S_Y\ S_Y\ E_T\ F_F\ F_F\ F_F$ $S_Y\ S_Y\ 4_0\ 4_0\ 7_F\ 7_F\ 2_D$
(Line De-Select) (General Poll)

2 = $S_Y\ S_Y\ 3_D$ (NAK)

3 = $S_Y\ S_Y\ 1_0\ 6_1$ (ACK1)

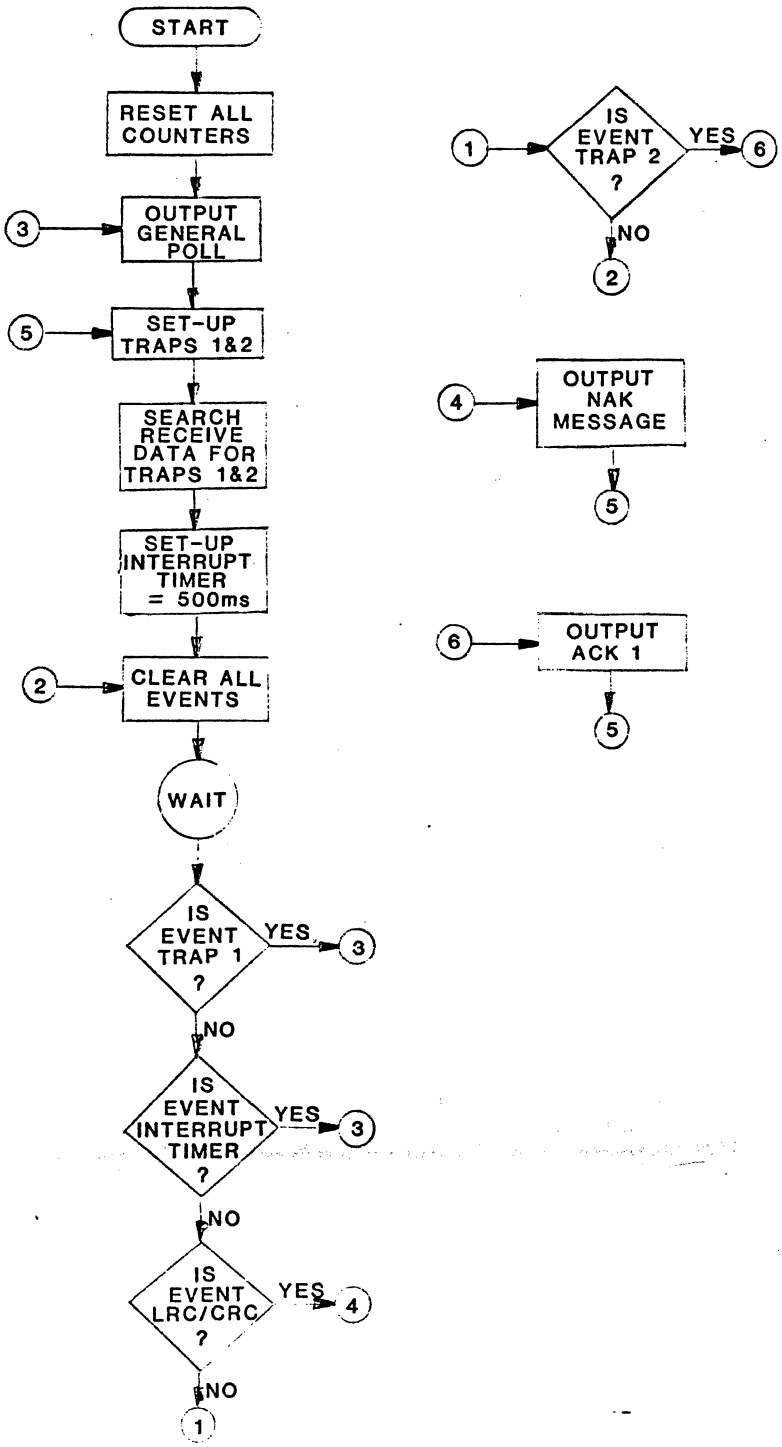
DLM 13.0

LISTING

STEP	INST	OPERAND
01	SET	COUNTER ALL 0
02	OUTM	BUFFER 1 MSG.1
03	TRAP	1 $S_y\ S_y\ E_T$ BIT MASK
04	TRAP	2 $E_x\ D_c\ D_c$ BIT MASK
05	SRCH	1 RECEIVE
06	SRCH	2 RECEIVE
07	INT	AFTER 500ms
08	CLR	ALL
09	WAIT	
10	IFEV	TRAP1 THEN GOTO 02
11	IFEV	TI THEN GOTO 02
12	IFEV	LRC/CRC THEN GOTO 15

STEP	INST	OPERAND
13	IFEV	TRAP2 THEN GOTO 17
14	GOTO	08
15	OUTM	BUFFER 1 MSG.2
16	GOTO	03
17	OUTM	BUFFER 1 MSG.3
18	GOTO	03

WHERE MSG 1 = $S_y\ S_y\ E_T\ F_F\ F_F\ F_F\ S_y\ S_y\ 4_0\ 4_0\ 7_F\ 7_F\ 2_D$
2 = $S_y\ S_y\ 3_D$
3 = $S_y\ S_y\ 1_0\ 6_1$


START
RESET ALL COUNTERS
OUTPUT GENERAL POLL
SET-UP TRAPS 1&2
SEARCH RECEIVE DATA FOR TRAPS 1&2
SET-UP INTERRUPT TIMER = 500ms
CLEAR ALL EVENTS
WAIT
IS EVENT TRAP 1 ?
YES
NO
IS EVENT INTERRUPT TIMER ?
YES
NO
IS EVENT LRC/CRC ?
YES
NO
IS EVENT TRAP 2 ?
YES
NO
OUTPUT NAK MESSAGE
OUTPUT ACK 1
1
2
3
4
5
6

DESCRIPTION

This program counts the number of polls sent to the terminal vs. the number of responses received.

APPLICATION

This program helps to locate an intermittently unresponsive terminal.

HOW TO USE

1. Set up output BUFFER 1.

MSG 1 = $\underbrace{S_Y\ S_Y\ E_T\ F_F\ F_F\ F_F}_{\text{(Line De-Select)}}\ \underbrace{S_Y\ S_Y\ 4_0\ 4_0\ 7_F\ 7_F\ 2_D}_{\text{(General Poll)}}$

