CONTROL DATA CORPORATION

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REV 05

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Data Systems Roseville Operations	

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Viking X Resident

APPROVAL SIGNATURES	DATE
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CONTROL DATA CORPORATION

Data Systems Roseville Operations DIVISION

NO 16042888
REV 05
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PRODUCT NAME Viking X Resident
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WP0047h
CD3390R

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Table

1.0 INTRODUCTION

The Viking X hardware has the capability of holding 16K bytes of ROM, 64K bytes of RAM, and 16K bytes in ROM pack. The ROM contains resident programs that provide self-testing of the terminal hardware via resident diagnostics as well as programs to autoload and checksum controlware in the terminal RAM loaded from the Data Services Network (DSN) or the flexible disk subsystem option. The resident ROM also contains CYBER mode with subroutines that can be used by other controlware that has been loaded. Operator control of loading is accomplished by setting certain installation parameters via the keyboard. This document describes the operation of the resident ROM programs in the terminal. Further information on the hardware or loaded controlware may be found in separate documents directed specifically toward those topics.

2.0 APPLICABLE DOCUMENTS

EIA RS-232-C	Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange
CDC-STD 1.80.000	Programming Standards
CDC-STD 1.01.103	Software Development Documentation
CDC-STD 1.01.105	External Reference Specification
CDC-SPEC 16042886	Display Terminal Equipment Specification
CDC-ERS 16042871	IST-III ERS (Predecessor Product)
CDC-PUB 62940019	Operator's Guide/Installation Manual
CDC-PUB 62940020	Reference/On-Site Hardware Maintenance Manual
CDC-ERS 16042910	Viking X PLATO Loader ERS
CDC-ERS 16042919	Viking X Flex Disk Handler ERS
CDC-SPEC 51941115	Viking X Keyboard Specification
CDC-SPEC 16042854	CDC PLATO Flexible Disk Subsystem

3.0 FEATURE DESCRIPTION

The resident ROM firmware consists of the following major program segments that interact to perform the overall desired functions.

3.0 (Contd)

- o Entry-Jump Table and Variables
- o Initialization
- o Resident Diagnostics
- o Parameter Selection
- o Load Source Selection
- o Load File Selection
- o ASCII Network Loader
- o Flexible Disk Loader
- o ROM Pack Load
- o CYBER Mode

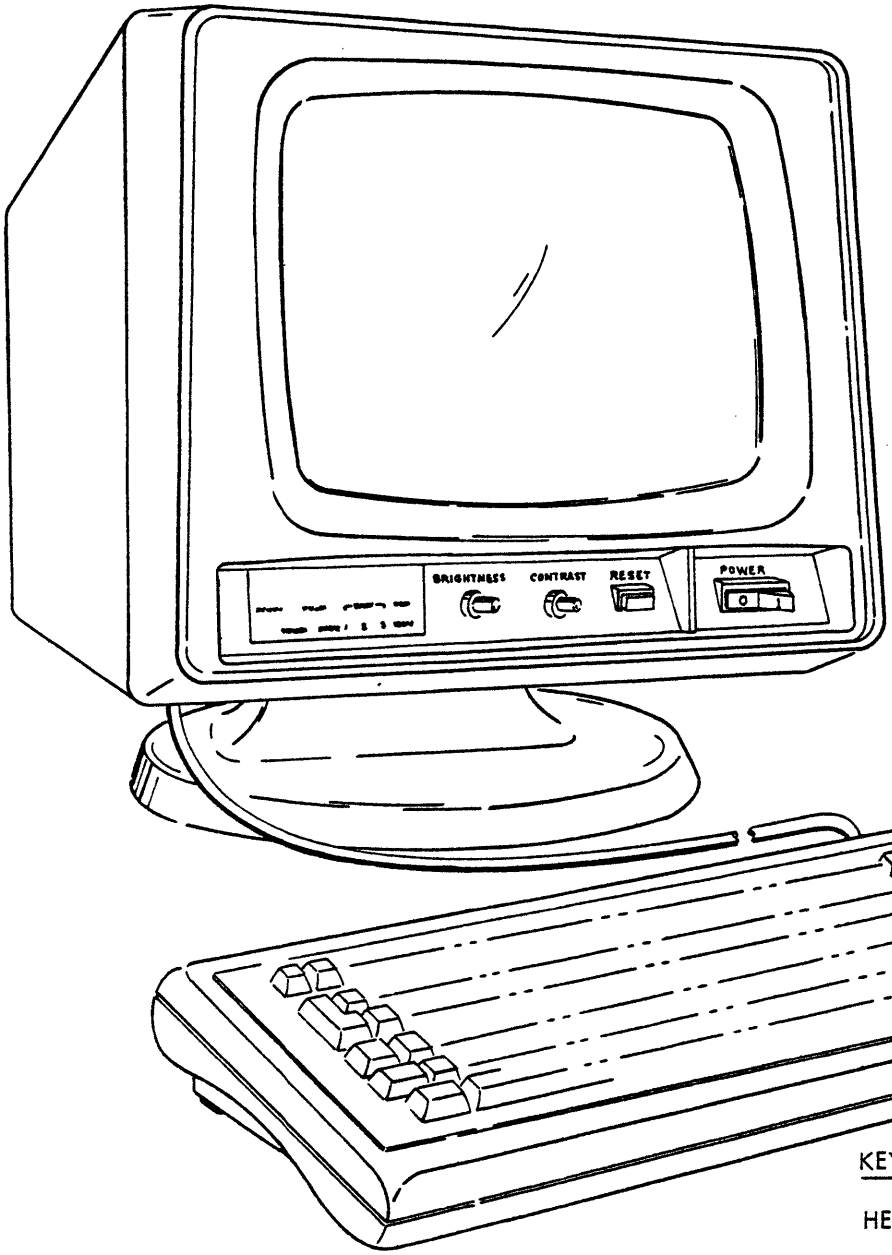
The terminal (Figures 3.0.1 and 3.0.2) is capable of having a ROM pack or external user controlware loaded into it. These external packages can use subroutines that already exist in the resident ROM. Section 4.3 is dedicated to describing the interfaces to the usable routines.

The terminal does not use switches for parameter definition. Instead it utilizes nonvolatile memory (NVM), which stores parameters while the machine is turned off or unplugged. The resident ROM has subroutines that will allow qualified people to change these parameters.

3.1 Initialization

3.1.1 Abstract

When the terminal is powered on or when the RESET switch is pressed, the initialization routine is executed.



STATION W/SWIVEL, TILT BASE

HEIGHT — 44 cm
WIDTH — 43 cm
DEPTH — 43 cm

KEYBOARD, DETACHED

HEIGHT — 8 cm
WIDTH — 49 cm
DEPTH — 23 cm

VIKING X TERMINAL WITH KEYBOARD

Figure 3.0.1. Viking X Cabinet

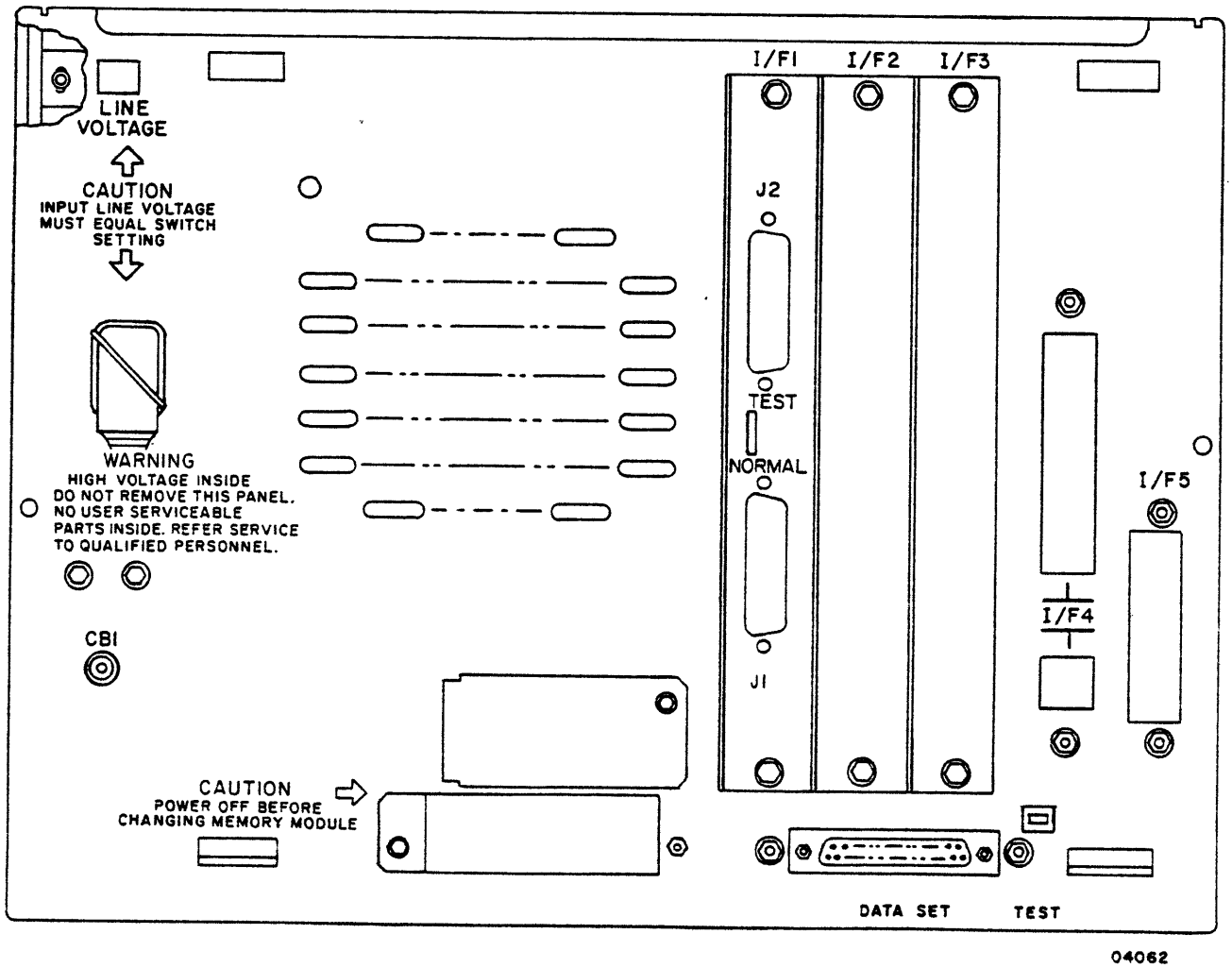


Figure 3.0.2. Connectors

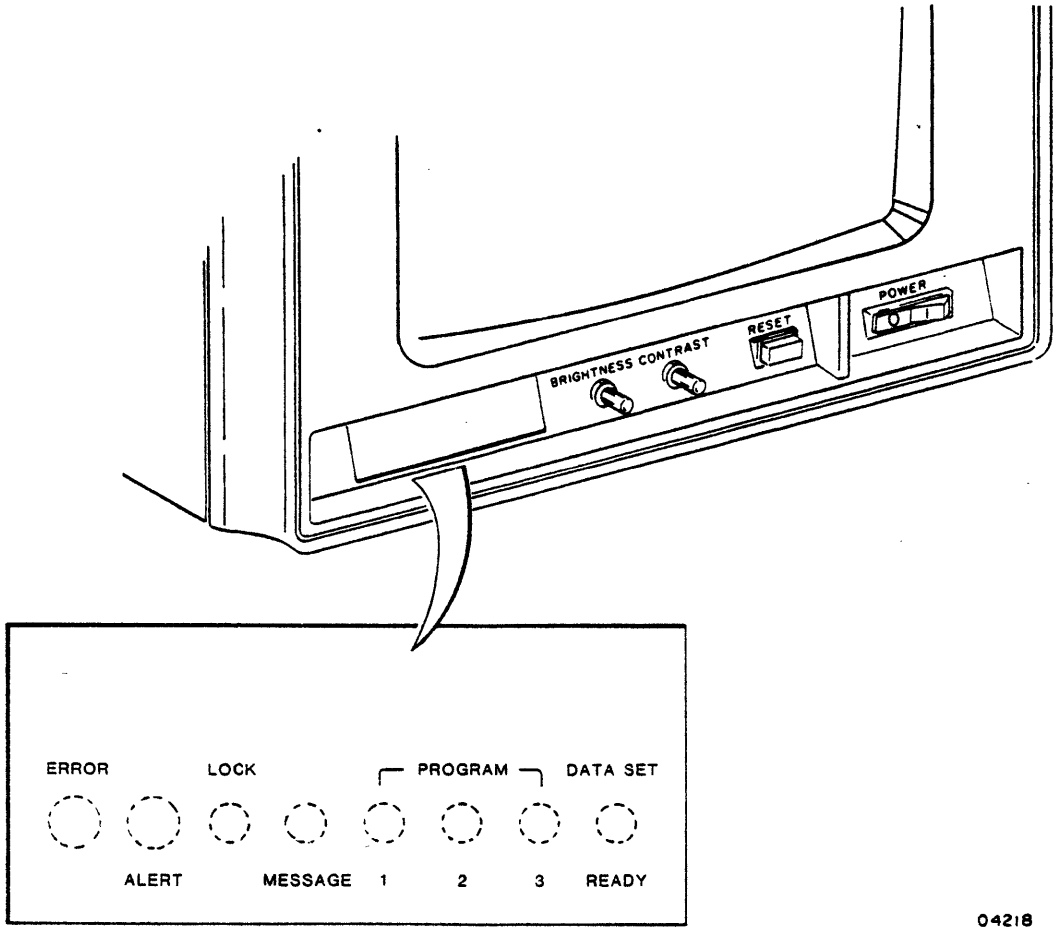


Figure 3.0.3. Switches and Indicators

3.1.2 Description

The initialization routine will first run test one of the resident diagnostic (quicklook). See Section 3.2. The error results are displayed on the CRT.

If any errors are detected while running test 1, the results will be left and the Mode Selection Menu prompt will be displayed. (see Figure 3.1.1). If no errors have occurred the AUTO SELECT ENABLED parameter will be tested and control transferred to Load Source Selection (Section 3.4) if enabled. If not enabled, the Mode Selection Menu will be displayed.

The operator must select the operating mode through a soft function key approach. This means the function keys are used according to the meaning given them on the screen.

Eight function keys and the selection of Parameter Entry Mode is enabled when the MODE SELECTION MENU is being displayed, (see Figure 3.1.1).

- F1 (MODE 1 CYBER) - If F1 is pressed, control will be transferred to CYBER mode.
- F2 (MODE 2 PLATO) - If F2 is pressed, the mode 2 installation parameters will be examined to determine from where and how to load that mode (see Section 3.4, Load Source Selection).
- F3 through F6 (MODES 3 through 6) - These modes are set up by the owner or installer to any type mode (except Resident CYBER Mode). If enabled the mode installation parameters for the associated mode will be examined to determine from where and how to load that mode (see Section 3.4, Load Source Selection).
- F7 (MODE 7 PACK) - If F7 is pressed, a test will be made to see if a ROM PACK is installed. If a pack is installed, a test will be made to see if a function is contained within that pack (see Section 3.8). If a function is contained in the pack, control will be transferred to that function.
- F8 TERMNL TEST - If F8 is pressed, test 3 of the resident diagnostics will be run (see Section 3.2.2.3).

3.1.2 (Contd)

- PARAMETER ENTRY MODE - If the operator simulatenously presses the CTRL and SETUP keys, control will be passed to Terminal Installation parameter entry mode (see Section 3.3). This mode should only be entered by terminal installation personnel or equivalent (operating system understanding required).

When a mode has been selected, the mode enabled/disabled parameter bit will be tested.

- If mode is disabled, a message will appear MODE NOT ENABLED, the alarm will sound, and the operator is required to enter another mode.
- When the mode is enabled, a test will be made to see if the access has been enabled for that mode (this is a mode installation parameter bit). If access is enabled, the following message will appear on line 27.

ENTER ACCESS CODE |_|_|_|_|

The four entry positions will appear in inverse video with the cursor under the first entry position. As a code is entered the inverse video will disappear and an X code will be displayed. Four entries are allowed. If an error is made, the RESET key can be pressed to start over. If the code entered (all four codes) does not match the access code entered into the mode installation parameters the word SORRY will be displayed, the alarm will sound and control sent back to require the selection of a new mode. If access is entered properly, control will transfer to load source selection, see Section 3.4.

3.1.3 Interfaces

The operator can cause the terminal to run the initialization routine by pressing the RESET switch. After running test 1 of the resident diagnostic, the operator must select a mode that has been enabled. Note that at this point a qualified person could enter parameters by pressing the CTRL and SETUP keys simultaneously. If the access for the selected mode has been enabled, the operator must type the proper access code sequence.

```
F|MODE 1|  F|MODE 2|  F|MODE 3|  F|MODE 4|  F|MODE 5|  F|MODE 6|  F|MODE 7|  F|TERMNL|  F|      |  F|      |
1|CYBER  |  2|PLATO  |  3| XXXX |  4| XXXX |  5| XXXX |  6| XXXX |  7| PACK  |  8| TEST  |  9|      | 10|      |
0          10         20         30         40         50         60         70         80
                                                  *          *
```

LAST TWO ROWS DISPLAY (VIRTUAL LINES)

AFTER POWER ON OR RESET

CONVENTIONS: (PERTAINING TO FIGURES 3.1.1, 3.3.2, AND 3.3.3)

1. LOWERCASE LABELS INDICATE A BRANCHING FUNCTION.
2. ALPHA CAPS LABELS INDICATE A DIRECT FUNCTION SELECTION.
3. "BOXES" ARE DISPLAYED IN INVERSE VIDEO.
4. F1 THROUGH F10 ARE SELECTED BY PRESSING (OPERATOR) FUNCTION KEYS F1 THROUGH F10.
5. AN * WILL APPEAR IN THE LOWER RIGHT CORNER OF THE BOX THAT IS THE AUTO SELECT MODE.