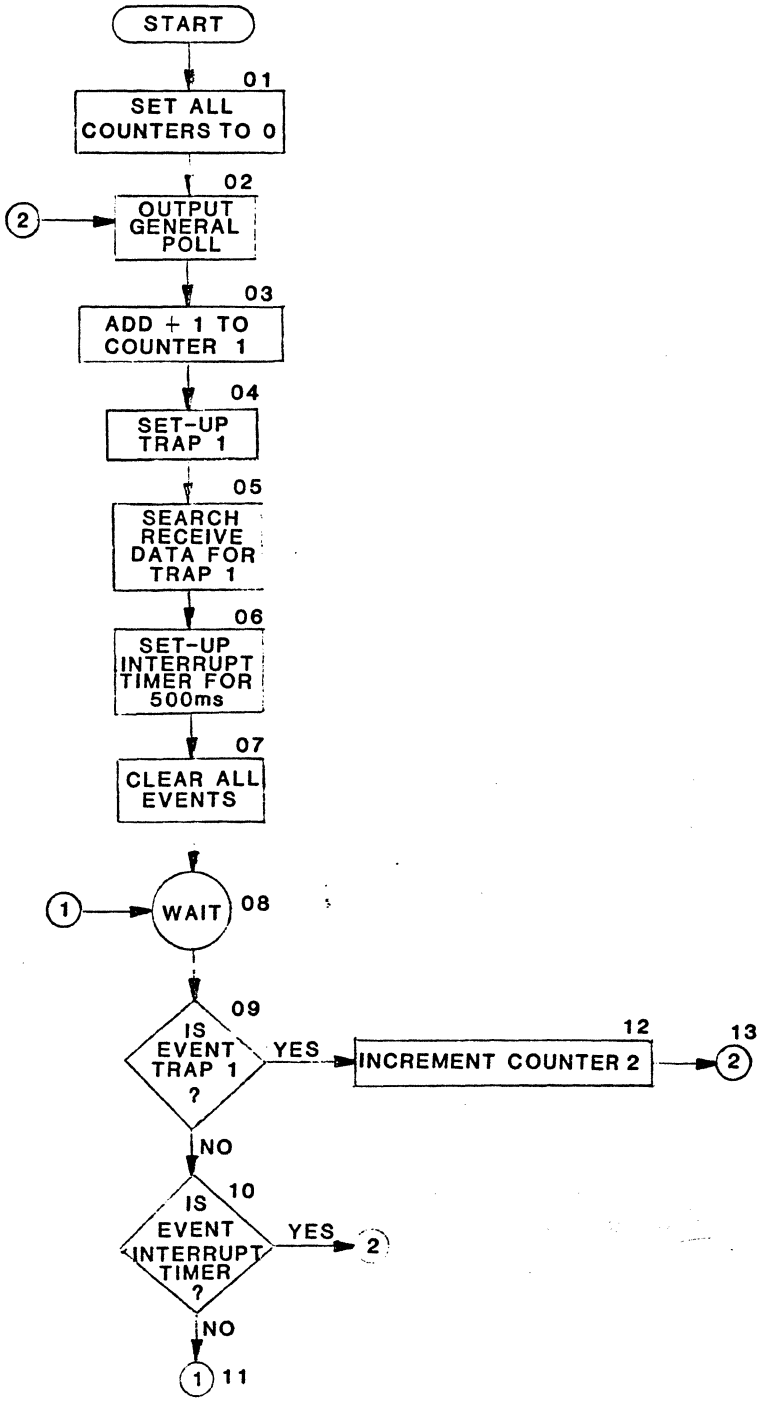
2. When halted, COUNTER 1 = Number of polls sent.
   COUNTER 2 = Number of EOT responses received.

DLM 14.0

LISTING

STEP	INST	OPERAND
01	SET	COUNTER ALL 0
02	OUTM	BUFFER 1 MSG.1
03	INC	COUNTER 1 BY +1
04	TRAP	1 $S_y\ S_y\ E_T$ BIT MASK
05	SRCH	1 RECEIVE
06	INT	AFTER 500ms
07	CLR	ALL
08	WAIT	
09	IFEV	TRAP1 THEN GOTO 12
10	IFEV	TI THEN GOTO 02
11	GOTO	08
12	INC	COUNTER 2 BY +1
13	GOTO	02

WHERE MSG.1 = $S_y\ S_y\ E_T\ F_F\ F_F\ F_F\ S_y\ S_y\ 4_0\ 4_0\ 7_F\ 7_F\ 2_D$
COUNTER 1 = NUMBER OF POLLS SENT
COUNTER 2 = NUMBER OF EOT RESPONSES RECEIVED WITHIN 500 ms.


START
01
SET ALL COUNTERS TO 0
02
2
OUTPUT GENERAL POLL
03
ADD + 1 TO COUNTER 1
04
SET-UP TRAP 1
05
SEARCH RECEIVE DATA FOR TRAP 1
06
SET-UP INTERRUPT TIMER FOR 500ms
07
CLEAR ALL EVENTS
1
WAIT
08
09
IS EVENT TRAP 1 ?
YES
12
INCREMENT COUNTER 2
13
2
NO
10
IS EVENT INTERRUPT TIMER ?
YES
2
NO
1
11

DESCRIPTION

This program tests all the capabilities of a 327X terminal device. Ten general polls are transmitted, followed by a select poll and a text message. The program also checks BCC on received messages, and responds with an ACK or NAK.

APPLICATION

This program can be used to test the full communication capabilities of a specified terminal device.

HOW TO USE

1. Set up output BUFFER 1.

MSG 1 = $\underbrace{S_Y\ S_Y\ E_T\ F_F\ F_F\ F_F}_{\text{(Line De-Select)}}\ \underbrace{S_Y\ S_Y\ 4_0\ 4_0\ 7_F\ 7_F\ 2_D}_{\text{(General Poll)}}$

MSG 2 = $S_Y\ S_Y\ 3_D$ (NAK)

MSG 3 = $S_Y\ S_Y\ 1_0\ 6_1$ (ACK1)

MSG 4 = $S_Y\ S_Y\ 6_0\ 6_0\ 4_0\ 4_0\ 2_D$ (Select Poll)

MSG 5 = $S_Y\ S_Y\ 3_X\ E_C$ 5 7 DIGILOG TEST E_X (Text Message)

2. Change STEP 36 if testing 3275 device.

3271 - TRAP 2 3_D (NAK)
3275 - TRAP 2 3_7 (EOT)

DLM 15.0

LISTING

STEP	INST	OPERAND
01	SET	COUNTER ALL 0
02	OUTM	BUFFER 1 MSG.1
03	TRAP	1 $S_y\ S_y\ C_T$ BIT MASK
04	TRAP	2 $E_x\ R_t\ R_t$ BIT MASK
05	SRCH	1 RECEIVE
06	SRCH	2 RECEIVE
07	INT	AFTER 500 ms.
08	CLR	ALL
09	WAIT	
10	IFEV	TRAP1 THEN GOTO 19
11	IFEV	TRAP2 THEN GOTO 17
12	IFEV	LRC/CRC THEN GOTO

STEP	INST	OPERAND
13	IFEV	TI THEN GOTO 02
14	GOTO	08
15	OUTM	BUFFER 1 MSG.2
16	GOTO	03
17	OUTM	BUFFER 1 MSG.3
18	GOTO	03
19	INC	COUNTER BY +1
20	IF	COUNTER 1 = 10 GOTO 22
21	GOTO	02
22	OUTM	BUFFER 1 MSG.4
23	TRAP	1 $b\ 7_0$ BIT MASK
24	TRAP	2 6_B BIT MASK

P	INST	OPERAND
	SRCH	1 RECEIVE
	SRCH	2 RECEIVE
	INT	AFTER 500ms
	CLR	ALL
	WAIT	
	IFEV	TI THEN GOTO 48
	IFEV	TRAP 1 THEN GOTO 34
	IFEV	TRAP 2 THEN GOTO 01
	GOTO	28
	OUTM	BUFFER 1 MSG.5
	TRAP	1 $^{1}_{0}$ $^{6}_{1}$ BIT MASK
	TRAP	2 $^{3}_{D}$ BIT MASK

STEP	INST	OPERAND
37	INT	2 AFTER 500ms
38	SRCH	1 RECEIVE
39	SRCH	2 RECEIVE
40	CLR	ALL
41	WAIT	
42	IFEV	TI THEN GOTO 48
43	IFEV	TRAP 1 THEN GOTO 46
44	IFEV	TRAP 2 THEN GOTO 34
45	GOTO	40
46	SET	COUNTER 1 0
47	GOTO	03
48	HALT	

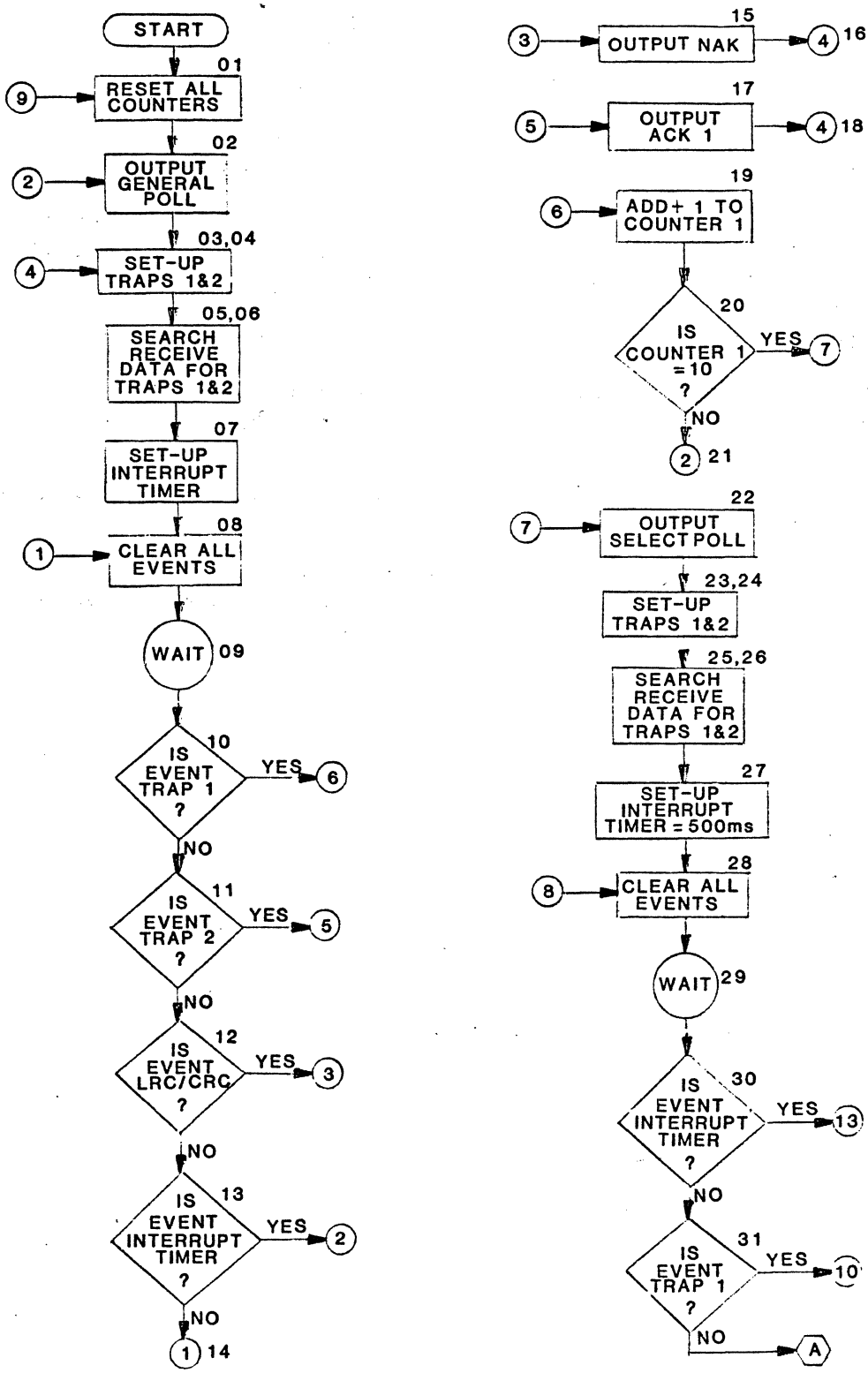
WHERE MSG.1 = $^{S}_{y}$ $^{S}_{y}$ $^{E}_{T}$ $^{F}_{F}$ $^{F}_{F}$ $^{F}_{F}$ $^{S}_{y}$ $^{S}_{y}$ $^{4}_{0}$ $^{4}_{0}$ $^{7}_{F}$ $^{7}_{F}$ $^{2}_{D}$

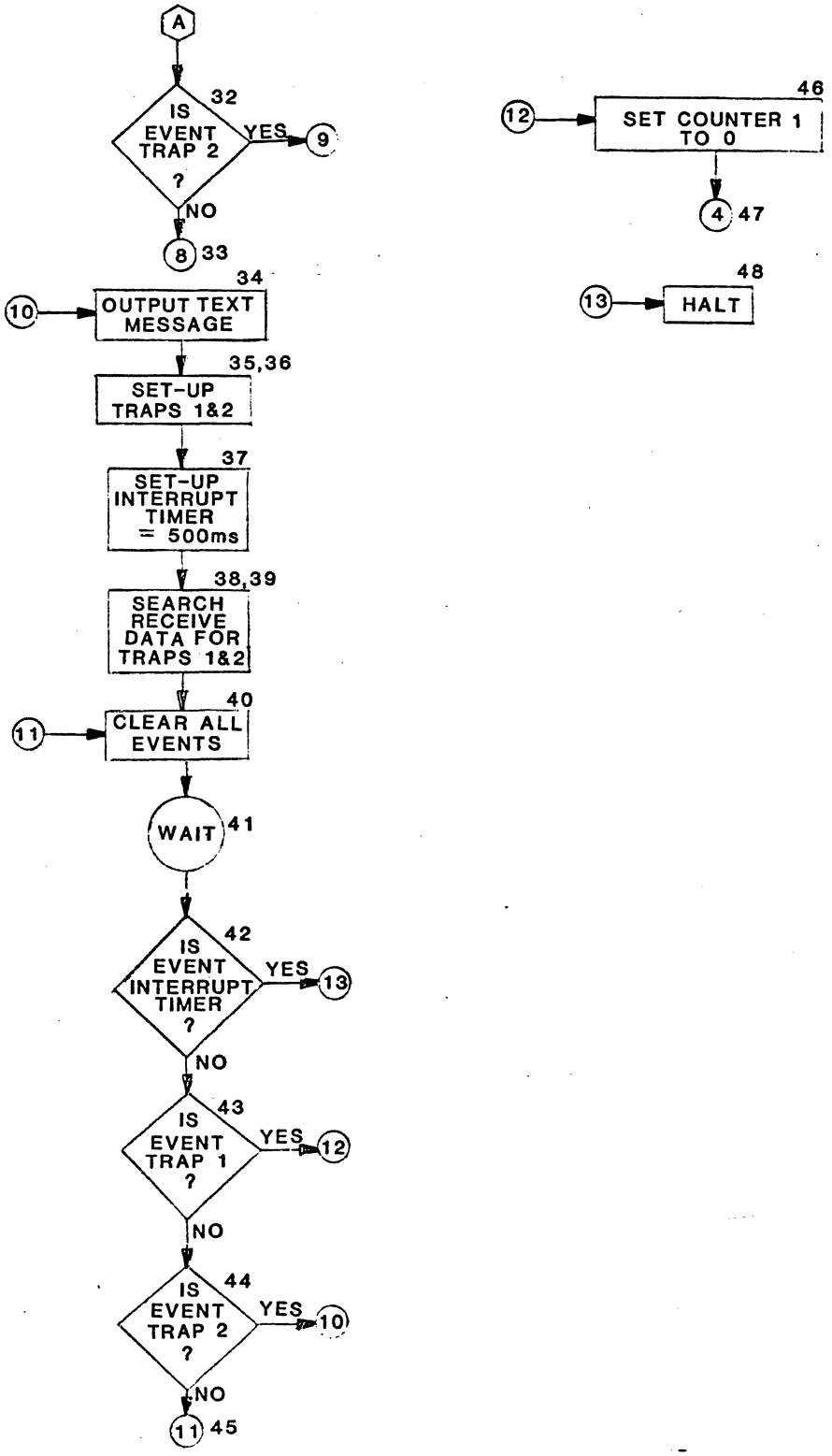
MSG.2 = $^{S}_{y}$ $^{S}_{y}$ $^{3}_{D}$

MSG.3 = $^{S}_{y}$ $^{S}_{y}$ $^{1}_{0}$ $^{6}_{1}$

MSG.4 = $^{S}_{y}$ $^{S}_{y}$ $^{4}_{0}$ $^{6}_{0}$ $^{4}_{0}$ $^{4}_{0}$ $^{2}_{D}$