*A CUSTOMER OR APPLICATION DEFINED ALPHANUMERIC CHARACTER LABEL FOR MODES 3 THROUGH 6 AND OPERATOR DEFINED AT MODE INSTALLATION TIME.

Figure 3.1.1. Mode Selection Menu

3.1.4 Aborts and Recovery

If the operator selects a mode that is not enabled or types an incorrect access code, the alarm is sounded and control is sent back to require entry of a new mode.

If the operator selects a mode that specifies a ROM pack, and a ROM pack has not been inserted, an error message MODE NOT ENABLED is displayed and control is sent back to require entry of a new mode.

3.1.5 Errors

If any keys are pressed that have not been defined previously, the alarm will sound and the key is ignored.

3.1.6 Performance

All sections require the Initialization section to work. Performance is discussed in each section.

3.1.7 Installation Parameters

Refer to Section 3.3.

3.2 Resident Diagnostics

3.2.1 Abstract

The resident diagnostics contain three tests. Test 1 runs after a power up or RESET and requires no operator verification or intervention. It should take less than 5 seconds to run. Test 2 is a host initiated test. Test 3 contains a setup raster and other tests that require operator verification or intervention. Resident diag-

3.2.1 (Contd)

nostics test the basic hardware, and some options. In test 1 if any failure occurs, a message will be displayed, an error flag will be set and the MODE SELECTION MENU displayed.

3.2.2 Description

3.2.2.1 Test 1 (Quicklook)

Test 1 runs after power on or by pressing the RESET switch. It is also run if test 2 is run. Test 1 contains the following subtests:

- Character RAM Test - A 55 hex and AA hex are written, read and compared throughout the RAM Character Generator memory. A failure of this test is signaled by displaying "CHARACTER RAM FAIL XXXX AA EE" on the next line of the CRT, where: XXXX = failing address; AA = actual data read; EE = expected data. Nothing will be displayed if there is no failure.

- RAM Test - A 55 hex and AA hex are written, read, and compared throughout the 64K resident RAM. A failure of this test is signaled by displaying RAM FAIL XXXX AA EE on the next line of the CRT (assuming a failure mode does not prevent display) where: XXXX = failing address; AA = actual data read; EE = expected data read. Nothing will be displayed if there are no failures. Parity error interrupts are enabled during the RAM test, and a failure will be reported if a parity error is detected. (Note: If actual = expected the parity chip itself may be bad.)

- Graphics, Option RAM - If this option is present, the graphics RAM will be selected and a 55 hex and AA hex pattern will be stored and tested. A failure of the test will be displayed on the next line saying GRAPHICS RAM FAIL XXXX, AA EE. Nothing will be displayed if there are no failures.

- ROM Test - A checksum is run on each 4K block of the resident ROM. A failure of this test is signaled by displaying "ROM FAIL XX XX XX XX". A value other than 00 is bad. A checksum will be run on the nonvolatile memory (NVM). A failure of this test is signaled by displaying NVM FAIL on the next line of the CRT. Nothing will be displayed if there are no failures.

3.2.2.1 (Contd)

- Loopback Test - The test is comprised of transferring 128 characters from the processor to the communications UART, which is conditioned to echo rather than transmit all data. The data is tested as it is received. Transmitter speed is fixed at 9600 baud. A failure of the test is signaled by displaying COMM FAIL on the next line of the CRT. The same test is conducted on the UART to the keyboard. A failure of this test is signaled by displaying KEYBOARD FAIL on the next line of the CRT.

- Timer Test - The timer will be started for a 5-millisecond delay with the timer interrupt enabled. If a timer interrupt does not occur before 6 milliseconds, interrupts will be disabled and the message TIMER FAIL displayed.

- Battery Test - This test will sample the battery low status. If the battery voltage level is low, BATTERY LOW will be displayed. This is not an error condition, but indicates battery should be replaced before NVM is lost.

- Serial Ports - If this option is present, this test will transfer 128 characters to the UART on ports A and B which are conditioned to echo rather than transmit all data. The data is tested as it is received. Transmission speed is fixed at 9600 baud. A failure of the test is signaled by displaying PORT A or PORT B FAIL.

- Test Switch - The test switch on the main logic board is tested. If not enabled it will go to the next section. If enabled it will:

  - Keyboard Clock - The keyboard clock is fed into the CTC timer chip, the timer is tested to see if it runs, if not the message KBD CLOCK FAIL will be displayed.

  - Keyboard Loopback - The keyboard UART, transmitter, and receiver will be tested. 128 characters from 00 to 7F hex will be transmitted, they should be looped back through the switch and tested as they are received. The message EXT KBD LOOPBACK FAIL will be displayed if an error occurs.

  - The message TEST SWITCH ENABLED will be displayed.

- Diagnostic ROM Pack - If a ROM PACK containing a diagnostic is installed, a call will be made to the ROM PACK diagnostic input. The ROM PACK diagnostic should do a ROM checksum, test any additional hardware used, display any error messages and display ROM PACK name and revision. If an error occurs, the call is returned with NZ condition active, else it is returned with Z active.

3.2.2.1 (Contd)

- Revision Level - The section displays the revision level of the resident firmware.

  RES REV 1.1

- Alarm - Completion of test 1 is signaled by the audible alarm sounding for one-quarter second at a soft level then one-quarter second at a loud level and followed by another one-quarter second at a soft level. See Figure 3.2.1 for internal diagnostic failure format after test.

```
CHARACTER RAM FAIL XXXX XX XX
RAM FAIL XXXX XX XX
GRAPHIC RAM FAIL XXXX XX XX
ROM FAIL XX XX XX XX
NVM FAIL
COMM FAIL
KEYBOARD FAIL
TIMER FAIL
BATTERY LOW
PORT A FAIL
PORT B FAIL
KBD CLOCK FAIL
EXT KBD LOOPBACK FAIL
TEST SWITCH ENABLED
(DIAGNOSTIC ROM PACK MESSAGES HERE)
RES REV 1.1
```

Figure 3.2.1. Diagnostic Display Test 1 If Everything Failed

3.2.2.2 Test 2

Test 2 can be initiated from the keyboard in local character mode or upon receipt of the Initiate Test command from the host while running in resident advanced mode (1E, 16). Test 1 is rerun. If an error occurs, the error flag will be set.

- Host Initiated - At the completion of the test, if the error flag is set an error response is sent to the host (STX, ACK, NAK). The error message will not remain on the screen. If the error flag is

3.2.2.2 (Contd)

not set, a positive response is sent (STX, ACK, ACK) to the host and the screen will be cleared.

- Locally Initiated - If the operator presses CTRL, =, V (RS, SYN) while in local CYBER mode, the test will be run, as long as no errors are detected the test will loop and keep running. This can only be cleared by pressing RESET. If an error occurs, the test will halt displaying the failure and the RESET must be pressed to exit.

3.2.2.3 Test 3

Test 3 is initiated if the operator presses the F8 key while the Mode Selection Menu is being displayed.

- Alignment Raster - This test enters an alignment pattern around the outer edge of the display area.
- ROM Character Generator - Six lines will be displayed as follows:
  - 32 Control codes
  - 33 Numeric and special characters
  - 32 Uppercase alpha and special characters
  - 31 Lowercase and special characters
  - 32 Foreign character symbols
  - 32 Line drawing characters
  - 64 PLATO characters

  Note: If a foreign character set is selected they will appear in their assigned locations.

  Note: The external RAM characters will not be displayed because they cannot be displayed simultaneously with PLATO characters.
- Attribute Test - A line (BLINK DIM UNDERSCORE INVERSE BLANK) will be displayed with each word having the associated bit set in background. If BLANK is seen on the CRT, the function is not working.

3.2.2.3 (Contd)

- Keyboard Test - This test displays KEYBOARD TEST - on one line on the CRT. As the operator presses a key, the hex code received from the key will be displayed after the words KEYBOARD TEST.

  Note: The keyboard sends a hex code whenever a key is depressed or released. Bit 2^7 is clear whenever a key is pressed and the same code with bit 2^7 set when the key is released. The codes sent by the keyboard are not ASCII codes. (Reference Keyboard Specification 51941115 for codes generated by the keyboard.) The following is an example.

  KEYBOARD TEST 55 (when a key is pressed)
  KEYBOARD TEST D5 (when key is released)

- Indicator Test - The eight indicators that are controlled by the firmware will be stepped on and off at a slow rate. After the first indicator is lit a short while, it will be shifted right. After the last indicator has been lit one-half second, the first will again be lit.

- Touch-Panel Test - The touch-panel interrupt will be enabled. When the screen is touched an interrupt occurs and the cursor will be moved to the area touched.

- External Loopback - A message displays near the bottom of the screen explaining how to run external loopback. It displays TO RUN EXTERNAL LOOPBACK - ENABLE TEST SWITCHES.

  When the test switch is enabled, the following test will be looped on;

  - The UART clock for the keyboard I/F will be tested and the message "KBD CLOCK OK" or "KBD CLOCK FAIL" will be displayed.

  - PARALLEL PORT - If a graphic printer is installed, it must be powered-on or an error will occur. A 55 hex and AA hex will be sent to the printer which is conditioned to echo data. If incorrect data is received back or no response received, the error message "PARALLEL PORT FAIL" will be displayed and there will be no further test on this port. If no error is detected, the message "PARALLEL PORT OK" is displayed.

    If the graphic printer is not installed, a test will be made for flexible disk present. A read ID will be sent to the disk. If an improper status is received, the message "PARALLEL

3.2.2.3 (Contd)

PORT FAIL" will be displayed. If proper status is received, the message "PARALLEL PORT OK" will be displayed.

- KEYBOARD LOOPBACK - The message "KEYBOARD RUNNING" will be displayed. 128 characters from 00 hex to 7F hex will be looped back continuously. If an error occurs, the word "RUNNING" will change to "FAIL" and the last code received will be displayed.

- COMMUNICATIONS LOOPBACK - The message "COMM RUNNING" will be displayed. 128 characters from 00 hex to 7F hex will be looped back continuously. If an error occurs, the word "RUNNING" will change to "FAIL".

- SERIAL PORT A and B - If either the Dual Serial Port board or the Dual Serial board with current loop are installed, a test will be made to see if the loopback switch is in test position. If not in test mode, the test is not performed. If in test (EXTERNAL LOOPBACK), the message "PORT A (or B) RUNNING" will be displayed. 128 characters from 00 hex to 7F hex will be looped back continuously. If an error occurs, the word "RUNNING" will change to "FAIL".

To exit test 3, the operator must press the RESET switch (see Figure 3.2.2 for display format of test).

3.2.3 Interfaces

- Test 1 - The only operator interface required to run test 1 is to power on unit or press RESET. Operator can verify failures by displayed messages.

- Test 2 - Host selectable in advanced mode only, and operator selectable in local character mode by pressing CTRL, =, V.

- Test 3 - The operator is required to press F8 while the Mode Selection Menu is displayed. The operator can verify all symbol shapes, indicators, and keyboard. Symbols will be displayed according to language selected. Figure 3.2.2 shows English selected. To run external loopback, the operator must switch the TEST switch.

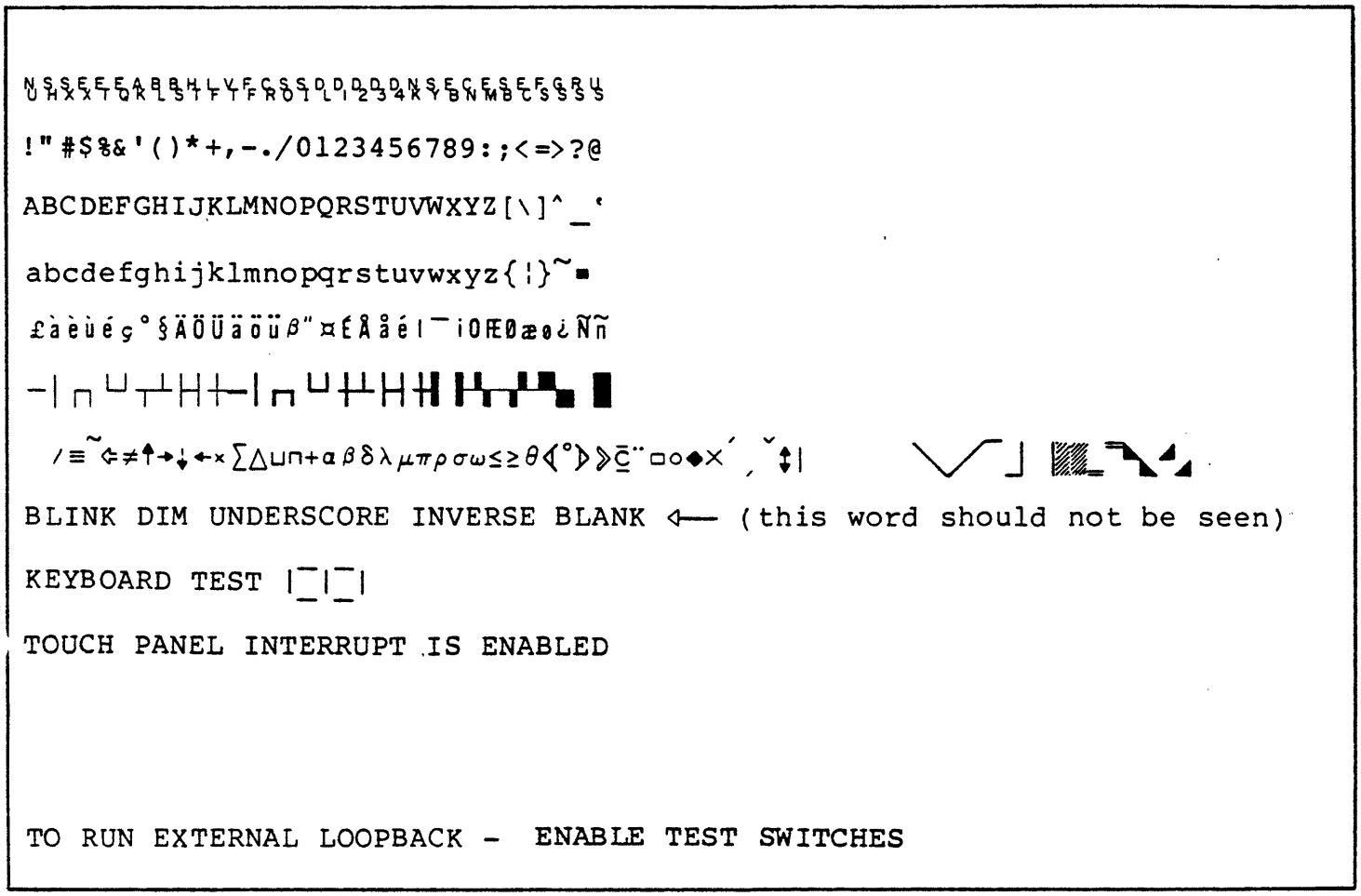


Figure 3.2.2. Diagnostic Display Test 3

3.2.4 Aborts and Recovery

- Test 1 - If an error occurs, the remainder of that section is aborted, an error message is displayed, and the test will continue. Depression of RESET will rerun Test 1.
- Test 2 - If initiated while on line and an error occurs, test 2 is aborted and a negative response is sent to the host. If initiated while local and an error occurs, Test 2 will halt with message displayed. Operator must press RESET to recover.

3.2.4 (Contd)

- Test 3 - If an error occurs during loopback, the failing section will no longer be run, the test will continue running all good sections. Operator must press RESET or TEST switch to end test.

3.2.5 Errors

- Test 1 - Errors display on the screen. If no error occurs, nothing is displayed. (Figure 3.2.1)
- Test 2 - An error message is sent back to the host.
- Test 3 - Operator verification required, except during external loopback. (Figure 3.2.2)
- See Figure 3.2.1 and Section 3.2.2.3 for error messages.

3.2.6 Performance

- Test 1 - Requires less than 5 seconds to run.
- Test 2 - Same as Test 1.
- Test 3 - No time limit, test ends when RESET is pressed.
- Usage of internal diagnostics will allow 98% error detection.
- Usage in combination with manuals will allow 95% isolation to the field replaceable module.

3.2.7 Installation Parameters

See Section 3.3 for Terminal Installation Parameters.