MSG.5 = $^{S}_{y}$ $^{S}_{y}$ $^{S}_{x}$ $^{E}_{C}$ 5 7 DIGILOG TEST $^{E}_{x}$


START
01
RESET ALL COUNTERS
9
02
OUTPUT GENERAL POLL
2
03,04
SET-UP TRAPS 1&2
4
05,06
SEARCH RECEIVE DATA FOR TRAPS 1&2
07
SET-UP INTERRUPT TIMER
08
CLEAR ALL EVENTS
1
WAIT
09
10
IS EVENT TRAP 1 ?
YES
6
NO
11
IS EVENT TRAP 2 ?
YES
5
NO
12
IS EVENT LRC/CRC ?
YES
3
NO
13
IS EVENT INTERRUPT TIMER ?
YES
2
NO
1
14
3
15
OUTPUT NAK
4
16
5
17
OUTPUT ACK 1
4
18
6
19
ADD+ 1 TO COUNTER 1
20
IS COUNTER 1 =10 ?
YES
7
NO
2
21
7
22
OUTPUT SELECT POLL
23,24
SET-UP TRAPS 1&2
25,26
SEARCH RECEIVE DATA FOR TRAPS 1&2
27
SET-UP INTERRUPT TIMER = 500ms
8
28
CLEAR ALL EVENTS
WAIT
29
30
IS EVENT INTERRUPT TIMER ?
YES
13
NO
31
IS EVENT TRAP 1 ?
YES
10
NO
A


A
32
IS EVENT TRAP 2 ?
YES
9
NO
8
33
34
10
OUTPUT TEXT MESSAGE
35,36
SET-UP TRAPS 1&2
37
SET-UP INTERRUPT TIMER = 500ms
38,39
SEARCH RECEIVE DATA FOR TRAPS 1&2
40
11
CLEAR ALL EVENTS
WAIT
41
42
IS EVENT INTERRUPT TIMER ?
YES
13
NO
43
IS EVENT TRAP 1 ?
YES
12
NO
44
IS EVENT TRAP 2 ?
YES
10
NO
11
45
12
46
SET COUNTER 1 TO 0
4
47
13
48
HALT

APPENDIX C - PROGRAM LIBRARY
PROGRAM: DLM 16.0

DESCRIPTION

This program extends the test done in DLM 15.0 to include recognizing a specific text message from the terminal line under test. General polls are sent to the terminal until the specific text sequence tested for is received. The program then responds with its own text message.

APPLICATION

This program tests the text message field from the terminal, and also tests complete communications.

HOW TO USE

1. Set up the output BUFFER 1, as it was set up in PROGRAM DLM 15.0.

2. Put text data to be tested for in STEP 14. (It is now set for six "A" characters in a row.

3. Change STEP 54 to: TRAP 2 3_7, if testing a 3275.

DLM 16.0

LISTING

STEP	INST	OPERAND
01	SET	COUNTER ALL 0
02	OUTM	BUFFER 1 MSG.1
03	TRAP	1 S_y S_y E_T BIT MASK
04	TRAP	2 S_{T_X} BIT MASK
05	INT	AFTER 500ms
06	SRCH	1 RECEIVE
07	SRCH	2 RECEIVE
08	CLR	ALL
09	WAIT	
10	IFEV	TI THEN GOTO 02
11	IFEV	TRAP 1 THEN GOTO 02
12	IFEV	TRAP 2 THEN GOTO 14

STEP	INST	OPERAND
13	GOTO	08
14	TRAP	I AAAAAA BIT MASK
15	TRAP	2 E_X D_C D_C BIT MASK
16	INT	AFTER 500ms
17	SRCH	1 RECEIVE
18	SRCH	2 RECEIVE
19	CLR	ALL
20	WAIT	
21	IFEV	TRAP 1 THEN GOTO 26
22	IFEV	TRAP 2 THEN GOTO 27
23	IFEV	TI THEN GOTO 64
24	IFEV	CRC/LRC THEN GOTO 38

STEP	INST	OPERAND
25	GOTO	19
26	SET	COUNTER 1 00001
27	OUTM	BUFFER 1 MSG.3
28	TRAP	1 S_y S_y E_T BIT MASK
29	SRCH	1 RECEIVE
30	INT	AFTER 500ms
31	CLR	ALL
32	WAIT	
33	IFEV	TI THEN GOTO 64
34	IFEV	TRAP 1 THEN GOTO 36
35	GOTO	31
36	IF	COUNTER 1=1 THEN GOTO 40

STEP	INST	OPERAND
37	GOTO	01
38	OUTM	BUFFER 1 MSG.2
39	GOTO	03
40	OUTM	BUFFER 1 MSG.4
41	TRAP	1 I_O T_O BIT MASK
42	TRAP	2 I_O E_B BIT MASK
43	SRCH	1 RECEIVE
44	SRCH	2 RECEIVE
45	INT	AFTER 500ms
46	CLR	ALL
47	WAIT	
48	IFEV	TRAP1 THEN GOTO 52

EP	INST	OPERAND
9	IFEV	TRAP2 THEN GOTO 01
0	IFEV	TI THEN GOTO 64
1	GOTO	46
2	OUTM	BUFFER 1 MSG.5
3	TRAP	1 $^{1}_{0}$ $^{6}_{1}$ BIT MASK
4	TRAP	2 $^{3}_{D}$ BIT MASK
5	INT	AFTER 500ms
6	SRCH	1 RECEIVE
7	SRCH	2 RECEIVE
8	CLR	ALL
9	WAIT	
0	IFEV	TRAP1 THEN GOTO 01

STEP	INST	OPERAND
61	IFEV	TRAP1 THEN GOTO 52
62	IFEV	TI THEN GOTO 64
63	GOTO	58
64	HALT	

WHERE MSG.1 = $^{S}_{y}$ $^{S}_{y}$ $^{E}_{T}$ $^{F}_{F}$ $^{F}_{F}$ $^{F}_{F}$ $^{S}_{y}$ $^{S}_{y}$ $^{4}_{0}$ $^{4}_{0}$ $^{7}_{F}$ $^{7}_{F}$ $^{2}_{D}$

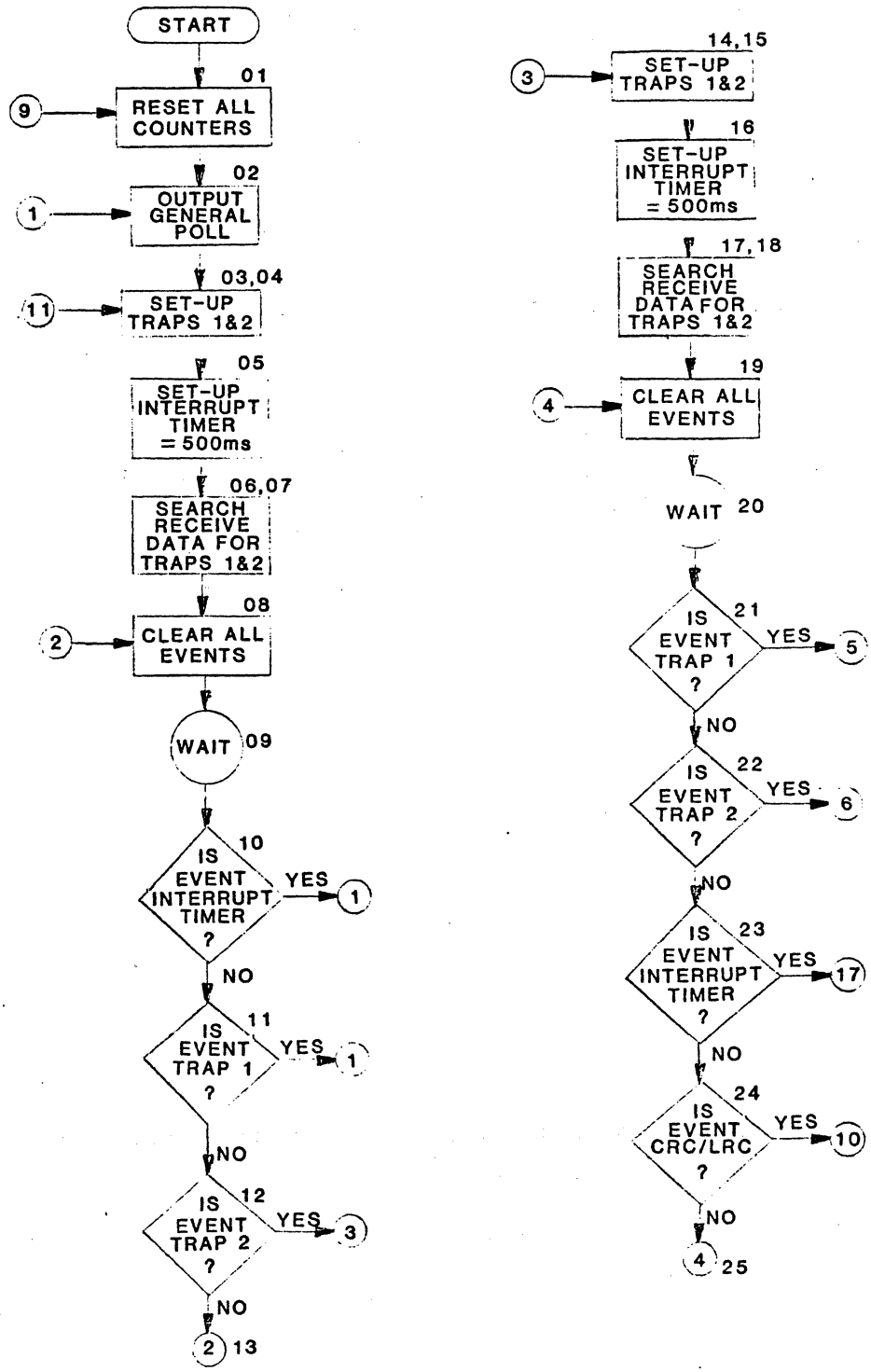
MSG.2 = $^{S}_{y}$ $^{S}_{y}$ $^{3}_{D}$

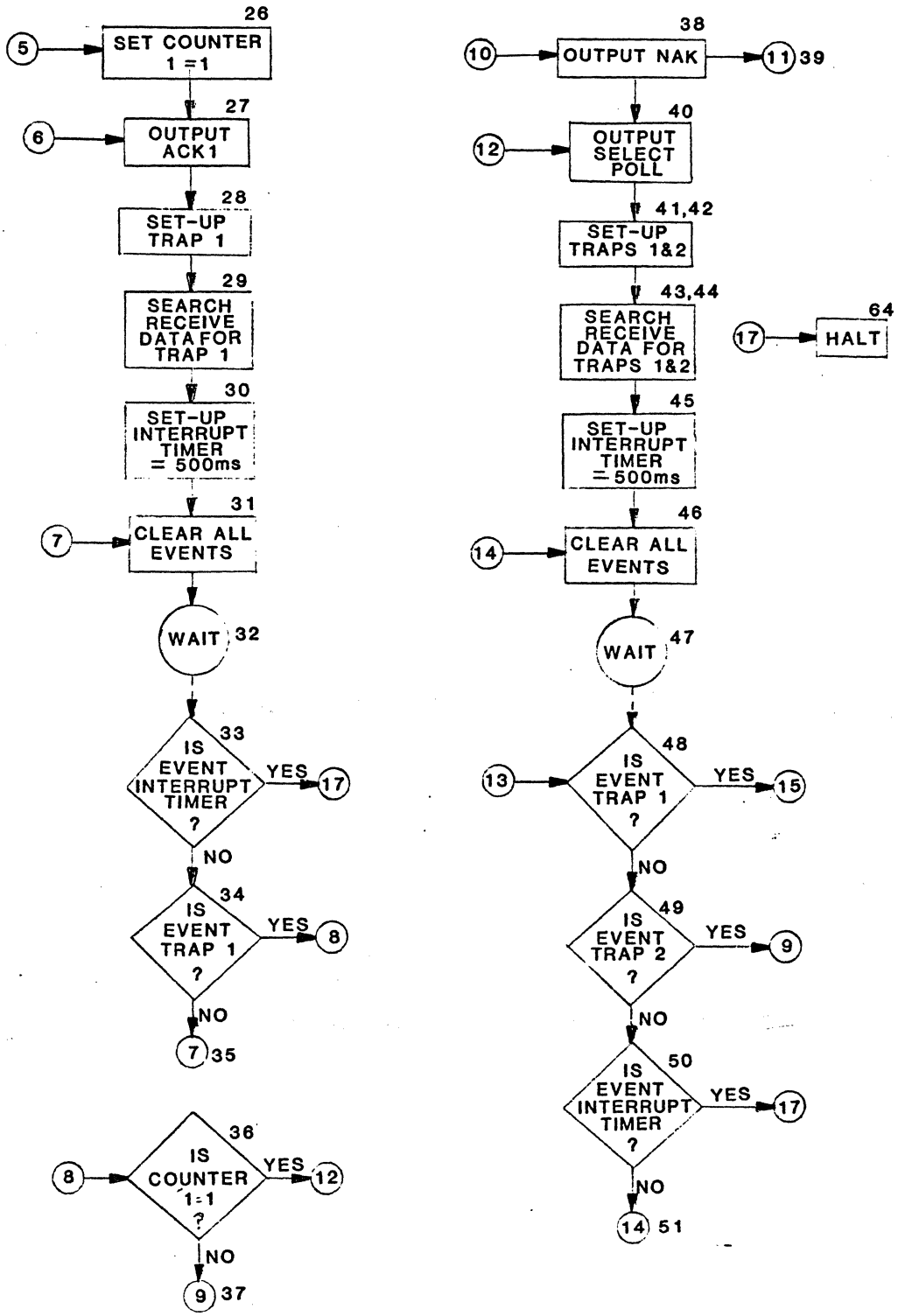
MSG.3 = $^{S}_{y}$ $^{S}_{y}$ $^{1}_{0}$ $^{6}_{1}$

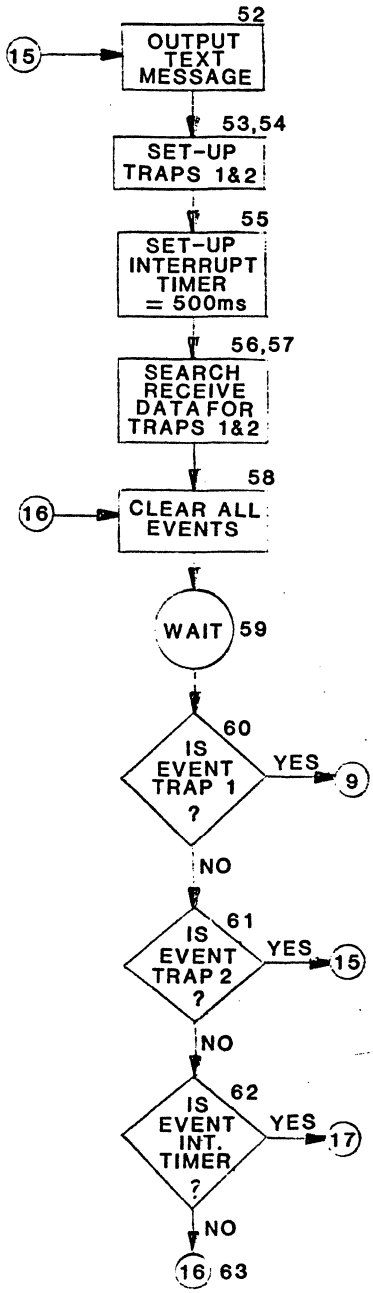
MSG.4 = $^{6}_{y}$ $^{S}_{y}$ $^{6}_{0}$ $^{6}_{0}$ $^{4}_{0}$ $^{4}_{0}$ $^{2}_{D}$