3.3 Parameter Selection Entry Mode

3.3.1 Abstract

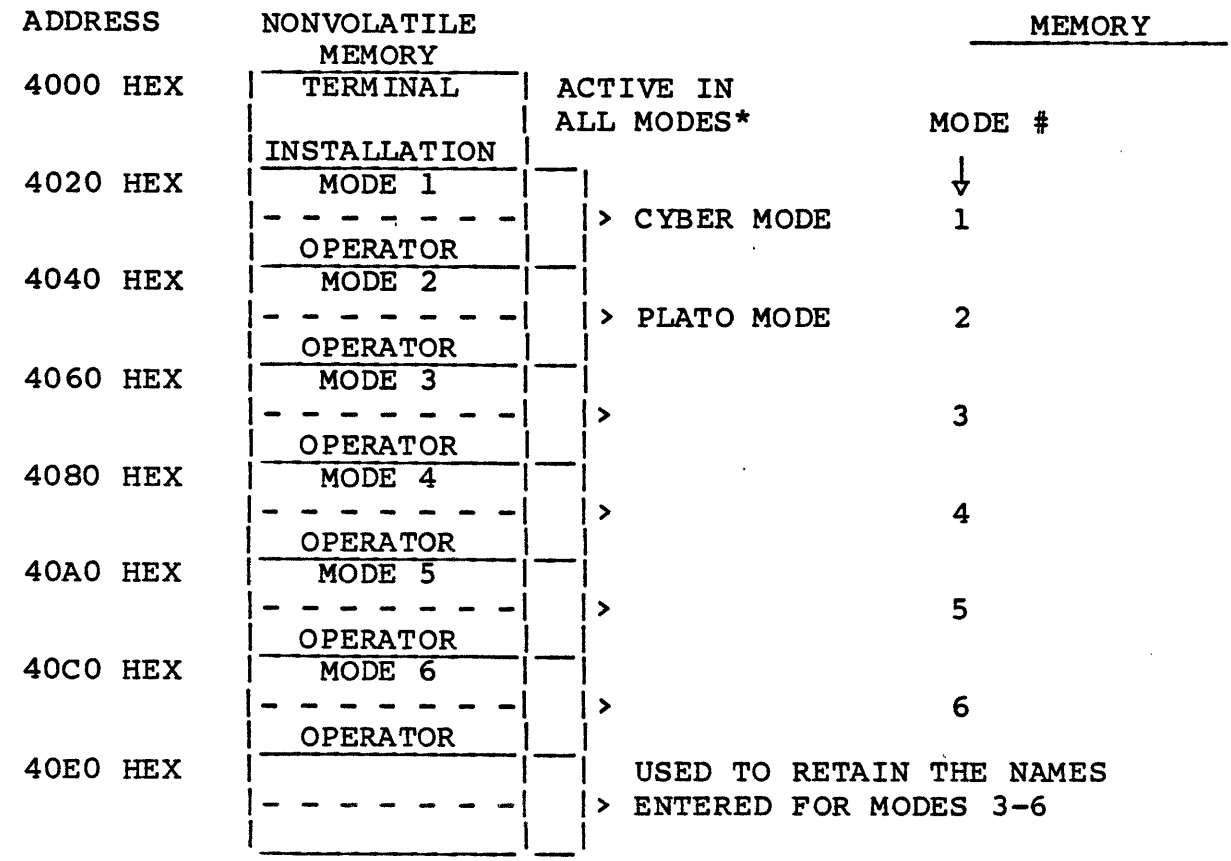
The terminal has no operator switches that can be sensed by the processor. Instead parameters are entered into a nonvolatile memory (NVM) and read by the processor. The NVM retains the parameters when power is off via the use of a battery. It is not intended for the operator to know how to change installation parameters. It is intended that these parameters be set/changed by terminal installation personnel or equivalent (operating system understanding required).

3.3.2 Description

The parameters are comprised of the following three groups.

- Terminal Installation Parameters
- Mode Installation Parameters
- Mode Operator Parameters

There is one set of terminal installation parameters, six sets of mode installation and operator parameters (see Figure 3.3.1). The terminal installation parameters are viewed and changed by simultaneously pressing, CTRL, and SETUP while waiting for the operator to enter the mode. The mode installation parameters can then be viewed and changed by pressing F10 and the desired mode number. Parameters are changed in NVM by pressing COPY. The mode operator parameters are viewed and temporarily changed by pressing SETUP while in the mode.



*ANY MODE CAN BE ASSIGNED TO ANY BLOCK, EXCEPT 1 AND 2 ARE RESERVED FOR RESIDENT CYBER MODE AND PLATO MODE.

Figure 3.3.1. Parameters

3.3.3 Interfaces

3.3.3.1 Terminal Installation Parameters

The terminal installation parameters are used in all modes. They can be viewed and changed by simultaneously pressing CTRL, and SETUP while the MODE SELECTION MENU is being displayed (See Figure 3.3.2 for screen format). To change any installation parameter, the cursor

3.3.3.1 (Contd)

must be positioned under the item to be changed. To do this the following keys are operable:

- o F1 — Returns to Mode Selection Menu.
- o F2-F9 — Moves cursor under first changeable parameter in the associated field.
- o F10 — Goes to Mode Installation Parameters (see Section 3.3.3.2).
- o COPY — Stores the current line of parameters displayed in NVM.
- o SPACE — Moves cursor to next changeable parameter. If cursor is under the last changeable parameter, it will wrap around and reposition again under the first changeable parameters.
- o Back Space — Moves cursor back to next changeable parameter. If cursor is under the first changeable parameter, it will stop.
- o 0-1 — Enters 0 or 1 at cursor if field requires a binary value.
- o 0-7 — Enters 0 to 7 at cursor if field requires an octal value.
- o 0-9/A-F — Entr 0-9 or A through F at cursor if field requires a Hex value.

The cursor advances to next changeable location after each data entry. See Figure 3.3.2 for terminal installation parameters.

3.3.3.1.1 F1 Return

Returns control to Mode Selection Menu.

F	return	F	CONFIG	F	CONFIG	F	CONFIG	F	CONFIG	F	AS X Y	F	L ID	F	PORT A	F	PORT B	F	instl
1		2	123456	3	123456	4	123456	5	123456	6	O O H	7	O HHHH	8	H H	9	H H	10	mode n

1-6 = BINARY
O = OCTAL
H = HEX

F2 CONFIGURATION (BINARY)

1 1 = SPARE
2 1 = TOUCH PANEL OPTION IN
3 1 = DUAL SERIAL INTERFACE OPTION IN
4 1 = GRAPHIC PRINTER OPTION IN
5 1 = FLEXIBLE DISK OPTION IN
6 1 = 21 BIT PLATO INTERFACE OPTION IN

F3 CONFIGURATION (BINARY)

1 1 = 1200/1200 INTERNAL MODEM OPTION IN
2 1 = ISO 3243 KEYBOARD
3 1 = GRAPHIC OPTION IN
4 1 = PARALLEL PORT OPTION IN
5 1 = RS-232-C/CURRENT LOOP OPTION IN
6 1 = FIXED DISK OPTION IN

F4 CONFIGURATION (BINARY)

1 1 = AUTO SELECT ENABLED 0 = AUTO SELECT DISABLED
2 1 = SPARE
3 1 = SPARE
4 1 = SPARE
5 1 = SPARE
6 1 = SPARE

F5 CONFIGURATION (BINARY)

1 1 = SPARE
2 1 = SPARE
3 1 = SPARE
4 1 = SPARE
5 1 = SPARE
6 1 = SPARE

FIGURE 3.3.2. Terminal Installation Parameters

F6 AS AUTO SELECT (MODE NUMBER) (OCTAL)

0 = CYBER MODE
1 = CYBER MODE
2 = PLATO MODE
3 = MODE 3
4 = MODE 4
5 = MODE 5
6 = MODE 6
7 = ROM PACK FUNCTION

F6 X DISPLACEMENT RIGHT/LEFT (OCTAL)

0 = NO DISPLACEMENT
1 = RIGHT 1 CHARACTER
2 = RIGHT 2 CHARACTER
3 = RIGHT 3 CHARACTER
4 = NO DISPLACEMENT
5 = LEFT 1 CHARACTER
6 = LEFT 2 CHARACTER
7 = LEFT 3 CHARACTER

F6 Y DISPLAY DISPLACEMENT UP/DOWN (HEX)

0 = NO DISPLACEMENT
1 = UP 1 SCANS
2 = UP 2 SCANS
3 = UP 3 SCANS
4 = UP 4 SCANS
5 = UP 5 SCANS
6 = UP 6 SCANS
7 = UP 7 SCANS
8 = NO DISPLACEMENT
9 = DOWN 1 SCANS
A = DOWN 2 SCANS
B = DOWN 3 SCANS
C = DOWN 4 SCANS
D = DOWN 5 SCANS
E = DOWN 6 SCANS
F = DOWN 7 SCANS

Figure 3.3.2. Terminal Installation Parameters (Contd)

F7 L LANGUAGE (OCTAL)

0 = ENGLISH
1 = ENGLISH
2 = FRENCH
3 = GERMAN
4 = SWEDISH/FINNISH
5 = BRITISH
6 = SPANISH
7 = DANISH/NORWEGIAN

F7 ID TERMINAL IDENTIFICATION

F8 PORT A (HEX)

1ST VALUE

B3 0 = PORT A PRINTER	1 = PORT A BI-DIRECTIONAL
B2 0 = PORT A PARITY ENABLED	1 = PORT A PARITY DISABLE
B1 0 = PORT A PARITY ODD/SPACE	1 = PORT A PARITY EVEN/MARK
B0 0 = PORT A STOP BITS 1	1 = A STOP BITS 2

2ND VALUE - BAUD RATE (HEX)

0 = 75 BAUD	4 = 300	8 = 2400
1 = 110	5 = 600	9 = 4800
2 = 150	6 = 1200	A = 9600
3 = 200	7 = 1800	B-F = 19.2K

F9 PORT B

Same as PORT A

F10 INSTALLATION PARAMETERS FOR MODE n

THE FOLLOWING MESSAGE WILL BE DISPLAYED

ENTER MODE n |__|

ENTER MODE NAME |____| (FOR MODES 3-6)

Figure 3.3.2. Terminal Installation Parameters (Contd)

3.3.3.1.4 F7

- L - Language - This parameter allows the display of special foreign characters; only the numbers 0 through 7 are allowed. The unit must be reset after changing this parameter.

  0 = English
  1 = English
  2 = French
  3 = German
  4 = Swedish/Finnish
  5 = British
  6 = Spanish
  7 = Danish/Norwegian

- ID - (Terminal Identification Code) - The ID code is broken up into 4 codes. Each code can be set between 0 and F. This code can be used as a physical or logical identifier (host defined). They will be sent to the host with the Model Report Request. (See Table 3.9.13.)

3.3.3.1.5 F8 (PORT A)

- 1st Value - This is an encoded value to select different parameters for Port A.

  - Bit 3 Printer/Bi-Directional - This parameter is used by the firmware to determine if an ASCII type printer is connected to the terminal. In order to connect an ASCII printer, the Dual Serial Interface Option or the RS-232-C/Current Loop Option must be installed. This option has two serial I/O Ports, A and B. This parameter must be set to 0 if the printer is connected to Port A. Otherwise, it must be set to 1 for a bi-directional port, which is supported by the resident firmware. Note: The firmware tests for a printer on Port A first. If both ports are set for printer, Port A will be used.

  - Bit 2 (Parity Enabled/Disabled) - If this parameter is set to Parity Enable, even or odd parity is transmitted with each code and tested for on each code received. If this parameter is set to Parity Disabled, the parity checking logic is disabled and the terminal will transmit either a mark or space condition in the parity position of each code. Transmission of either mark

3.3.3.1.2 F2 through F5 CONFIG (Configuration)

Each parameter must be set to 1 for each option present, set to 0 if option not present or disabled. See Figure 3.2.2 for options list.

3.3.3.1.3 F6

- AS (AUTO SELECT) - This parameter allows the entry of a number between 0 and 7. The parameter value is used as the mode number if auto select enable is selected.

  0-1 - Executes CYBER mode.
  2-6 - Executes the appropriate mode.
  7 - Executes function in a ROM PACK.

- X (Screen Move in X Direction) - As the CRT ages the picture raster may drift. This parameter will allow the installer to move the raster left or right up to 3 characters in width. It is set to 0 when aligned at factory.

  To move the raster left or right see the following listing:

0 = No move	4 = No move
1 = Move right 1 character	5 = Move left 1 character
2 = Move right 2 characters	6 = Move left 2 characters
3 = Move right 3 characters	7 = Move left 3 characters

- Y-Screen Move in Y Direction - As the CRT ages the picture raster may drift. This parameter will allow the installer to move the raster up or down, up to 7 scans. It is set to 0 when aligned at factory. To move the raster up or down see the following listing:

0 = No move	8 = No move
1 = Move up 1 scans	9 = Move down 1 scans
2 = Move up 2 scans	A = Move down 2 scans
3 = Move up 3 scans	B = Move down 3 scans
4 = Move up 4 scans	C = Move down 4 scans
5 = Move up 5 scans	D = Move down 5 scans
6 = Move up 6 scans	E = Move down 6 scans
7 = Move up 7 scans	F = Move down 7 scans

3.3.3.1.5 (Contd)

or space parity is determined by the setting of the Port A Parity Odd/Even.

- Bit 1 (Parity Odd/Even) - This parameter interacts with Port A Parity Enabled/Disabled. If Channel A Parity Enabled is selected and:

  -- This parameter is set to Parity Odd - The terminal will transmit and test for odd parity.

  -- This parameter is set to Parity Even - The terminal will transmit and test for even party.

  If Port A Parity Disabled is selected and:

  -- This parameter is set to Parity Odd - The terminal will transmit a space in place of the parity bit.

  -- This parameter is set to Parity Even - The terminal will transmit a mark in place of the parity bit.

- Bit 0 (1/2 Stop Bits) - If this parameter is set to 1 stop bit, only 1 stop bit is transmitted with each code. If this parameter is set to 2 stop bits, 2 stop bits are transmitted with each code. Received data may have one or two stop bits regardless of the parameter setting.

o 2nd Value (PORT A Baud Rate) - This parameter will be used to select the baud rate (send and receive) of PORT A. The value is encoded; 0 through F may be entered. (See Figure 3.3.2).

3.3.3.1.6 F9 (PORT B)

o 1st Value - This is an encode value to select different parameters for PORT B.

- Bit 3 (Printer/Bi-Directional) - Same as stated in Section 3.3.3.1.5 except in regards to PORT B.

- Bit 2 (Parity Enabled/Disabled) - Same as stated in Section 3.3.3.1.5 except in regards to PORT B.

3.3.3.1.6 (Contd)

- Bit 1 (Parity Odd/Even - Same as stated in Section 3.3.3.1.5 except in regards to PORT B.
- Bit 0 (1/2 Stop Bits - Same as stated in Section 3.3.3.1.5 except in regards to PORT B.

o 2nd Value (PORT B Baud Rate) - Same as A.Baud, Section 3.3.3.1.5, except in regards to Channel B.

3.3.3.1.7 F10 [Instl Mode n (Installation Mode n)]

When F10 is pressed the following message will be displayed on line 27:

ENTER MODE n (1-6) |_|

The number 1 through 6 must be entered. It will be displayed where the inverse box is, and the inverse will go to normal intensity. If any other key is pressed, the alarm will sound and the key is ignored.

If mode 3 through 6 are selected, the following message will be displayed on line 28:

ENTER MODE NAME |_|_|_|_|

The current mode name will be displayed in the inverse boxes. If no change is desired, the NEXT key can be pressed. A change can be made by entering the new codes. When all four codes are entered (or the NEXT key pressed) control will transfer to mode installation parameter entry (see Section 3.3.3.2).

3.3.3.2 Mode Installation Parameters

There are six sets of mode installation parameters, one for each mode 1 through 6 (see Figure 3.3.3). To enter into this mode, the operator must press F10 and enter the desired mode while in the terminal installation parameter entry mode. To change any parameter,

3.3.3.2 (Contd)

the cursor must be positioned under the item to be changed. To do this the following keys are enabled.

- o F1 - Returns to Mode Selection Menu.
- o F2-F10 - Moves cursor under first changeable parameter in the associated field.

See Section 3.3.3.1 for Copy, Space, Backspace, 0-F.

The cursor advances to the next changeable location after each data entry. If an entry is not allowed in the field the alarm will sound and the key ignored.

3.3.3.2.1 F1 Return

Return control to Mode Selection Menu.

3.3.3.2.2 F2 CONFIG (Configuration)

- o F2-1 Mode Disabled/Enabled - When this parameter is set to 0, the mode is disabled and will not be executed. All the other parameters in the block can be set to perform a given load. This could allow a supervisor to simply disable or enable a mode. When this parameter is set to 1, the mode is enabled and can be executed.
- o F2-2 Access Off/On - If this parameter is set to 1 (Access On), the operator will be required to enter the proper access code before the mode is loaded. If this parameter is set to 0 (Access Off), the load will commence immediately after entering the mode block number.
- o F2-3 Load Default/Operator Selected Source/File/Phone # - If the host load has been selected and this parameter is set to 0, the default source and file parameters will be used to select the load source and file. If the parameter is set to 1, the operator will be allowed to select the source file and phone number.

```
ENTER MODE n (1-6) 1

F|return| F|CONFIG| F|CONFIG| F|CONFIG| F|CONFIG| F|OPR DF| F|A-DIAL| F|A-DIAL| F|DF T R| F|ACCESS|
1|      | 2|123456| 3|123456| 4|123456| 5|123456| 6| HHHH | 7|HHHHHH| 8|HHHHHH| 9|OH H H| 10| HHHH |
```

F2 CONFIGURATION (BINARY)

1	0 = MODE DISABLED	1 = MODE ENABLED
2	0 = ACCESS DISABLED	1 = ACCESS ENABLED
*3	0 = USE DEFAULT SOURCE/FILE/PHONE NUMBER	1 = OPERATOR SELECT SOURCE/FILE/PHONE NUMBER
*4	0 = RUN INTERNAL	1 = LOAD EXTERNAL
*5	0 = LOAD FROM HOST	1 = LOAD FROM FLEXIBLE DISK
6	0 = HOST INTERFACE	1 = 1200/1200 INTERNAL MODEM INTERFACE

F3 CONFIGURATION (BINARY)

1	0 = NORMAL RS-232-C/CCITT V.24	1 = CURRENT LOOP SELECTED
2	0 = AUTO DIAL DISABLED	1 = AUTO DIAL ENABLED
3	0 = HOST 7 BITS (DATA)	1 = HOST 8 BITS (DATA)
4	0 = HOST PARITY DISABLE	1 = HOST PARITY ENABLE
5	0 = HOST PARITY ODD	1 = HOST PARITY EVEN
6	0 = HOST 1 STOP BIT	1 = HOST 2 STOP BITS

F4 CONFIGURATION (BINARY)

1	0 = DTR CONSTANT	1 = DTR SWITCHED
2	0 = RTS CONSTANT	1 = RTS SWITCHED
3	0 = TYPAMATIC ON	1 = TYPAMATIC OFF
4	0 = DATA ONLY OFF	1 = DATA ONLY ON
5	0 = HOME UPPER LEFT	1 = HOME LOWER LEFT
6	0 = AUTO LF OFF	1 = AUTO LF ON

*Not checked if Mode 1 selected

Figure 3.3.3. Mode Installation Parameters

WP0047h

F5 CONFIGURATION (BINARY)

1	0 = PACING DISABLED	1 = PACING ENABLED
2	0 = BIAS DISABLED	1 = BIAS ENABLED
3	0 = SPARE	
4	0 = SPARE	
5	0 = SPARE	
*6	0 = CYBER MODE	1 = LOAD FROM ROM PACK

F6 OPERATOR DEFAULT PARAMETERS (HEX)

1ST VALUE

B0	0 = ONLINE	1 = LOCAL
B1	0 = PRINTER DESELECTED	1 = PRINTER SELECTED
B2	0 = MARGIN ALERT OFF	1 = MARGIN ALERT ON
B3	0 = ALERT SOFT	1 = ALERT LOUD

2ND VALUE (HEX)

B0	0 = ALPHA LOCK	1 = SHIFT LOCK
B1	0 = NUMERIC PAD NORMAL	1 = NUMERIC PAD SHIFT
B2	0 = PAGE SCREEN	1 = ROLL SCREEN
B3	0 = ADV. / SMALL CYBER	1 = NATIVE / LARGE CYBER

3RD VALUE (HEX)

B0	0 = BACKGROUND DARK	1 = BACKGROUND LIGHT
B1	0 = CURSOR LINE	1 = CURSOR BOX
B2	0 = CURSOR BLINK	1 = CURSOR SOLID ON
B3	0 = SPARE	1 =

*NOT CHECKED IF MODE 1 SELECTED

Figure 3.3.3. Mode Installation Parameters (Contd)

4TH VALUE (HEX)

B0	0 = HALF DUPLEX	1 = FULL DUPLEX
B1	0 = 80 CHARACTERS/LINE	1 = 132 CHARACTERS/LINE
B2	0 = 24 LINES	1 = 30 LINES
B3	0 = TRANSPARENT OFF	1 = TRANSPARENT ON

F7 A-DIAL AUTO DIAL NUMBER PART 1 (HEX)

F8 A-DIAL AUTO DIAL NUMBER PART 2 (HEX)

F9

DF DEFAULT FILE NUMBER (HEX)

T TRANSMIT BAUD RATE (HEX)

0 = 75	4 = 300	8 = 2400	C = 19.2K
1 = 110	5 = 600	9 = 4800	D = 19.2K
2 = 150	6 = 1200	A = 9600	E = 19.2K
3 = 200	7 = 1800	B = 19.2 K	F = 19.2K

R RECEIVE BAUD RATE

SAME AS TRANSMIT BAUD RATE

F10 ACCESS CODE (HEX)

THIS IS THE CODE THAT MUST BE ENTERED IF ACCESS ENABLED BEFORE ENTERING A MODE.

Figure 3.3.3. Mode Installation Parameters (Contd)

3.3.3.2.2 (Contd)

- o F2-4 Run Internal/Load External - This parameter must be set to 0 to execute CYBER mode or run from ROM pack. This parameter must be set to 1 to load a mode from host or disk.

- o F2-5 Load From Host/Disk - This parameter works in conjunction with the Run Internal/Load External parameter. If the Load External (1) is selected and this parameter is set to 0, a load from host will be initiated. If this parameter is set to 1, a load from disk is initiated.

- o F2-6 Use Resident Host/Internal Modem Interface - This parameter work in conjunction with LOAD FROM HOST/DISK. If LOAD FROM HOST is selected and this parameter is set to 0, the Resident Host interface is used. If this parameter is set to 1, the internal 1200/1200 modem is used.

3.3.3.2.3 F3 CONFIG - Configuration

- o F3-1 Current Loop - If the Host Interface is selected and this bit is set to 0 the normal RS-232-C signals will be used on the Resident Host Interface. If this bit is set to 1 (current loop) the current loop option will be used on the RS-232-C/Current Loop Option Interface. If option is not present, a message "MODE NOT ENABLED" will be displayed and control sent to MODE SELECTION.

- o F3-2 Auto Dial Off/On - This parameter is not used by the resident firmware (future enhancement). The intent is described here. If the host load has been selected using the internal modem, the internal modem option is installed, and this parameter is a 1, the auto dial or operator entered number will be used. If this parameter is a 0, the operator will be requested to make an external phone connection.

- o F3-3 Host 7/8 Bits
- o F3-4 Host Parity Enabled/Disabled
- o F3-5 Host Parity Odd/Even
- o F3-6 Host 1/2 Stop Bits

These four parameters work together to select the proper word format to the host. If 8 bits is selected, 8 data bits are sent. The parity bit is dependent upon Parity Enabled/Disabled and Parity Odd/Even. If 7 bits is selected, only 7 data bits are sent.

If 8 bits is selected and parity is disabled, the Even/Odd parameter is used to select a mark or space in place of the parity bit 8th bit.

3.3.3.2.3 (Contd)

The following example is to aid in selecting the proper word format:

	7/8	Enabled/ Disabled	Odd/ Even	Stop 1/2
8 data bits with parity	1	1	X	X
7 data bits with odd parity	0	1	0	X
7 data bits with even parity	0	1	1	X
7 data bits with space parity (bit 8)	1	0	0	X
7 data bits with mark parity (bit 8)	1	0	1	X
7 data bits with no parity	0	0	X	X
Where X can be either 0 or 1.	0=7 1=8	0=DIS 1=ENA	0=ODD 1=EVEN	0=1 STOP BIT 1=2 STOP BITS

3.3.3.2.4 F4 CONFIG - Configuration

- F4-1 DTR Constant/Switched - If this parameter is set to 0 (DTR Constant), the DTR (Data Terminal Ready) signal on the host connector will be held on at all times. If this parameter is set to 1 (DTR Switched), the DTR signal on the host connector will be switched off if the mode is in local operation. DTR is maintained in the on condition at all other times. Received data is ignored if DTR is off.

- F4-2 RTS Constant/Switched - If this parameter is set to 0 (RTS Constant), the RTS (Request to Send) signal will be on whenever DSR and DTR are on. If this parameter is set to 1 (RTS Switched), the RTS signal will operate as follows if DSR and DTR are on, and Data Only Off:

  - Half Duplex - RTS is on with the first keystroke and is switched off a minimum of 1 millisecond, maximum of 16 milliseconds following transmission of a CR, LF, ACK, or NAK. RTS will be placed to off if a break is received, or local operation is selected. Automatic responses to the host will cause RTS to be on for the duration of the response and switched off 1 to 16 milliseconds following the last word transmitted.

3.3.3.2.4 (Contd)

- Full Duplex - RTS is on until local operation is selected.

o F4-3 Typamatic On/Off - If Typamatic is on the keys shown in Table 3.9.12 will repeat at a rate of 15 ± 3 characters per second if held down longer than 1 second. If typamatic is off, no keys will repeat when held down.

o F4-4 Data Only Off/On - If this parameter is set to 0 (Data Only Off), the terminal honors the DSR and DTR when sending and CO when receiving. If this parameter is set to 1 (Data Only On), the terminal will disregard the RS-232-C modem control signals. Data is transmitted without regard to the presence of DSR or CTS. Received data is acted upon without regard to CO or DSR. DTR operates normally, but is not required for system operation if the current-loop feature is used.

o F4-5 Home Upper/Lower Left - This parameter may be ignored in some modes. In the resident CYBER mode it is operational, but should be set to Upper Left to be compatible with Viking TTY advanced mode. If this parameter is set to a 0, the cursor will be placed to upper left for home. If this parameter is set to a 1, the cursor will be placed to lower left for home.

o F4-6 Auto LF Off/On - This parameter may be ignored in some modes. In the resident CYBER mode it is operational. If this parameter is set to a 0 (Auto LF Off), it is intended that a carriage return operation position the cursor to the beginning of the current line. If this parameter is set to a 1 (Auto LF On), it is intended that a line feed operation in addition to a carriage return operation be performed upon actuation of the CR key or receipt of the carriage return code.

3.3.3.2.5 F5 CONFIG - Configuration

o F5-1 Pacing Disabled/Enabled - When this parameter is set to 1, the rate of data being sent to the host will be limited to one code every 8 milliseconds regardless of the baud rate. This gives an effective throughput of 1200 baud. If the parameter is set to 0, no limiting is performed.

3.3.3.2.5 (Contd)

- o F5-2 Code Bias Off/On - This parameter may be ignored in some modes. In the resident CYBER mode it is operational. If this parameter is set to a 0 (Code Bias Off, no bias is added to the cursor address when sending or receiving X/Y positioning information or set scroll field information. If this parameter is set to a 1 (Code Bias On), a bias of 20 hex is added to the cursor address when sending or receiving X/Y positioning information or set scroll field information.

- o F5-3 Spare

- o F5-4 Spare

- o F5-5 Spare

- o F5-6 CYBER MODE/ROM PACK - If the Run Internal Parameter is selected this parameter will be tested to see if control is passed to CYBER mode or to the ROM PACK.

3.3.3.2.6 F6 OPR DF - Operator Default

All of the Mode Operator Parameter default values are encoded in hex digits. They are the initial operator parameters when a mode is selected. They are not the same in all modes and must be defined in the ERS for each mode. The initial value is moved from NVM into an active RAM table to allow temporary changes by operator or host.

- o F6 1st Digit

  - Bit 0 - Online/Local - This parameter may be ignored in some modes. In the resident CYBER mode it determines the initial state. If this parameter is set to 1 (Local), the transmit portion of the terminal is disabled and data originating at the keyboard is displayed. Modem interface circuits are also affected. If this parameter is set to 0 (Online), data originating at the keyboard is transmitted in character mode and block mode transmission is enabled. It is possible to receive data while in local mode if Constant DTR is selected.

3.3.3.2.6 (Contd)

- Bit 1 Printer Off/On - This parameter may be ignored in some modes. In the resident CYBER mode it is operational. If this parameter is set to 1 (Printer On), the initial condition will have the printer interface active. The host can also change the active value. If this parameter is set to 0 (Printer Off), the initial condition will have the printer interface disabled. When the printer is on, all data sent or received in Character mode will be printed while it is being displayed.

- Bit 2 Margin Alert Off/On - This parameter may be ignored by some modes. In the resident CYBER mode it is operational. If this parameter is set to 1 (Margin Alert On), the audible alarm will sound whenever the cursor is advanced into the eighth position from the end of a line during keyboard entry. The audible alarm will also sound when the cursor is moved into the last line from the previous line during keyboard entry. If this parameter is set to 0 (Margin Alert Off), the audible alarm will not sound due to cursor movement from the keyboard.

- Bit 3 Alert Soft/Loud - This parameter may be ignored in some modes. In the resident CYBER mode it is operational. If this parameter is set to 1 (Alert Loud), the audible alarm will be at a higher volume. If this parameter is set to 0 (Alert Soft), the audible alarm will be at a lower volume.

o F6 2nd Digit

- Bit 0 Shift/Alpha Lock - When this parameter is set to 0, the LOCK key will be a shift lock (all keys used as shifted). If the parameter is set to 1, the LOCK key will lock only alpha keys.

- Bit 1 Numeric Pad - When this parameter is set to 0 (normal), the 13 key numeric pad will be used with the normal shift and control features. When the parameter is set to 1 (shift), the 13 key numeric pad will be used as if the shift key were depressed.

- Bit 2 Roll/Page Screen - This parameter may be ignored in some modes. In the resident CYBER mode it is operational. If this parameter is set to 0 (Roll Screen), the scroll feature is enabled, the field scroll feature is unaffected. It is recommended to set this parameter to Roll Screen to be compatible with Viking TTY. The host has the capability to switch the active value. If this parameter is set to 1 (Page Screen), the initial value will disable the scroll feature.

3.3.3.2.6 (Contd)

- Bit 3 Advanced (Small)/Native (Large) Operation - This parameter will determine which code is sent as keys are pressed (see Keyboard Keycode Table 3.9.12) and reaction to receive codes (see Table 3.9.13).

o F6 3rd Digit

- Bit 0 Background Dark/Light - This parameter may be ignored in some modes. In the resident CYBER mode it is operational. If this parameter is set to 0 (Background Dark), characters will be displayed as light characters on a dark background. If this parameter is set to 1 (Background Light), characters will be displayed as dark characters on a light background (inverse video).

- Bit 1 Cursor Line/Block - This parameter may be ignored in some modes. In the resident CYBER mode it is operational. If this parameter is set to 0 (Cursor Line), the cursor will appear as an underline. It may be blinking or solid depending upon the next parameter. If this parameter is set to 1 (Cursor Block), the cursor will appear as a solid box. It may be blinking or solid depending upon the next parameter.

- Bit 2 Cursor Blink/Solid On - This parameter may be ignored by some modes. In the resident CYBER mode it is operational. If this parameter is set to 0 (Cursor Blink), the cursor will blink. If this parameter is set to 1 (Cursor Solid On), the cursor will be always on.

- Bit 3 Spare.

o F6 4th Digit

- Bit 0 Half/Full Duplex - This parameter may be ignored in some modes. In the resident CYBER mode a 0 selects Half Duplex and a 1 selects Full Duplex. In half-duplex operation, data is displayed, printed (if enabled), and sent to the host as it is typed. In full-duplex operation data is only sent to the host as it is typed. In either operation, data will be displayed and printed (if enabled) as data is received from the host. This parameter is ignored if the terminal is in local or block mode operations.

3.3.3.2.6 (Contd)

- Bit 1 80/132 Characters/Line - This parameter may be ignored by some modes. In the resident CYBER mode it is operational. If this parameter is set to 0 (80 Characters/Line), 80 characters will be the maximum number per line. If this parameter is set to 1 (132 Characters/line), 132 characters will be the maximum number per line.

- Bit 2 24/30 Lines - This parameter is ignored by some modes. In the resident CYBER mode it is operational. If this parameter is set to 0 (24 Lines), there will be a maximum of 24 lines displayed. If this parameter is set to 1 (30 Lines), there will be a maximum of 30 lines displayed.

- Bit 3 Transparent - This parameter may be ignored by some modes. In the resident CYBER mode it is operational. If this parameter is set to 1 (transparent on) all control codes received and entered on the keyboard will be displayed and not acted upon. When set to 0 (off) control functions will be performed.

o F7 A-DIAL Auto Dial number part 1.

o F8 A-DIAL Auto Dial number part 2. - This will be supported by the resident firmware when it becomes available, for now, its intent is described here. This parameter is used if auto dial is selected. It contains up to 12 digits. If less than 12 digits are used, they must be left justified with any letter A to F after the last digit used to denote terminational digits.

o F9 - DF - Default File Number - This parameter may be used when requesting a downline load (see Section 3.5, Load File Selection, for when it is used).

o T - Host Transmit Baud Rate - This parameter will be used to select the host transmit baud rate. It can be set to a value between 0 and F hex, which represents baud rates between 75 and 19.2K baud (see Figure 3.3.3 for table).

o R - Host Receive Baud Rate - This parameter will be used to select the host receive baud rate. It can be set to a value between 0 and F hex, which represents baud rates between 75 and 19.2K baud (see Figure 3.3.3 for table).

3.3.3.2.6 (Contd)

- F10 ACCESS - Access Code - This parameter is used if the Access On parameter is selected. It contains four hexadecimal digits. The operator is required to type in the same four digits before the mode is entered. If the Access Disabled parameter is selected, this parameter is ignored.

3.3.3.3 CYBER Mode Operator Parameters

Operator parameters are mode dependent. It is intended that all mode operator parameters operate similar to the resident CYBER mode operator parameters described in the following paragraphs. The initial state of each operator parameter is set in the mode installation parameters. The operator parameters are moved into an Active RAM section and can only be temporarily changed by the operator or host. The operator cannot change the NVM values.

To change the operator parameters, the operator must press SETUP while in an operating mode. An X-Off code will be sent to the host. Eight parameters will be written on the bottom line. To change any parameter, the operator must press the FUNCTION key number that precedes the word. The alternate state will then be displayed. If there are more parameters, F10 will say "MORE SELECT". Pressing F10 will display eight new parameters. If there are no more parameters, F10 will say "mode SELECT". Pressing F1 at any time will exit the operation and send an X-On to the host.

If the operator does not change the 80/132 Characters/Line parameter, or 24/30 lines the data on the display will not change. If the parameters are changed, the CRT will be cleared and the cursor placed at home.

The only keys operational in this mode are:

- F1 return - return to mode.
- F2-F9 - alternate state of that parameter.
- F10 - display next group or go to MODE SELECTION MENU.

All other keys are inoperable. See Figure 3.3.4 for CYBER Mode Operator Parameters.