MSG.5 = $^{S}_{y}$ $^{S}_{y}$ $^{S}_{x}$ $^{E}_{c}$ 5 7 DIGILOG TEST $^{E}_{x}$

$^{3}_{D}$ CHANGES TO $^{3}_{7}$ FOR 3275 (STEP 54)


START
01
RESET ALL COUNTERS
9
02
OUTPUT GENERAL POLL
1
03,04
SET-UP TRAPS 1&2
11
05
SET-UP INTERRUPT TIMER = 500ms
06,07
SEARCH RECEIVE DATA FOR TRAPS 1&2
08
CLEAR ALL EVENTS
2
WAIT 09
10
IS EVENT INTERRUPT TIMER ?
YES
1
NO
11
IS EVENT TRAP 1 ?
YES
1
NO
12
IS EVENT TRAP 2 ?
YES
3
NO
2 13
14,15
SET-UP TRAPS 1&2
3
16
SET-UP INTERRUPT TIMER = 500ms
17,18
SEARCH RECEIVE DATA FOR TRAPS 1&2
19
CLEAR ALL EVENTS
4
WAIT 20
21
IS EVENT TRAP 1 ?
YES
5
NO
22
IS EVENT TRAP 2 ?
YES
6
NO
23
IS EVENT INTERRUPT TIMER ?
YES
17
NO
24
IS EVENT CRC/LRC ?
YES
10
NO
4 25


26
SET COUNTER 1 =1
5
27
OUTPUT ACK1
6
28
SET-UP TRAP 1
29
SEARCH RECEIVE DATA FOR TRAP 1
30
SET-UP INTERRUPT TIMER = 500ms
31
CLEAR ALL EVENTS
7
WAIT
32
33
IS EVENT INTERRUPT TIMER ?
YES
17
NO
34
IS EVENT TRAP 1 ?
YES
8
NO
7
35
36
IS COUNTER 1=1 ?
8
YES
12
NO
9
37
38
OUTPUT NAK
10
11
39
40
OUTPUT SELECT POLL
12
41,42
SET-UP TRAPS 1&2
43,44
SEARCH RECEIVE DATA FOR TRAPS 1&2
64
17
HALT
45
SET-UP INTERRUPT TIMER =500ms
46
CLEAR ALL EVENTS
14
WAIT
47
48
IS EVENT TRAP 1 ?
13
YES
15
NO
49
IS EVENT TRAP 2 ?
YES
9
NO
50
IS EVENT INTERRUPT TIMER ?
YES
17
NO
14
51


15
52
OUTPUT TEXT MESSAGE
53,54
SET-UP TRAPS 1&2
55
SET-UP INTERRUPT TIMER = 500ms
56,57
SEARCH RECEIVE DATA FOR TRAPS 1&2
58
16
CLEAR ALL EVENTS
WAIT
59
60
IS EVENT TRAP 1 ?
YES
9
NO
61
IS EVENT TRAP 2 ?
YES
15
NO
62
IS EVENT INT. TIMER ?
YES
17
NO
16
63

APPENDIX C - PROGRAM LIBRARY
PROGRAM: DLM 17.0

DESCRIPTION

This program calculates average response time for poll responses to a 327X terminal.

APPLICATION

Use of this program gives the operator an overall average response time for use in network planning and/or throughput analysis.

HOW TO USE

1. Set the poll to be tested in STEP 03.

2. Run the program.

3. When halted: COUNTER 1 + TIMER 1 = Total response time.
   min. sec. ms.

   COUNTER 2 = Total number of responses
   COUNTER 3 = Number of 1 second timeouts

NOTE

Subtract the value in COUNTER 3 from the total response time to get a true value. Timeouts are not included in the number of responses, but are included in total response time.

DLM 17.0

LISTING

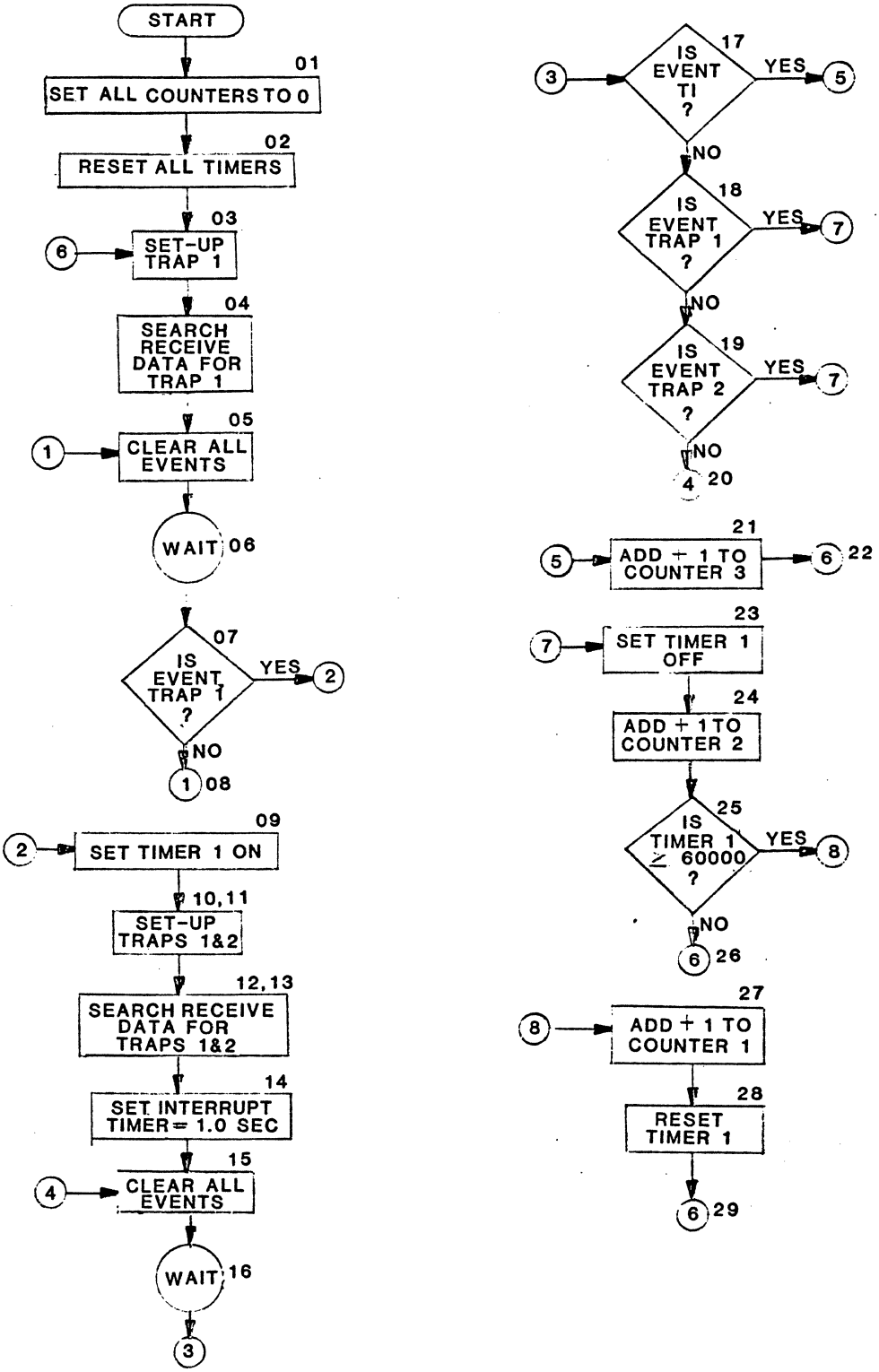
STEP	INST	OPERAND
01	SET	COUNTER ALL 0
02	SET	TIMER ALL CLEAR
03	TRAP	1
04	SRCH	1 RECEIVE
05	CLR	ALL
06	WAIT	
07	IFEV	TRAP1 THEN GOTO 09
08	GOTO	05
09	SET	TIMER 1 ON
10	TRAP	1
11	TRAP	2
12	SRCH	1 RECEIVE