F 1	return	F 2	LINE (OFF) (ON)	F 3	PRINTR (OFF) (ON)	F 4	MARGIN (OFF) (ON)	F 5	ALERT (SOFT) (LOUD)	F 6	LOCK (ALPHA) (SHIFT)	F 7	NPAD NORMAL (SHIFT)	F 8	SCREEN (ROLL) (PAGE)	F 9	CYBER (SMALL) (LARGE)	F 10	MORE SELECT
0		10		20		30		40		50		60		70		80			

SETUP #1

1. OPERATOR SELECTED AFTER MODE ACTIVE BY DEPRESSING SETUP KEY.

2. F(N) KEY SELECTION ACTIVATES ALTERNATE SPECIFIED FUNCTION.

F 1	return	F 2	BACKGD (DARK) (LIGHT)	F 3	CURSOR (LINE) (BLOCK)	F 4	CURSOR (BLINK) (SOLID)	F 5	SPARE ZERO (ONE)	F 6	DUPLEX HALF (FULL)	F 7	CH/LN (80) (132)	F 8	LINES (24) (30)	F 9	XPARNT (OFF) (ON)	F 10	mode SELECT
0		10		20		30		40		50		60		70		80			

Character Position

SETUP #2

1. OPERATOR SELECTED VIA F10 = more select IN SETUP #1.

2. F(N) KEY SELECTION ACTIVATES ALTERNATE SPECIFIED FUNCTION.

Figure 3.3.4. CYBER Mode Operator Parameters

3.3.4 Aborts and Recovery

None.

3.3.5 Errors

If an unallowable key is pressed the alarm will sound.

3.3.6 Performance

The time required to change parameters is installer or operator dependent. Mode operation is dependent on parameter installation.

3.3.7 Installation Parameters

The initial values must be set up before a mode is selected, as previously discussed.

3.4 Load Source Selection

3.4.1 Abstract

If the operator selects modes 2 thru 6 and has met the access requirement or host selects a mode change, the resident controlware must determine which load source is to be used. This is accomplished by the resident controlware looking at preset mode installation parameters.

3.4.2 Description

This feature allows automatic or operator selection of load source in any mode. Any of the following load sources can be selected if present.

- o Resident Host 1200/1200 internal modem, or Current Loop
- o Optional Flexible Disk Subsystem
- o Optional ROM Pack

Automatic or operator selection of load source is accomplished by presetting these Mode Installation Parameters.

- o Use Default/Operator Select-Source/File/Phone Number
- o Run Internal/Load External
- o Load From Host/Load From Disk
- o Resident Host/1200/1200 Internal Modem
- o RS-232-C/Current Loop
- o CYBER Mode/ROM Pack

3.4.3 Interfaces

This activity is entered to select the load source if

- o The auto select enable parameter is a 1 and auto select number is 2-6.
- o If F2-F6 (modes 2 thru 6) are depressed while displaying the mode selection menu.

The "USE DEFAULT/OPERATOR SELECT" parameter will be tested first.

- o If USE DEFAULT SOURCE/FILE is selected the parameter RUN INTERNAL/ LOAD EXTERNAL CYBER MODE/ROM PACK, and LOAD FROM HOST/LOAD FROM DISK will be used.
- o If OPERATOR SELECT SOURCE/FILE/PHONE NUMBER is selected the following prompt will be displayed.

  SELECT LOAD SOURCE > DISK HOST ROM

3.4.3 (Contd)

Selection of source is done from keyboard by pressing D, H or R. Pressing the NEXT key will result in auto selection of the load source using the installation parameters.

If ROM pack is selected as the load source, the ROM Pack Load will be performed (see ROM Pack Load Section 3.8).

If Load External is selected, the controlware must then look at the Load From Host/Disk parameter.

If Load From Disk is selected, the flexible disk loader is performed (see Flexible Disk Loader Section 3.7).

If Load From Host is selected:

- o The firmware will first test if Host interface is used or the 1200/1200 Internal Modem* is used.
- o If the Host is selected, the current loop parameter is tested.
  - If current loop is selected and the RS-232-C/current loop option is in, port B interface will be used with current loop and the ASCII Loader Used. If RS-232-C/current loop option not installed, the error message "MODE NOT ENABLED" is displayed.
  - If current loop is not selected, the Resident Host interface will be used with ASCII Loader.
- o If the 1200/1200 Internal Modem* is selected, it is used with the ASCII loader. If the internal modem is selected but the board is not installed the error message "MODE NOT ENABLED" will be displayed. Control will be sent to address 8000 BANK 11.

*The internal modem with auto dial has not been defined at this time, so this paragraph is only the intended procedure. This is the 1200/1200 baud modem not the 12/21-bit PLATO internal modem.

3.4.3 (Contd)

If this is the intended use of the auto dial firmware:

- There will be two entry points into the Auto Dial.

  1. Address 8000 - This entry will determine if the Auto Dial default number is used or if the operator is to enter a number.
  2. Address 8003 - This entry will dial the numbers starting at the address specified by HL.

- There will be two exits points.

  1. Connection made (IX)
  2. Connection not made (IY)

If Auto Dial is not selected, it is assumed the operator has made the connection and return made through IX).

If Auto Dial is selected, the operator select - Source/File/Phone Number will be tested.

- If Default is selected - The Auto Dial number is used.

- If Operator is selected - The message "ENTER PHONE NUMBER" is displayed. If the operator presses "NEXT" without entering a number, the Auto Dial number is used. If an operator makes a mistake, the ERASE key will clear all entries and start over. When the operator has entered the correct number the NEXT key will cause the number to be dialed.

The controlware must next determine the load file number (see Section 3.5 for this process).

3.4.4 Aborts and Recovery

If operator error is made during number entry, the ERASE key will clear all entries.

3.4.5 Errors

If a selected option board is not present the error message "MODE NOT ENABLED" will appear and control sent to mode selection menu.

3.4.6 Performance

The time required to enter entries is operator dependent.

3.4.7 Installation Parameters

The mode installation parameters must be preset to the desired load source, as previously discussed.

3.5 Load File Selection

3.5.1 Abstract

When loading from the communications host, this feature allows different controlware load files to be selected for loading into the terminal.

3.5.2 Description

When the communications host has been selected (see Section 3.4), this feature allows selection of a controlware load file to be loaded into the terminal. This can be done either automatically or manually. One default value can be used in the mode installation parameters or one of 64 different files may be selected manually.

3.5.3 Interfaces

Automatic selection of a load file is done if the Use Default Source/File/Phone Number parameter is selected in the mode installation parameters.

3.5.3 (Contd)

Manual selection is done if the Operator Selected Source/File/Phone Number parameter is selected. The terminal requests the load file selection with the following prompt:

SELECT LOAD FILE _

The operator then selects the desired load file by using the keyboard. Entry is done by entering one or two hexadecimal digits followed by pressing the NEXT key. The file number entered must be less than 40 hexadecimal. If an error is made during entry, the ERASE key may be pressed to start over. Other keyboard keys are ignored.

If the file number entered is 40 hexadecimal or more, the program will force entry to start over; the same as if ERASE had been pressed.

If the NEXT key is pressed before any other entry is made, the program will select the automatic default file; the same as if the Load Default File parameter were selected.

3.5.4 Aborts and Recovery

If operator error is made during number entry, the ERASE key will clear all entries.

3.5.5 Errors

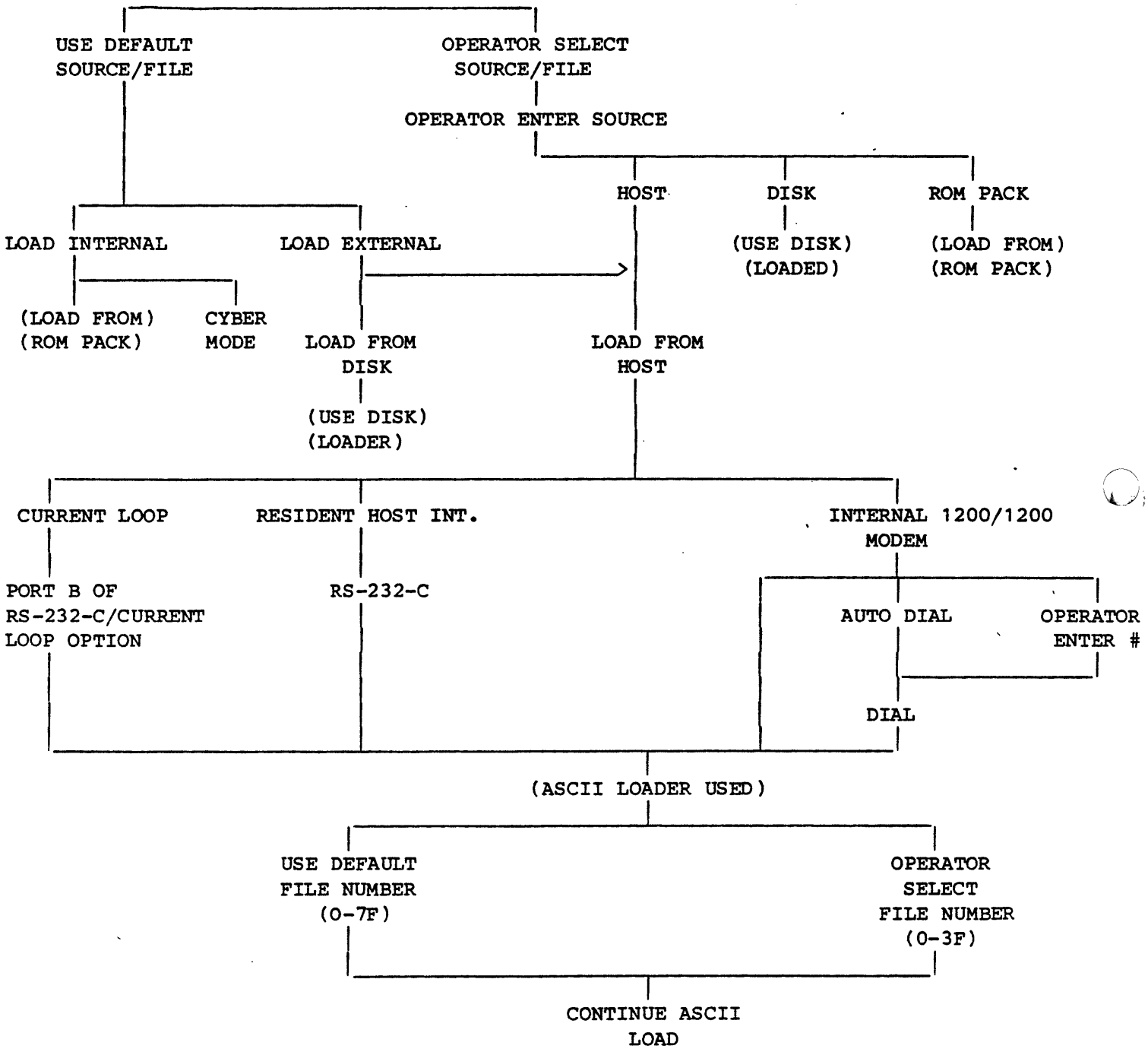
Not applicable.

3.5.6 Performance

The time required to enter entries is operator dependent.

3.5.7 Installation Parameters

The appropriate mode installation parameters must be setup. (See figure 3.4.1).



*The Internal Modem with auto dial has not been defined at this time, so this is only the intended procedure. This is the 1200/1200 baud modem not the 12/21 bit PLATO internal modem.

Figure 3.4.1 Load Source/File Selection

3.6 ASCII Network Loader

3.6.1 Abstract

The ASCII network loader allows the terminal to load a selected controlware program from an ASCII communications network, which supports the protocol described in the following paragraphs.

3.6.2 Description

3.6.2.1 General Data

The ASCII communications loader loads a selected controlware file into the RAM of the terminal. Once the load file is selected, the load process proceeds automatically until control is transferred to the loaded controlware or until an unrecoverable error situation occurs. This section describes the communications protocol for loading the terminal from the ASCII communications network.

The protocol contains the following features:

1. All data transmitted to the terminal from the network is in blocks and associated with each block is a cyclic redundancy check.*
2. The load process generates a memory checksum of the loaded controlware. It is intended that the loaded controlware have a routine that utilizes this checksum for checking the integrity of the loaded controlware during operation.
3. The RESET switch can be used to exit from operation on the ASCII network if other techniques do not work.
4. Automatic error recovery during loading is limited to three attempts. After three unsuccessful load attempts, the terminal will abort the load.
5. Partial loading of selected blocks is not supported. If a checksum error occurs or a load is aborted, a full load is then performed.

---

*Transmit and receive data is switched to 8 bits of data and no parity.

3.6.2.1 (Contd)

6. The maximum number of production load files is 64. Block lengths are variable with a maximum number of 240 data characters per block. The maximum number of blocks in a file is 65536.

7. The first block is loaded starting at a host defined memory address and all succeeding blocks are loaded contiguously after this block. No auxiliary block loading table is used.

   Host is restricted from using addresses 0000 to 3FFF hex and D900 to FFFF hex. (See Section 4.3.1 Memory Layout.)

8. If no carrier is detected within 30 sec of load initialization the message "HOST NOT CONNECTED" is displayed.

3.6.2.2 Autoload Message Formats

The following message formats are utilized by the host communications line autoload routine (currently supported on the DSN). Unless otherwise specified, communications characters are those in the ASCII character set with even parity.

- Load Block
- Load Request
- NAK Sequence
- Load Complete

3.6.2.2.1 Load Block

Each Load Block received from the host (DSN compatible) is formatted as follows:

DLE	STX	HEADING	DATA	DLE	ETB or ETX	CRC

3.6.2.2.1 (Contd)

The heading is formatted as follows:

SEQ1 SEQ2	LDN	A1 A2 A3

Each block begins with a DLE STX character sequence and ends with either a DLE ETB or DLE ETX character sequence followed by a block cyclic redundancy check. The DLE ETB sequence is used on all blocks except for the last one. In this case, a DLE ETX sequence is used, signifying to the terminal that this is the last block of the load. The CRC is a two-character, 16-bit cyclic redundancy check; that is, the remainder after polynomial division modulo two. The polynomial divisor is $X^{16}+X^{15}+X^{2}+1$. The end of the block occurs immediately after the CRC characters. The division is performed on all characters except the initial DLE STX sequence and the first DLE of any DLE DLE sequence in the block.

The heading and data parts of the block can be comprised of any 8-bit character sequence. If any character happens to be a DLE, it is prefixed by another DLE.

SEQ1 SEQ2 is a two-character, 16-bit binary number that uniquely identifies each load block being transmitted. SEQ1 SEQ2 equals 0 for the first load block and is incremented by one for each subsequent load block initially transmitted.

LDN is a single 8-bit character that uniquely identifies the particular load file. The load file can be selected by the operator if desired.

A1 A2 A3 is a three-character, 24-bit binary number that identifies the absolute starting address of the load data in the present block. The address sequence must be in sequential ascending order with all load data being loaded contiguously in memory. Only the lower 16 bits are used.

The data portion of the block may be variable in length from one to 240 8-bit load-data characters.

3.6.2.2.2 Load Request

The downline load operation from the host is initiated by the terminal sending the following character sequence, termed a Load Request.

L	N1	N2	CR

The sequence begins with an uppercase ASCII L and ends with an ASCII CR. The N1 N2 sequence is an ASCII representation of the desired load file. Each N is a hexadecimal number represented by the corresponding ASCII character (uppercase for the numbers A through F). N1 N2 corresponds to the LDN binary number in the resulting load blocks. All four ASCII characters have even parity.

3.6.2.2.3 NAK Sequence

If the terminal detects an error during the load process that can be corrected by retransmitting the load block, it sends a five-character NAK sequence indicating the block to be retransmitted.

DSN compatible	N A K	SEQ1 SEQ2	(SEQ1) (SEQ2)

The NAK is the corresponding ASCII NAK character. SEQ1 SEQ2 is a two-character sequence identifying the load block from which point retransmission is to occur. This sequence corresponds to the SEQ1 SEQ2 16-bit binary number in the load block where the error occurred. (SEQ1) (SEQ2) is a one's complement of SEQ1 SEQ2 and is used for error detection.

The use of NAK does not alter the sequence of alternating acknowledgments. The same positive reply (ACK 0 or ACK 1) is used for successful retransmission as would have been used if the previous transmission of the unaccepted block had been successful.

3.6.2.2.4 Load Complete

Upon successful receipt of the last load block, the terminal sends the following Load Complete message to the DSN.

D	E
L	O
E	T

The characters are the corresponding ASCII characters with even parity.

3.6.2.3 Autoload Sequence

After the host autoload routine is initiated, the following sequence shall occur.

1. The terminal will transmit a Load Request upon detection of the network sign on message (ASCII "/"). If the default file is not selected, the terminal will wait for the operator to select the desired load file from the keyboard before transmitting the load request. The message LOADING FILE MM is also displayed to indicate that file number MM is the selected load file.

2. The network must then send load blocks to the terminal. As it receives the load blocks, the terminal checks for valid SEQ1 and SEQ2 characters. If they are too large, a NAK sequence is sent and the terminal waits for successful retransmission of the desired block. If they are too small, the terminal ignores the block. The terminal also checks the LDN and A1 A2 A3 characters to see if they match the values expected by the terminal. If not, the terminal sends a NAK sequence and awaits retransmission of the block. After the header has been verified, the terminal stores data characters at sequentially increasing RAM addresses. When the end of the block is encountered, the received CRC characters are compared to the CRC calculated by the terminal on the received data. If they do not agree, the terminal sends a NAK sequence to request retransmission of the load block.

3. If the two CRC values agree, the block has been received successfully. For DSN operation, if this was not the last load block, the terminal then updates the expected values for the header and awaits receipt of the next block (no positive acknowledgement is sent). If this was the last load block, the terminal sends a Load Complete message signaling a positive acknowledgement of completing the load process.

3.6.2.3 (Contd)

4. The network then returns to its sign-on phase and awaits operator action. The loader, upon detection of the sign-on phase, turns over control to the loaded controlware.

5. During the load process, the loader program calculates an 8-bit arithmetic-sum checksum of the loaded RAM controlware and saves it for use by the memory checksum routine.

While each block is being loaded the message LOADING FILE MM BLOCK NN is displayed to indicate that block number NN of load file MM is being loaded.

During the load, various timeout conditions can occur. When this happens, the Error light is turned on and error recovery is attempted.

If no response to a NAK sequence has been received, the NAK sequence is resent. After three tries without success, the load is aborted with a load-failure message being displayed.

If no response to a load request has been received, the load request is retried up to three times. If there is still no success, the load is aborted with a load-failure message being displayed.

If the network does not return to the sign-on phase after the load-complete message has been sent, the load-complete message is resent. After three retries without success, the load is aborted with a load-failure message.

3.6.3 Interfaces

The operator interface consists of a series of messages on the CRT screen indicating progress of the load operation. The load process is automatic and does not require any operator interaction.

The message LOADING FILE MM is displayed whenever the terminal sends a load request to the network, indicating that a load of controlware file number MM has been initiated.

The message LOADING FILE MM BLOCK NN is displayed to indicate that block NN of controlware load file MM is being loaded. Error messages are shown in Section 3.6.5.

3.6.3 (Contd)

The common variables are as follows at the end of a completed ASCII load.

- o LINFO is set to X1 (ASCII loader used)

3.6.4 Aborts and Recovery

If the load is unsuccessful due to checksum errors, no response from the network for 30 seconds or loss of carrier on the selected RS-232-C communications interface, the ASCII loader will display the message HOST LOAD FAIL, MODE NOT ENABLED and then return to the mode selection routine.

Pressing the RESET switch on the terminal front panel will result in the terminal aborting the load and running diagnostics again.

3.6.5 Errors

The following error messages can be generated on the CRT screen during the course of the load process.

NO REPLY

Indicates that the load operation has not progressed for 30 seconds due to no response or incorrect response from the network. The terminal will then send a new load request and try loading again up to three times.

HOST LOAD FAIL

Indicates that the load process has been aborted after three unsuccessful load attempts or that host carrier has been lost. The terminal will return to load file selection after momentarily displaying this message.

In addition, the ERR light on the front panel will be lit whenever a load error has occurred and will remain lit until the error has been recovered or the load has been aborted.

3.6.5 (Contd)

HOST NOT CONNECTED

No initial carrier signal was detected within 30 sec of load initialization.

3.6.6 Performance

The ASCII loader program in the terminal is capable of loading programs from the ASCII network at communication line rates specified by the send and receive parameters in the mode installation parameters. A typical controlware load will take about 3 to 4 minutes at 1200 bps.

3.6.7 Installation Parameters

Transmit and receive rates are selectable in the mode installation parameters. These rates must be set to the desired value at installation (see Parameter Selection Section 3.3). The host transmit and receive is forced to 8 data bits and no parity.

3.7 Flexible Disk Loader

3.7.1 Abstract

This feature loads a controlware file from the optional flexible disk subsystem.

3.7.2 Description

When disk is selected by the load source selection feature (see Section 3.4), control is transferred to the Flexible Disk Loader. Loading from the flexible disk subsystem is performed by sending an autoload command from the terminal firmware to the flexible disk subsystem. If no errors occur, the flexible disk subsystem sends binary data to the terminal. The terminal firmware stores this data in RAM locations and then returns control to the caller program. If disk load was caused by mode selection, control will be passed to the initial load address.

3.7.3 Interfaces

The following steps occur when loading the terminal from disk. The PFDS is connected to the parallel I/O interface of the terminal.

1) The terminal sends out a load command (06 hex) and looks for a status reply (48 hex). If the correct reply status is not received, a timeout occurs and the disk load is terminated.

2) The terminal sends out an inverse load command (F9 hex) and looks for a status reply (4A hex). If the correct reply status is not received, a timeout occurs and the disk load is terminated.

3) The terminal inputs the terminal memory address at which to start storing data, this starting address is stored and used as an entry point. Then the number of data bytes and the data itself. The address and number of bytes are each two bytes long, with least significant byte being read first.

4) The terminal inputs two bytes of checksum data, which are compared to a calculated checksum of the data bytes. If the checksums do not agree, the disk load is terminated. If they do agree, the terminal firmware returns control to the calling routine.

   Checksum algorithm:

```
H = (H .XOR. DATA) CLS 1     First Byte
L = (L .XOR. DATA) CRS 1     Second Byte
```

   H and L are both 0 initially.

The common variables are set as follows at the end of the Flexible Disk Load.

- LINFO is set to a value of X2 hex (disk loader used).
- The other variables are not used.

The CRT screen is used to display a loading failure message should the load fail for some reason.

The operator must make the flexible disk subsystem ready and insert the desired autoload flexible disk into the flexible disk subsystem before selecting the flexible disk subsystem as the load source.

3.7.3 (Contd)

Once loading is started from flexible disk subsystem, it runs automatically without operator intervention until sucessfully completed or until the load fails.

3.7.4 Aborts and Recovery

Should the Flexible Disk Load fail for some reason, the terminal will display a DISK LOAD FAIL message on the CRT screen. To recover, the operator must correct the problem with the flexible disk subsystem and then RESET. The terminal will then run diagnostics and prompt for the operator to enter mode block number again, this will then return to load source selection (see Section 3.4).

3.7.5 Errors

If loading errors occur due to checksum problems, flexible disk subsystem not ready, or disk not inserted, the message DISK LOAD FAIL will be displayed on the CRT screen. To recover, the operator must correct the disk subsystem problem and then press RESET.

3.7.6 Performance

This feature requires the presence of an optional flexible disk subsystem. Loading time depends on controlware residing on the flexible disk.

3.7.7 Installation Parameters

An optional flexible disk subsystem must be connected to the parallel I/O interface of the terminal. Refer to flexible disk subsystem documentation for installation parameters of the flexible disk subsystem itself. See Section 3.4 to select the proper parameters for using the flexible disk subsystems as the load source. The device address of the disk must be set to 7.

3.8 ROM Pack Load

3.8.1 Abstract

The ROM pack can be used in many different ways. It can contain a mode like PLATO load mode. It can contain Diagnostics or special functions. In fact a pack can contain one, two or all three operations all at the same time.

3.8.2 Description

The ROM pack has a name, revision level, and three entry points.

ADDRESS	DATA	DESCRIPTION
8000	C3 __ __	Entry point to Mode
8003	C3 __ __	Entry point to Diagnostic
8006	C3 __ __	Entry point to Function
800A	X X X	3 ASCII codes of Pack name
800D	X X X	3 ASCII codes of Pack version

- Mode entry - When ROM pack is selected as the load source (see Section 3.4), control will be transferred to address 8000 if that address contains a C3 with mode parameters loaded in RAM. If the C3 is not read a message "MODE NOT ENABLED" will be displayed.

- Diagnostic Entry - When test 1 is complete, it will test address 8003 for a C3. If a C3 is read control will be transferred to 8003. If a C3 is not read, control is not transferred and test 1 will be completed. The ROM pack should contain a checksum of its own ROM, test any special hardware it uses and display its name and revision.

- Function Entry - When the terminal is displaying the Mode Selection Menu and the F7 key is depressed, or if Auto Select Mode 7 is selected control will be transferred to address 8006 if it contains a C3. If the C3 is not read the alarm will sound, the message "MODE NOT ENABLED" is displayed and control transferred to the mode selection menu.

3.8.3 Interfaces

Selection of the ROM pack as load source is explained in Section 3.4.

Once selected, loading proceeds automatically without operator intervention. If the ROM pack option is not present, the message "MODE NOT ENABLED" is displayed.

The common variables are set as follows before the jump to ROM.

- o LINFO is set to a value of X4 hex (ROM loader used).

3.8.4 Aborts and Recovery

See Section 3.8.5

3.8.5 Errors

If the ROM pack option is not present, the message MODE NOT ENABLED is displayed on the CRT screen.

3.8.6 Performance

The ROM pack load requires the presence of a ROM pack option at address 8000 hex, bank 5, with address 8000 hex containing a value of C3 hex. The operation of the ROM pack load takes only a short fraction of a second to execute

3.8.7 Installation Parameters

A ROM pack option must be installed. See Section 3.4 to select the proper parameter for using the ROM pack as the load source.

3.8.7 (Contd)

The ROM pack must contain the proper format: (See 3.8.2)

3.9 CYBER Mode Operation

3.9.1 Abstract

None.

3.9.2 Description

3.9.2.1 General Information

The basic terminal mode is CYBER mode. CYBER mode consists of two operating submodes. Small CYBER mode is referred to as Advanced (ADV) mode and is functional on CYBER-C120 compatible systems. Large CYBER Mode is referred to as Advanced Native (ADVN) mode and is functional on CYBER C170/C180 compatible systems. Small CYBER mode emulates an enhanced Advanced Mode operation compatible with the Viking TTY terminal product. Small CYBER and Large CYBER alternate submodes are host and operator selectable. The differences are covered by Tables 3.9.12 and 3.9.13. See Table 3.9.13 for CYBER control codes and escape sequences.

The CYBER mode supports character mode operation, in both protect and nonprotect operation, and block mode, both protect and nonprotect operation.

3.9.2.1.1 Terminal Switches, Controls, and Indicators

These switches are mounted on the main terminal cabinet.

- Power ON/OFF - Allows the operator to control primary power to the terminal. It is located on the front of the terminal.
- Circuit Breaker - Provides line circuit over current protection for the terminal. It is located at the back of the terminal and can be reset when the current fault condition is cleared.
- TEST Switch - This switch located at the back of the terminal allows maintenance loop back of the host interface and keyboard interface for fault isolation capability in Test 3.
- RESET Switch - Allows operator to reset the terminal to a normal restart condition. This provides a clear function when the terminal is in an abnormal condition. This switch is located on the front of the terminal.
- INTENSITY Control - Front access control which allows the operator to adjust video intensity to ambient lighting conditions.
- CONTRAST Control - Front access control which allows the operator to adjust the intensity variation between the normal characters and background.
- Line Voltage Control - Located at the rear of the unit, this control switch allows the installer to select the line voltage range (120/ 220/240 V ac).
- Data Set Ready Indicator* - Is illuminated if the Data Set Ready signal at the modem interface is on. Refer to the RS-232-C/CCITT V.24 Interface for a description of the DSR signal.
- LOCK (Keyboard Locked) Indicator* - Is illuminated during;
  - Page print operations
  - Unable to transmit do to loss of CTS or DSR and online
  - Block mode transmission active
  - Host message active
  - Disk operation active
  - Host locked keyboard

*All indicators are located on the front of the terminal and are driven by the controlware.

3.9.2.1.1 (Contd)

- Message Indicator* - Is illuminated when a host message is available to the operator. Also, under host control.
- Alert Indicator* - Illuminated under host control.
- Error Indicator* - Is illuminated when a terminal load or diagnostic error condition is detected.
- Programmable Indicators* - Are illuminated under host control.
- Audible Alarm - A two-level, loud/soft intensity audible signal is provided. Operation is under firmware control and is operator parameter bit controlled. The alarm will sound for the following conditions:
  - After power on or RESET has run test 1
  - Improper key depressions during MODE selection.
  - Host code sequence
  - Entry of certain key while the cursor is in a protected position
  - Entry on keyboard while the keyboard is locked
  - Entry of the cursor by the keyboard into the 8th position from end of line or into the last line caused by keyboard entry and margin alert enabled.

3.9.2.1.2 Cursor

The cursor indicates the current entry position. It is represented on the screen in one of the following manners:

- Constant underline
- Blinking underline

*All indicators are located on the front of the terminal.

3.9.2.1.2 (Contd)

- o Solid block
- o Blinking solid block

The type of cursor is determined by two operator selectable parameter bits.

3.9.2.1.3 Character Attributes

A character attribute code (background) is loaded into the line buffer for every character display code (foreground). These are:

Bit No.	Feature	
0	Blank	Used by Hardware
1	Underscore	
2	Inverse	
3	Blink	
4	Dim	
5	Modified	
6	Validate	
7	Protect	

3.9.2.1.4. Line Attribute

Two line attribute bits are available, but not used.

3.9.2.1.5 Keyboard Operation

The keyboard provides for operator entry of specific symbol and control codes which are displayed or transmitted as directed by the Half-Duplex/Full-Duplex, Online/Local, characer/block mode and protect enable/disabled parameter settings. Terminal function keys are provided in addition to the alphanumeric and control-code entry keys. The keyboard has the capability of generating all 128 ASCII 3.4 codes. Refer to Figures 3.9.1 and 3.9.2 for keystation assignments and keyboard layout respectively. Table 3.9.12 is a listing of keyboard codes and legends.

3.9.2.1.5 (Contd)

The keyboard incorporates sculptured keycaps and provides N-key rollover. Also typamatic key action is provided on all keys indicated in Table 3.9.12. This typamatic action provides a repeat rate of 15 ±3 characters per second after a 1 second delay when the operator holds the desired key continuously depressed. This feature can be disabled by the host or mode installation parameter.

A serial keyboard interface is provided. A single, standard-length cable is provided to allow 1 metre keyboard to monitor separation.

Two keyboard layouts are supported by CYBER mode. An installation parameter must be set accordingly.

Figure 3.9.1 shows the 48-key proposed ANSI standard keyboard array. Figure 3.9.1A shows the 48-key ISO standard keyboard array. Figure 3.9.2 shows the keyboard keystation assignments. The symbols on the top of the key support the standard alphanumeric requirements and mode dependant special function keys. The keyboard allows the use of special overlay templates for the function keys which allow them to be labeled with application-unique legends. The keyboard conforms to ANSI X4.14-1971 and the 46-key subset of ISO 3243 Standard. A provision is made to support full compatibility with the 48-key ISO 3243 Standard and the proposed 48-key ANSI X4A12 Standard.

3.9.2.1.6 (SHIFT) Keys

When two symbols share a key, the upper symbol or control function is active while either one of the two SHIFT keys is actuated.

Actuating the SHIFT key in conjunction with a key labeled with a single legend causes the transmission of the uppercase code for the symbol indicated on the key. See Table 3.9.12.

3.9.2.1.7 (LOCK) Key/Indicator

This key is operator parameter selectable to perform a shift lock or alpha lock function. In shift lock mode, all function, control and alpha/numeric keys unconditionally transmit the level two column shifted keycode definition in Table 3.9.12 unless modified by a specific mode. Operator care must be exercised to ensure intended

3.9.2.1.7 (Contd)

operation of all keys when shift lock is active. Shift lock is provided for single key activation "ease of use".

In alpha lock, when depressed, this key causes all alpha keys only to transmit the uppercase code until pressed a second time. The alpha lock mode is provided to disable the generation of lowercase codes. If this key is in the lock position, uppercase characters are generated in place of the lowercase characters. Special function, control and numeric keys are unaffected. This key contains an indicator that is illuminated when in lock mode.

3.9.2.1.8 CTRL (CTRL) Key

Actuation of the CTRL key in conjunction with any data key or combination of data key and SHIFT key causes the generation of the codes outlined in the level three and four column of Table 3.9.12 unless modified by a specific mode.

3.9.2.1.9 Validation

The host has the ability to load validation code, (see Host Specified Code Sequence/Controlware) and start/stop validation.

As the host is entering data on the screen the start validation will store the validate bit in background memory for each code stored while the start validation is active.

As keys are pressed on the keyboard, the following coditions are tested:

- o Is the key a host loadable key
  - YES-perform loadable key function
  - NO-is current position a validate position
    - NO-perform normal function
    - YES-has host loaded validation code
      - NO-perform normal function
      - YES-call host loaded validation code. When control is returned, the normal function will be performed if the ZERO flag is clear. Nothing will be done if the ZERO flag is set.