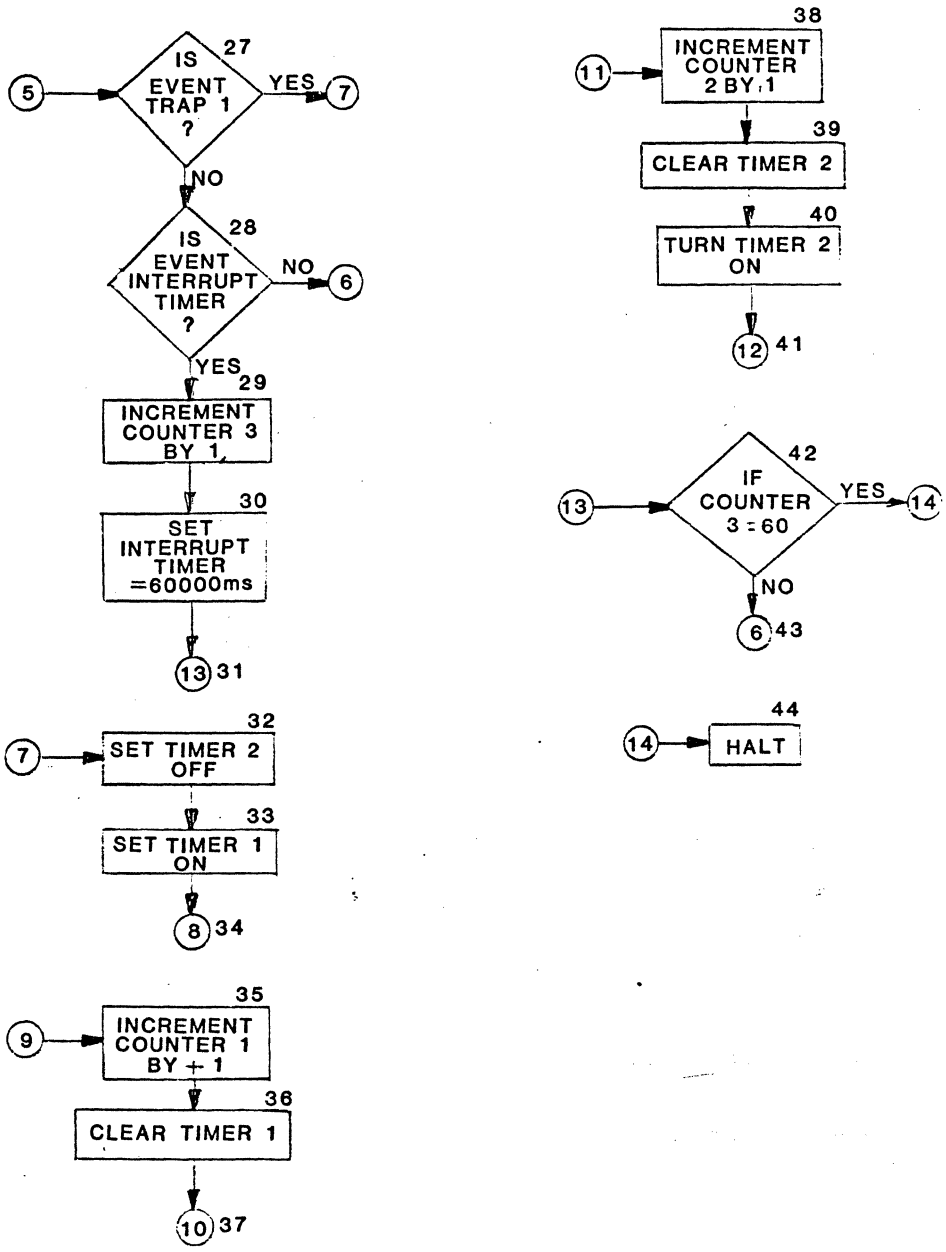
STEP	INST	OPERAND
13	SRCH	2 RECEIVE
14	INT	AFTER 1000ms
15	CLR	ALL
16	WAIT	
17	IFEV	TI THEN GOTO 21
18	IFEV	TRAP1 THEN GOTO 23
19	IFEV	TRAP2 THEN GOTO 23
20	GOTO	15
21	INC	COUNTER 3 BY +1
22	GOTO	03
23	SET	TIMER 1 OFF
24	INC	COUNTER 2 BY +1

STEP	INST	OPERAND
25	IF	TIMER 1 60000 GOTO 27
26	GOTO	03
27	INC	COUNTER 1 BY +1
28	SET	TIMER 1 CLEAR
29	GOTO	03

NOTE: Subtract counter 3 number of seconds from the response time in counter/timer number 1.

WHERE COUNTER 1 TIMER 1=TOTAL RESPONSE TIME
COUNTER 2 =NUMBER OF RESPONSES INCLUDED
COUNTER 3 =NUMBER OF 1 SEC. TIMEOUTS


START
01
SET ALL COUNTERS TO 0
02
RESET ALL TIMERS
03
6
SET-UP TRAP 1
04
SEARCH RECEIVE DATA FOR TRAP 1
05
1
CLEAR ALL EVENTS
WAIT 06
07
IS EVENT TRAP 1 ?
YES
2
NO
1 08
09
2
SET TIMER 1 ON
10,11
SET-UP TRAPS 1&2
12,13
SEARCH RECEIVE DATA FOR TRAPS 1&2
14
SET INTERRUPT TIMER = 1.0 SEC
15
4
CLEAR ALL EVENTS
WAIT 16
3
3
17
IS EVENT TI ?
YES
5
NO
18
IS EVENT TRAP 1 ?
YES
7
NO
19
IS EVENT TRAP 2 ?
YES
7
NO
4 20
21
5
ADD + 1 TO COUNTER 3
6 22
23
7
SET TIMER 1 OFF
24
ADD + 1 TO COUNTER 2
25
IS TIMER 1 ≥ 60000 ?
YES
8
NO
6 26
27
8
ADD + 1 TO COUNTER 1
28
RESET TIMER 1
6 29


5
27
IS EVENT TRAP 1 ?
YES
7
NO
28
IS EVENT INTERRUPT TIMER ?
NO
6
YES
29
INCREMENT COUNTER 3 BY 1
30
SET INTERRUPT TIMER =60000ms
13
31
7
32
SET TIMER 2 OFF
33
SET TIMER 1 ON
8
34
9
35
INCREMENT COUNTER 1 BY + 1
36
CLEAR TIMER 1
10
37
11
38
INCREMENT COUNTER 2 BY 1
39
CLEAR TIMER 2
40
TURN TIMER 2 ON
12
41
13
42
IF COUNTER 3 = 60
YES
14
NO
6
43
14
44
HALT

APPENDIX C - PROGRAM LIBRARY
PROGRAM: DLM 18.0

ESCRIPTION

This program calculates the line utilization on one side of the line. The esult is a time answer for data on line vs. idles on line.

PPLICATION

This program is useful in determining overall line utilization to be used n network planning. For example, if a line has low utilization, it may upport more terminals. If utilization is high, fewer terminals may be eeded.

OW TO USE

- CAUTION -
IDLE SUPPRESS MUST BE OFF FOR GOOD RESULTS.

1. Run the program.
2. The program will halt after 60 minutes.
3. The results:

   a. COUNTER 1 (min.) + TIMER 1 (sec. ms.) = Time Actual Data was Present.

   b. COUNTER 2 (min.) + TIMER 2 (sec. ms.) = Time Line was Idle.

   c. COUNTER 3 = Total run time in minutes.