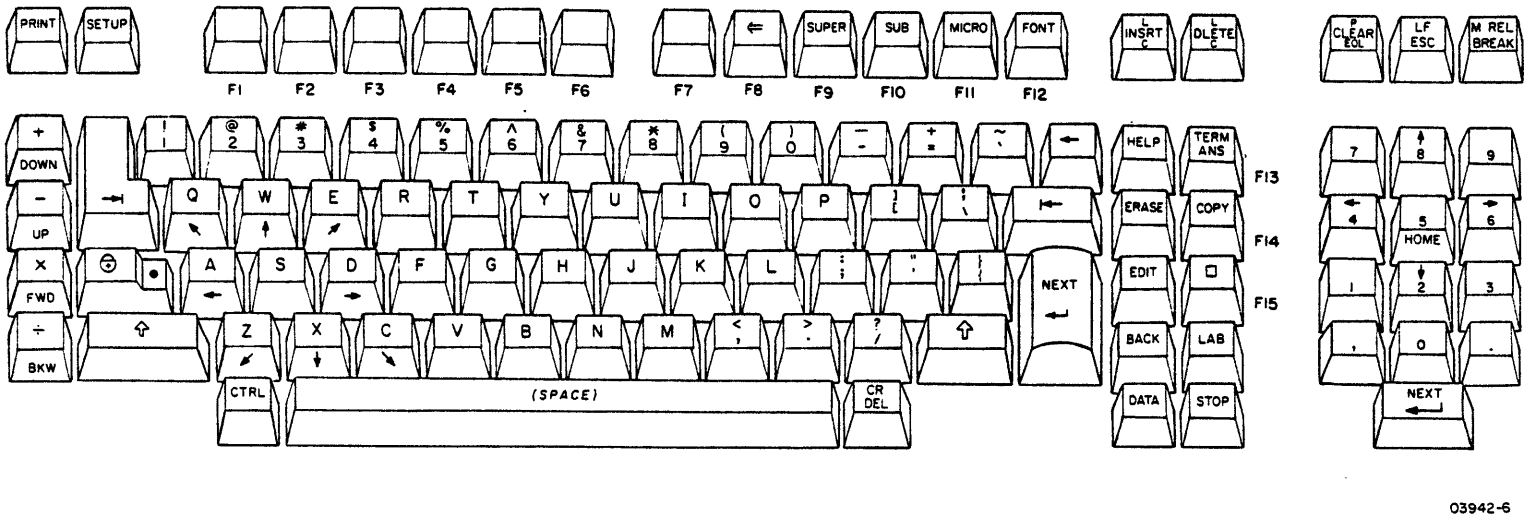


Figure 3.9.1. Multifunction Keyboard, Viking X (ANSI X4.14)

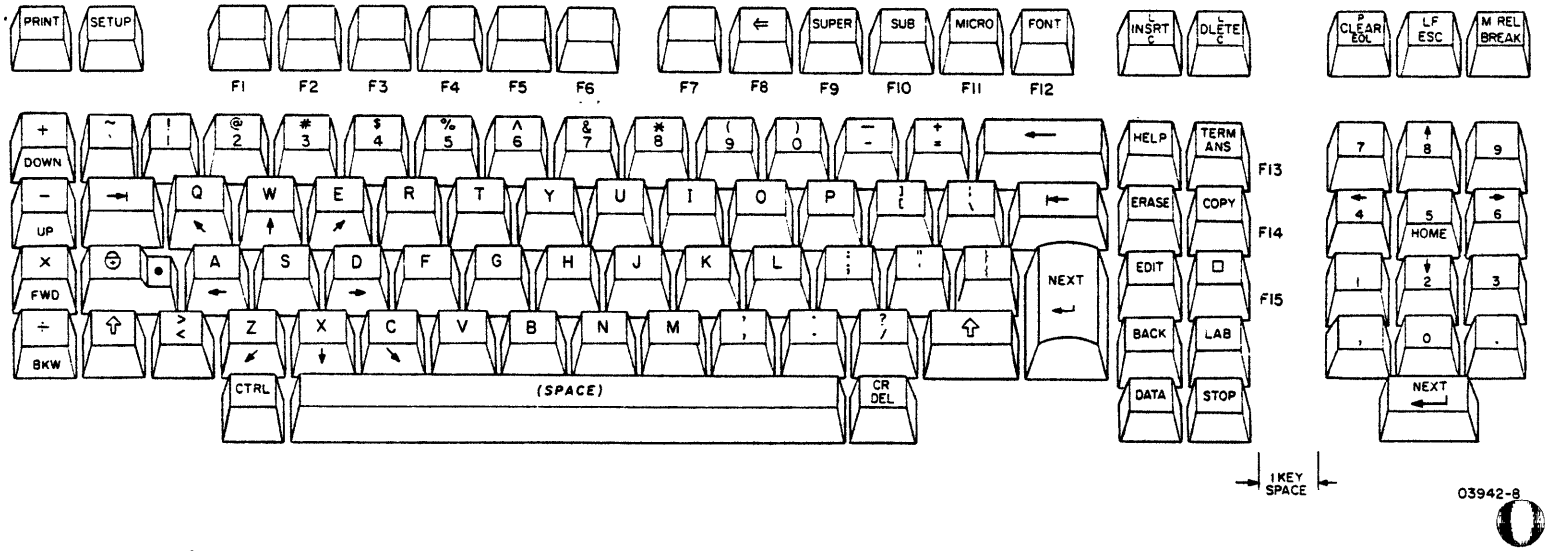


Figure 3.9.1A. Multifunction Keyboard, Viking X (ISO 3243 Compatible, ANSI X4A12 Compatible)

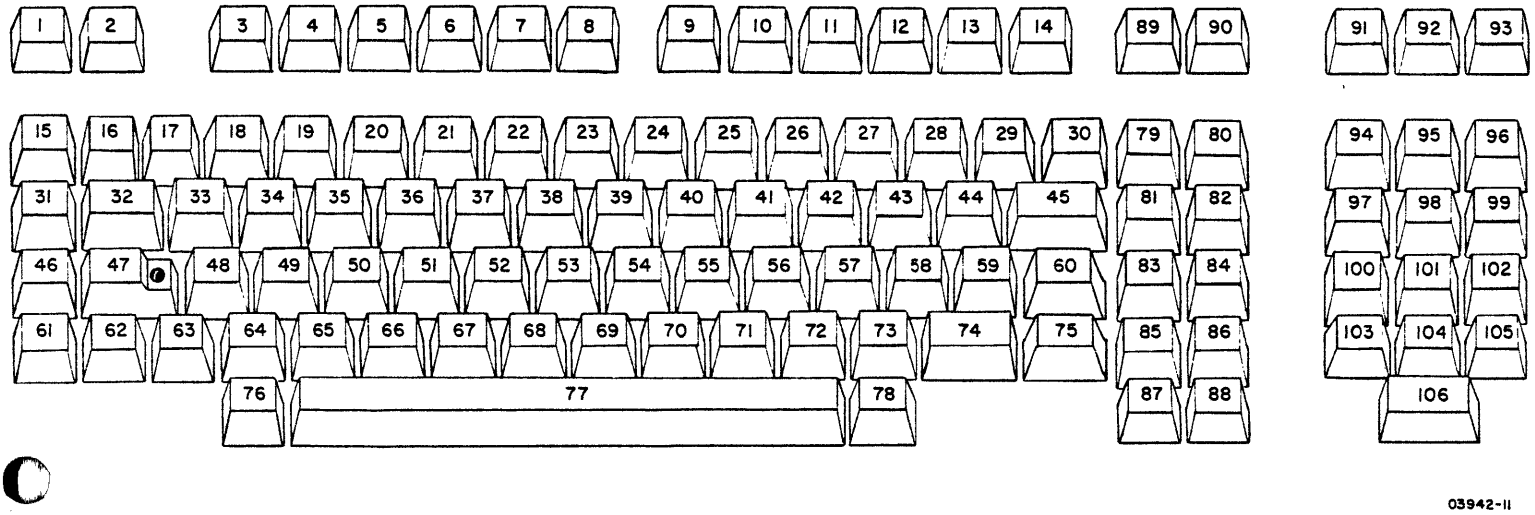


Figure 3.9.2. Keystation Assignments

TABLE 3.9.1. CTRL CHARACTER CODES

b7 → / b6 → / b5 → / BITS b4 b3 b2 b1	COLUMN → / ROW ↓	0 (0 0 0)	0 (0 0 1)	1 (1 1 1)
0 0 0 0	0	NUL	DLE	
0 0 0 1	1	SOH	DC1	
0 0 1 0	2	STX	DC2	
0 0 1 1	3	ETX	DC3	
0 1 0 0	4	EOT	DC4	
0 1 0 1	5	ENQ	NAK	
0 1 1 0	6	ACK	SYN	
0 1 1 1	7	BEL	ETB	
1 0 0 0	8	BS	CAN	
1 0 0 1	9	HT	EM	
1 0 1 0	10 (A)	LF	SUB	
1 0 1 1	11 (B)	VT	ESC	
1 1 0 0	12 (C)	FF	FS	
1 1 0 1	13 (D)	CR	GS	
1 1 1 0	14 (E)	SO	RS	
1 1 1 1	15 (F)	SI	US	DEL(1)

02016

(1) This character code is used to denote a parity error.

TABLE 3.9.2. ENGLISH ALPHANUMERIC CHARACTER CODES

b7 → / b6 → / b5 → / BITS					0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b4 ↓	b3 ↓	b2 ↓	b1 ↓	COLUMN → / ROW ↓	2	3	4	5	6	7
0	0	0	0	0	SP	0	@	P	`	p
0	0	0	1	1	!	1	A	Q	a	q
0	0	1	0	2	"	2	B	R	b	r
0	0	1	1	3	#	3	C	S	c	s
0	1	0	0	4	$	4	D	T	d	t
0	1	0	1	5	%	5	E	U	e	u
0	1	1	0	6	&	6	F	V	f	v
0	1	1	1	7	'	7	G	W	g	w
1	0	0	0	8	(	8	H	X	h	x
1	0	0	1	9	)	9	I	Y	i	y
1	0	1	0	10(A)	*	:	J	Z	j	z
1	0	1	1	11(B)	+	;	K	[	k	{
1	1	0	0	12(C)	,	<	L	\	l	|
1	1	0	1	13(D)	-	=	M	]	m	}
1	1	1	0	14(E)	.	>	N	^	n	~
1	1	1	1	15(F)	/	?	O	_	o	

02015

TABLE 3.9.3. FRENCH ALPHANUMERIC CHARACTER CODES

b7 → / b6 → / b5 → / BITS					0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b4 ↓	b3 ↓	b2 ↓	b1 ↓	COLUMN → / ROW ↓	2	3	4	5	6	7
0	0	0	0	0	SP	0	à	P	`	p
0	0	0	1	1	!	1	A	Q	a	q
0	0	1	0	2	"	2	B	R	b	r
0	0	1	1	3	£	3	C	S	c	s
0	1	0	0	4	$	4	D	T	d	t
0	1	0	1	5	%	5	E	U	e	u
0	1	1	0	6	&	6	F	V	f	v
0	1	1	1	7	'	7	G	W	g	w
1	0	0	0	8	(	8	H	X	h	x
1	0	0	1	9	)	9	I	Y	i	y
1	0	1	0	10(A)	*	:	J	Z	j	z
1	0	1	1	11(B)	+	;	K	°	k	é
1	1	0	0	12(C)	,	<	L	ç	l	ù
1	1	0	1	13(D)	-	=	M	§	m	è
1	1	1	0	14(E)	.	>	N	^	n	¨
1	1	1	1	15(F)	/	?	O	_	o	

02015-1

TABLE 3.9.4 GERMAN ALPHANUMERIC CHARACTER CODES

b7 → / b6 → / b5 → / BITS b4 ↓	b3 ↓	b2 ↓	b1 ↓	COLUMN → / ROW ↓	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
					2	3	4	5	6	7
0	0	0	0	0	SP	0	§	P	`	p
0	0	0	1	1	!	1	A	Q	a	q
0	0	1	0	2	"	2	B	R	b	r
0	0	1	1	3	#	3	C	S	c	s
0	1	0	0	4	$	4	D	T	d	t
0	1	0	1	5	%	5	E	U	e	u
0	1	1	0	6	&	6	F	V	f	v
0	1	1	1	7	'	7	G	W	g	w
1	0	0	0	8	(	8	H	X	h	x
1	0	0	1	9	)	9	I	Y	i	y
1	0	1	0	10(A)	*	:	J	Z	j	z
1	0	1	1	11(B)	+	;	K	Ä	k	ä
1	1	0	0	12(C)	,	<	L	Ö	l	ö
1	1	0	1	13(D)	-	=	M	Ü	m	ü
1	1	1	0	14(E)	.	>	N	^	n	β
1	1	1	1	15(F)	/	?	O	_	o	

02015-2

TABLE 3.9.5. SWEDISH/FINNISH ALPHANUMERIC CHARACTER CODES

b7 → / b6 → / b5 → / BITS					0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b4 ↓	b3 ↓	b2 ↓	b1 ↓	COLUMN → / ROW ↓	2	3	4	5	6	7
0	0	0	0	0	SP	0	É	P	é	p
0	0	0	1	1	!	1	A	Q	a	q
0	0	1	0	2	"	2	B	R	b	r
0	0	1	1	3	#	3	C	S	c	s
0	1	0	0	4	$	4	D	T	d	t
0	1	0	1	5	%	5	E	U	e	u
0	1	1	0	6	&	6	F	V	f	v
0	1	1	1	7	'	7	G	W	g	w
1	0	0	0	8	(	8	H	X	h	x
1	0	0	1	9	)	9	I	Y	i	y
1	0	1	0	10(A)	*	:	J	Z	j	z
1	0	1	1	11(B)	+	;	K	Ä	k	ä
1	1	0	0	12(C)	,	<	L	Ö	l	ö
1	1	0	1	13(D)	-	=	M	Å	m	å
1	1	1	0	14(E)	.	>	N	Ü	n	ü
1	1	1	1	15(F)	/	?	O	_	o	

02015-3

TABLE 3.9.6. BRITISH ALPHANUMERIC CHARACTER CODES

b7 → / b6 → / b5 → / BITS					0 0 0	0 0 1	1 0 0	1 0 1	1 1 0	1 1 1
b4 ↓	b3 ↓	b2 ↓	b1 ↓	COLUMN → / ROW ↓	2	3	4	5	6	7
0	0	0	0	0	SP	0	@	P	`	p
0	0	0	1	1	!	1	A	Q	a	q
0	0	1	0	2	"	2	B	R	b	r
0	0	1	1	3	£	3	C	S	c	s
0	1	0	0	4	$	4	D	T	d	t
0	1	0	1	5	%	5	E	U	e	u
0	1	1	0	6	&	6	F	V	f	v
0	1	1	1	7	'	7	G	W	g	w
1	0	0	0	8	(	8	H	X	h	x
1	0	0	1	9	)	9	I	Y	i	y
1	0	1	0	10(A)	*	:	J	Z	j	z
1	0	1	1	11(B)	+	;	K	[	k	{
1	1	0	0	12(C)	,	<	L	\	l	|
1	1	0	1	13(D)	-	=	M	]	m	}
1	1	1	0	14(E)	.	>	N	^	n	~
1	1	1	1	15(F)	/	?	O	_	o	

02015-4

TABLE 3.9.7. SPANISH ALPHANUMERIC CHARACTER CODES

b7 → / b6 → / b5 → / BITS					0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b4 ↓	b3 ↓	b2 ↓	b1 ↓	COLUMN → / ROW ↓	2	3	4	5	6	7
0	0	0	0	0	SP	0	§	P	`	p
0	0	0	1	1	!	1	A	Q	a	q
0	0	1	0	2	"	2	B	R	b	r
0	0	1	1	3	£	3	C	S	c	s
0	1	0	0	4	$	4	D	T	d	t
0	1	0	1	5	%	5	E	U	e	u
0	1	1	0	6	&	6	F	V	f	v
0	1	1	1	7	'	7	G	W	g	w
1	0	0	0	8	(	8	H	X	h	x
1	0	0	1	9	)	9	I	Y	i	y
1	0	1	0	10(A)	*	:	J	Z	j	z
1	0	1	1	11(B)	+	;	K	¡	k	°
1	1	0	0	12(C)	,	<	L	Ñ	l	ñ
1	1	0	1	13(D)	-	=	M	¿	m	ç
1	1	1	0	14(E)	.	>	N	^	n	~
1	1	1	1	15(F)	/	?	O	_	o	

02015-5

TABLE 3.9.8. DANISH/NORWEGIAN ALPHANUMERIC CHARACTER CODES

b7 → / b6 → / b5 → / BITS					0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b4 ↓	b3 ↓	b2 ↓	b1 ↓	COLUMN → / ROW ↓	2	3	4	5	6	7
0	0	0	0	0	SP	0	Ä	P	ä	p
0	0	0	1	1	!	1	A	Q	a	q
0	0	1	0	2	"	2	B	R	b	r
0	0	1	1	3	¤	3	C	S	c	s
0	1	0	0	4	$	4	D	T	d	t
0	1	0	1	5	%	5	E	U	e	u
0	1	1	0	6	&	6	F	V	f	v
0	1	1	1	7	'	7	G	W	g	w
1	0	0	0	8	(	8	H	X	h	x
1	0	0	1	9	)	9	I	Y	i	y
1	0	1	0	10(A)	*	:	J	Z	j	z
1	0	1	1	11(B)	+	;	K	Æ	k	æ
1	1	0	0	12(C)	,	<	L	Ø	l	ø
1	1	0	1	13(D)	-	=	M	Å	m	å
1	1	1	0	14(E)	.	>	N	Ü	n	ü
1	1	1	1	15(F)	/	?	O	_	o	

02015-6

TABLE 3.9.10. LINE DRAWING SYMBOL CODES

b7 → / b6 → / b5 → / BITS					0 / 1 / 0	0 / 1 / 1
b4 ↓	b3 ↓	b2 ↓	b1 ↓	COLUMN → / ROW ↓	2	3
0	0	0	0	0	─	┘
0	0	0	1	1	│	┐
0	0	1	0	2	┌	└
0	0	1	1	3	┐	├
0	1	0	0	4	└	┤
0	1	0	1	5	┘	┼
0	1	1	0	6	┬	▌
0	1	1	1	7	┴	▌
1	0	0	0	8	├	▟
1	0	0	1	9	┤	▛
1	0	1	0	10 (A)	┼	▜
1	0	1	1	11 (B)	─	▙
1	1	0	0	12 (C)	│	■
1	1	0	1	13 (D)	┌	■
1	1	1	0	14 (E)	┐	
1	1	1	1	15 (F)	└	▌