DLM 18.0

LISTING

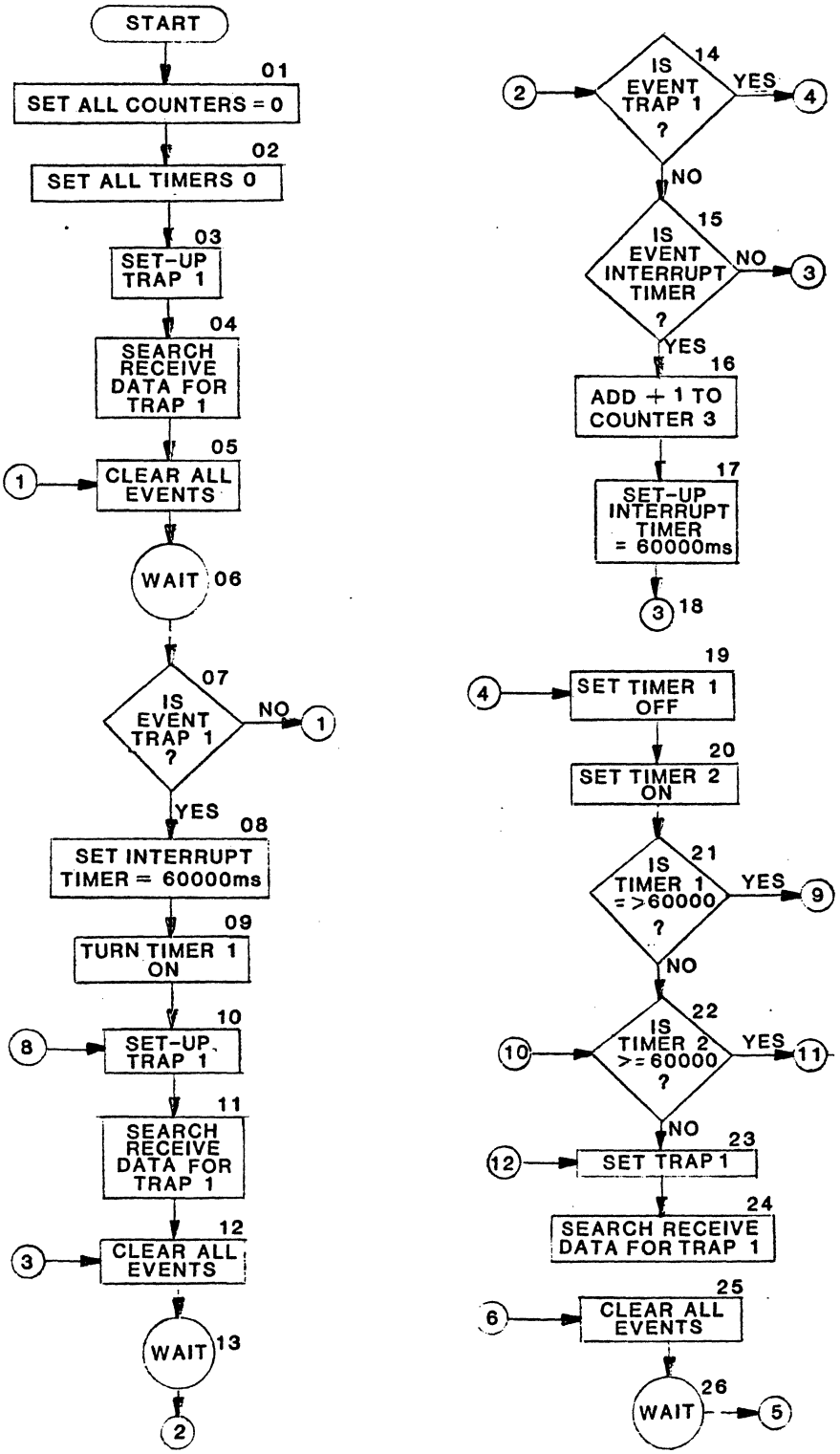
STEP	INST	OPERAND
01	SET	COUNTER ALL 0
02	SET	TIMER ALL CLEAR
03	TRAP	1
04	SRCH	1 RECEIVE
05	CLR	ALL
06	WAIT	
07	IFEV	TRAP1 ELSE GOTO 05
08	INT	AFTER 60.000ms
09	SET	TIMER 1 ON
10	TRAP	1
11	SRCH	1 RECEIVE
12	CLR	ALL

STEP	INST	OPERAND
13	WAIT	
14	IFEV	TRAP1 THEN GOTO 19
15	IFEV	TI ELSE GOTO 12
16	INC	COUNTER 3 BY +1
17	INT	AFTER 60.000ms
18	GOTO	12
19	SET	TIMER 1 OFF
20	SET	TIMER 2 ON
21	IF	TIMER 1 60.000 GOTO 35
22	IF	TIMER 2 60.000 GOTO 38
23	TRAP	1
24	SRCH	1 RECEIVE

STEP	INST	OPERAND
25	CLR	ALL
26	WAIT	
27	IFEV	TRAP1 THEN GOTO 32
28	IFEV	TI ELSE GOTO 25
29	INC	COUNTER 3 BY +1
30	INT	AFTER 60.000ms
31	GOTO	42
32	SET	TIMER 2 OFF
33	SET	TIMER 1 ON
34	GOTO	10
35	INC	COUNTER 1 BY +1
36	SET	TIMER 1 CLEAR

STEP	INST	OPERAND
37	GOTO	22
38	INC	COUNTER 2 BY +1
39	SET	TIMER 2 CLEAR
40	SET	TIMER 2 ON
41	GOTO	23
42	IF	COUNTER 3=60, GOTO 44
43	GOTO	25
44	HALT	

WHERE COUNTER 1/TIMER 1 =TIME ACTUAL DATA WAS PRESENT
COUNTER 2/TIMER 2 =TIME LINE WAS IDLE
COUNTER 3 =RUN TIME OF PROGRAM IN MIN.


START
01
SET ALL COUNTERS = 0
02
SET ALL TIMERS 0
03
SET-UP TRAP 1
04
SEARCH RECEIVE DATA FOR TRAP 1
05
1
CLEAR ALL EVENTS
WAIT
06
07
IS EVENT TRAP 1 ?
NO
1
YES
08
SET INTERRUPT TIMER = 60000ms
09
TURN TIMER 1 ON
10
8
SET-UP TRAP 1
11
SEARCH RECEIVE DATA FOR TRAP 1
12
3
CLEAR ALL EVENTS
WAIT
13
2
2
14
IS EVENT TRAP 1 ?
YES
4
NO
15
IS EVENT INTERRUPT TIMER ?
NO
3
YES
16
ADD + 1 TO COUNTER 3
17
SET-UP INTERRUPT TIMER = 60000ms
3
18
4
19
SET TIMER 1 OFF
20
SET TIMER 2 ON
21
IS TIMER 1 = >60000 ?
YES
9
NO
10
22
IS TIMER 2 >= 60000 ?
YES
11
NO
12
23
SET TRAP 1
24
SEARCH RECEIVE DATA FOR TRAP 1
6
25
CLEAR ALL EVENTS
WAIT
26
5

DIGILOG DLM V PROGRAM LAYOUT SHEET

PROGRAMMER _____ PROG. NUMBER _____

DESCRIPTION _____

STEP NO.	INSTR	OPERAND	BYTES USED
01			
02			
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DIGILOG DLM V PROGRAM LAYOUT SHEET

PROGRAMMER _____ PROG. NUMBER _____

DESCRIPTION _____

STEP NO.	INSTR	OPERAND	BYTES USED
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READERS COMMENTS

DLM V
DATA LINE MONITOR
OPERATOR'S INSTRUCTION MANUAL
P/N 98-7005-00 Rev. B

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TECHNICAL or EDITORIAL ERRORS:
(include page number) _____

_____

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SUGGESTIONS FOR IMPROVEMENT: _____

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Name _____ Title _____

Company & Division _____

Address _____

City & State _____ Zip _____

Phone: ( ) _____ Ext: _____

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