02016-2

TABLE 3.9.11. PLATO SYMBOL CODES

B7 B6 B5 / B4 B3 B2 B1	ROW \ COLUMN	1 0 0	1 0 1	1 1 0	1 1 1
		4	5	6	7
0 0 0 0	0		α	C̄	\
0 0 0 1	1	/	β	..	\
0 0 1 0	2	≡	δ	□	/
0 0 1 1	3	~	λ	○	/
0 1 0 0	4	⇦	μ	◆	–
0 1 0 1	5	≠	π	×	–
0 1 1 0	6	↑	ρ	′	|
0 1 1 1	7	→	σ	,	|
1 0 0 0	8	↓	ω	v	▨
1 0 0 1	9	←	≤	↕	▨
1 0 1 0	10 (A)	×	≥	|	=
1 0 1 1	11 (B)	Σ	θ		=
1 1 0 0	12 (C)	Δ	∠		◣
1 1 0 1	13 (D)	∪	°		◣
1 1 1 0	14 (E)	∩	⟩		◢
1 1 1 1	15 (F)	÷	≫		◢

03415-3

TABLE 3.9.12. KEYBOARD KEYCODES AND LEGENDS

KEY NO.	NOTES*	KEY LEGENDS LOWER	CENTER	UPPER	PRESSED WITH KEY ... GENERATE	⇧	CTRL	⇧ ·CTRL
1	D, L		PRINT					
		ADV Mode			1E,11	1E,01	1E,11	1E,01
		ADV N Mode			1E,02	1E,01	1E,02	1E,01
2			SETUP					
		ADV Mode			16	16	16	16
		ADV N Mode			13	13	13	13
3	D, L		(F1)		1E,71	1E,61	1E,31	1E,21
4	D, L		(F2)		1E,72	1E,62	1E,32	1E,22
5	D, L		(F3)		1E,73	1E,63	1E,33	1E,23
6	D, L		(F4)		1E,74	1E,64	1E,34	1E,24
7	D, L		(F5)		1E,75	1E,65	1E,35	1E,25
8	D, L		(F6)		1E,76	1E,66	1E,36	1E,26
9	D, L		(F7)		1E,77	1E,67	1E,37	1E,27
			⇐					
10	D, L		(F8)		1E,78	1E,68	1E,38	1E,28
			SUPER					
11	D, L		(F9)		1E,79	1E,69	1E,39	1E,29
			SUB					
12	D, L		(F10)		1E,7A	1E,6A	1E,3A	1E,2A
			MICRO					
13	D, L		(F11)		1E,7B	1E,6B	1E,3B	1E,2B
			FONT					
14	D, L		(F12)		1E,7C	1E,6C	1E,3C	1E,2C
15	L,D		+	DOWN **	1E,12,20	1E,12,21	1E,12,22	1E,12,23
16	R, L	`		~				
		ISO			60	7E	60	7E
		ANSI			-	-	-	-
17	R	1		!	31	21	31	21

TABLE 3.9.12. KEYBOARD KEYCODES AND LEGENDS (CONTD)

KEY NO.	NOTES*	KEY LEGENDS LOWER	CENTER	UPPER	PRESSED WITH KEY ... GENERATE		CTRL	⇧ CTRL
18	R	2		@	32	40	00	00
19	R	3		#	33	23	33	23
20	R	4		$	34	24	34	24
21	R	5		%	35	25	35	25
22	R	6		^	36	5E	36	5E
23	R	7		&	37	26	37	26
24	R	8		*	38	2A	38	2A
25	R	9		(	39	28	39	28
26	R	0		)	30	29	30	29
27	R	-		_	2D	5F	1F	1F
28	R	=		+	3D	2B	1E	1E
29	R	`		~				
		ANSI			60	7E	60	7E
		ISO			-	-	-	-
30	R		←					
		ADV MODE			19	19	19	19
		ADV N MODE			08	08	08	08
31	L,D		—	UP **	1E,12,24	1E,12,25	1E,12,26	1E,12,27
32	R,L,D		→|					
		ADV MODE			1E,04	1E,04	1E,12,57	1E,12,57
		ADV N MODE			09	09	1E,12,57	1E,12,57
33	R		Q	↖ **	71	51	11	11
34	R		W	↑ **	77	57	17	17
35	R		E	↗ **	65	45	05	05
36	R		R		72	52	12	12
37	R		T		74	54	14	14
38	R		Y		79	59	19	19
39	R		U		75	55	15	15
40	R		I		69	49	09	09

TABLE 3.9.12. KEYBOARD KEYCODES AND LEGENDS (CONTD)

KEY		KEY LEGENDS			PRESSED WITH KEY ... GENERATE			
NO.	NOTES*	LOWER	CENTER	UPPER		⇧	CTRL	⇧ CTRL
41	R		O		6F	4F	0F	0F
42	R		P		70	50	10	10
43	R	[		]	5B	5D	1D	1D
44	R	\		¦	5C	7C	1C	1C
45	R,L,D		←		1E,0B	1E,0B	1E,12,58	1E,12,58
46	D,L		X	FWD **	1E,12,28	1E,12,29	1E,12,2A	1E,12,2B
47			⊕					
48	R		A	← **	61	41	01	01
49	R		S		73	53	13	13
50	R		D	→ **	64	44	04	04
51	R		F		66	46	06	06
52	R		G		67	47	07	07
53	R		H		68	48	08	08
54	R		J		6A	4A	0A	0A
55	R		K		6B	4B	0B	0B
56	R		L		6C	4C	0C	0C
57	R	;		:	3B	3A	3B	3A
58	R	'		"	27	22	27	22
59	R	{		}	7B	7D	7B	7D
60	See Key 75				-	-	-	-
61	D, L		÷	BKW **	1E,12,2C	1E,12,2D	1E,12,2E	1E,12,2F
62			⇧					
63	R	<		>				
		ANSI			-	-	-	-
		ISO			3C	3E	3C	3E
64	R		Z	↙ **	7A	5A	1A	1A
65	R		X	↓ **	78	58	18	18

TABLE 3.9.12. KEYBOARD KEYCODES AND LEGENDS (CONTD)

KEY		KEY LEGENDS			PRESSED WITH KEY ... GENERATE			
NO.	NOTES*	LOWER	CENTER	UPPER		⇧	CTRL	⇧ CTRL
66	R		C	↘ **	63	43	03	03
67	R		V		76	56	16	16
68	R		B		62	42	02	02
69	R		N		6E	4E	0E	0E
70	R		M		6D	4D	0D	0D
71	R	,		< ANSI	2C	3C	2C	3C
		,		, ISO	2C	2C	2C	2C
72	R	.		> ANSI	2E	3E	2E	3E
		.		. ISO	2E	2E	2E	2E
73	R	/		?	2F	3F	2F	3F
74			⇧					
75	L	↵		NEXT				
		ADV MODE			0A	0A	0A	0A
		ADV N MODE			0D	0D	0D	0D
76			CTRL					
77	R		(Space)		20	20	20	20
78		DEL		CR	7F	0D	7F	0D
79	D, L		HELP		1E,5C	1E,58	1E,5C	1E,58
80	D, L	ANS	(F13)	TERM	1E,7D	1E,6D	1E,3D	1E,2D
81	L, D		ERASE		1E,5D	1E,59	1E,5D	1E,59
			COPY					
82	D, L		(F14)		1E,7E	1E,6E	1E,3E	1E,2E
83	D, L		EDIT		1E,5E	1E,5A	1E,5E	1E,5A
			□					
84	D, L		(F15)		1E,70	1E,60	1E,30	1E,20

TABLE 3.9.12. KEYBOARD KEYCODES AND LEGENDS (CONTD)

KEY NO.	NOTES*	KEY LEGENDS			PRESSED WITH KEY ... GENERATE			
		LOWER	CENTER	UPPER		⇧	CTRL	⇧ ·CTRL
85	D, L		BACK		1E,5F	1E,5B	1E,5F	1E,5B
86	D, L		LAB		1E,12,31	1E,12,32	1E,12,33	1E,12,33
87	D, L		DATA		1E,12,35	1E,12,36		
88	D, L		STOP		1E,49	1E,4A	1E,49	1E,4A
89	D, L,R	C	INSERT	L	1E,4F	1E,52	1E,4F	1E,52
90	D, L,R	C	DELETE	L	1E,4E	1E,51	1E,4E	1E,51
91	L	EOL	CLEAR	P	0B	0C	0B	0C
92		ESC		LF	1B	0A	1B	0A
93		BREAK		M REL	BREAK		BREAK	
94	R, L,N		7		37		37	
95	R, L,N	8		↑	38	17	38	17
96	R, L,N		9		39		39	
97	R,L,N	4		←				
	D	ADV MODE			34	19	19	1E,19
		ADV N MODE			34	1F	34	1F
98	R,L,N	5		HOME**				
	D	ADV MODE			35	08	08	1E,08
		ADV N MODE			35	19	35	19
99	R,L,N	6		→				
	D	ADV MODE			36	18	18	1E,18
		ADV N MODE			36	18	36	18
100	R, L,N	1			31		31	
101	R,L,N	2		↓				
	D	ADV MODE			32	1A	1A	1E,1A
		ADV N MODE			32	1A	32	1A
102	R, L,N	3			33		33	
103	R, L,N	,			2C		2C	
104	R, L,N	0			30		30	

TABLE 3.9.12. KEYBOARD KEYCODES AND LEGENDS (CONTD)

KEY NO.	NOTES*	KEY LEGENDS			PRESSED WITH KEY ... GENERATE			
		LOWER	CENTER	UPPER		⇧	CTRL	⇧ CTRL
105	R, L, N	.			2E		2E	
106	L, N	↵		NEXT				
		ADV MODE			0A	0A	0A	0A
		ADV N MODE			0D	0D	0D	0D

*Key to Notes:

N - Modified if the Numeric Pad parameter set to SHIFT.
R - Auto repeat if TYPAMATIC is on.
L - Host loadable.
D - Delimiter. CR sent when enabled by host.
- - No function performed.
** - Labeled on skirt of keycap.

3.9.2.2 Character Mode Operation

The basic operation of CYBER mode is in character mode operation. This mode is used to emulate the Viking TTY (Small CYBER ADV Mode). It also supports protect enable.

As keys are pressed the associated codes are sent to the host if online. The associated codes are displayed if in local or half-duplex. As the codes are displayed the attribute word is stored in background memory with modified bit set. If the cursor occupied a protect position and if the key pressed is a displayable code, nothing is sent and the alarm will sound.

The keyboard has two types of keys, alphanumeric keys and control/function keys. The alphanumeric keys send codes and display symbols, control/function keys send codes and perform special actions. These special actions are defined later.

The cursor is allowed in protected positions. The host must do a Protect Disable to perform Clear functions. The host can store data over protected positions.

When a function requiring the clearing of data is performed, the modified attribute bit is cleared for each position cleared.

CYBER mode supports host loadable code sequences or host loaded controlware. The codes specified by Table 3.9.12 can function in one of three ways.

- Normal - As the key is pressed the code in Table 3.9.12 will be sent to the host.
- Host Loaded Code Sequence - If the host has loaded an ASCII code sequence for that key, those codes will be sent to the host instead of the codes in Table 3.9.12. If the terminal is in half duplex, the codes will not be acted upon by the terminal.
- Host Loaded Controlware - If the host has loaded Z80 code controlware for that key, a call will be made to the controlware.

3.9.2.2.1 PRINT Key

Activation of this key causes the transmission of a page print code sequence. If half-duplex is selected, the terminal causes all data to be printed as it appears on the screen. All control codes are replaced by spaces and a carriage return/line feed is inserted at the start of the page and at the end of each line. When online, all incoming codes are ignored (not lost) until completion of the print transmission. Print completion is signaled by the terminal transmitting a print complete code (ACK) or if the operation is aborted by actuating SHIFT/M REL; transmission of an abnormal completion sequence (RS, NAK).

If the PRINT key is actuated in conjunction with the SHIFT key, a print form code sequence is generated. If half-duplex is selected, the terminal sends all data as previously described except dimmed data is replaced with space codes for transfer to the printer.

Any data received during the print operation is ignored. The keyboard is locked during the print operation. A 250 ms delay is inserted after each CR, LF, FF if the SRTs is off. If the printer is not ready, DTR off, or goes not ready, nothing will be sent to the printer until DTR goes on.

3.9.2.2.2 SETUP Key

Unshifted or shifted, this key will cause the terminal to display operator mode status on the bottom two lines of the display and send an XOFF to the host. The bottom lines will not be lost. When displayed, mode operator parameters can be changed. Activating the F1 (return) key will cause the status line to be deleted, screen data to return to its original position, and an XON to be sent to the host. (See Section 3.3.3.3.)

3.9.2.2.3 Special Function Keys

Fifteen four-level special function keys (F1 through F15) are available on the keyboard. When pressed, these keys cause a code sequence to be transmitted. The first character is an $1E_{16}$; the second is unique to the individual function key whether it is shifted, unshifted, or activated in conjunction with the CTRL key (refer to the keyboard codes Table 3.9.12).

3.9.2.2.3 (Contd)

In addition, the following additional host defined actions are available:

- o A host selectable CR ($0D_{16}$) code delimiter added to the code sequence defined in Table 3.9.12.
- o A host specified code sequence or a host defined controlware sequence executed in response to a key activation. The host specified action includes a key identifier, a code sequence or controlware sequence selector and the actual code sequence or controlware sequence.. See Section 3.9.2.5.1.

3.9.2.2.4 L/INSRT/C Key

Unshifted this key causes an insert character code sequence ($1E_{16}$, $4F_{16}$) to be transmitted; shifted it causes the transmission of an insert line code sequence ($1E_{16}$, 52_{16}). See 3.9.2.4.3.8 if half-duplex is selected. Received code sequence is defined in TABLE 3.9.13.

3.9.2.2.5 L/DLETE/C Key

Unshifted this key causes a delete character code sequence ($1E_{16}$, $4E_{16}$) to be transmitted; shifted it causes the transmission of a delete line sequence ($1E_{16}$, 51_{16}). See 3.9.2.4.3.9 if half-duplex is selected. Received code sequence is defined in TABLE 3.9.13.

3.9.2.2.6 Clear Page/EOL

If protect operation is active see Section 3.9.2.4.3.4.

When unshifted this key causes the entry of a space code into all display positions from, and including, the current cursor position to the end of the current line. The cursor is not moved. The modified attribute bit is cleared for all character locations cleared.

3.9.2.2.6 (Contd)

Shifted, this key causes the entry of a space code into all display positions. The cursor is moved to home position. The modified attribute bit is cleared for all positions.

3.9.2.2.7 LF/ESC

Unshifted this key causes an ESC code to be sent to the host. Shifted this key causes a LF code to be sent to the host.

3.9.2.2.8 MREL/BREAK Key

Unshifted, actuation of this key causes the Transmitted Data signal to be held to a space (logical 0) condition for approximately 250 milliseconds. If a break is received a parity error symbol is entered at the cursor position and the alarm is actuated.

Shifted, actuation of this key causes a manual release operation to be executed. This provides a controlware/ firmware break function. If a print operation is active, it will be aborted. If a disk operation is active, it will be aborted. If a host message in or out is active, it will be aborted.

3.9.2.2.9 Special Action Keys (+, -, X, %, HELP, ERASE, EDIT, BACK, LAB, DATA, STOP)

Eleven special action keys are available on the keyboard. Action keycodes and code sequences as defined by Table 3.9.12 are transmitted to the host.

All keys identified in Table 3.9.12 that are not Function Keys and support a host specified optional code sequence or controlware sequence support the additional host defined action:

3.9.2.2.9 (Contd)

- o A host specified code sequence or a host defined controlware sequence executed in response to a key activation. The host specified action includes a key identifying a code sequence or controlware sequence selector and the actual code sequence or controlware sequence.
- o ERASE - This key performs a LINE CLEAR and carriage return in half duplex. See Protect Operation Section 3.9.2.4.3.10 if protect is enabled.

3.9.2.2.10 NEXT/↵ (New Line/Carriage Return) Key

Activation of this key causes a new line code ($0A_{16}$) to be transmitted in ADV mode or a carriage return code ($0D_{16}$) to be transmitted in ADV Native mode.

3.9.2.2.11 →| (Tab Forward)

If pressed in conjunction with the Control key it will set the current column as a tab stop.

Activation of this key causes the transmission of the tab sequence (see Table 3.9.12).

See Protect Operation Section 3.9.2.4.3.5 if protect is enabled. If not enabled the key will move the cursor to the first position following the next low intensity field or next column tab (whichever comes first.) If none are present, the cursor moves to top of page.

3.9.2.2.12 |← (Tab Backward)

If pressed in conjunction with the Control key it clears the current column as a tab stop.

Activation of this key causes the transmission of the back tab sequence (see Table 3.9.12).

3.9.2.2.12 (Contd)

See Protect Operation Section 3.9.2.4.3.5 if protect is enabled. If not enabled the key will move the cursor backwards to the start of the current or next non-dim field or to the next column tab position (whichever comes first). If none are present, the cursor moves to top of page.

3.9.2.2.13 Cursor Control Keys

The cursor control keys consist of the cursor up (↑), cursor down (↓), cursor left (←), cursor right (→), and HOME keys. They are physically located in the numeric pad and are activated by actuation of the appropriate key with the SHIFT key or SHIFT and Control keys. Refer to the keyboard codes in Table 3.9.12 for a list of the codes generated by these keys. The numeric pad keys are also affected by the N PAD NORMAL/SHIFT parameter.

See Protect Operation Section 3.9.2.4.3.6 for the functional description.

3.9.2.2.14 CR/DEL Key

Unshifted, actuation of this key causes transmission of a delete code (DEL). Shifted, actuation of this key causes transmission of a carriage return code (CR). See Table 3.9.12

3.9.2.3 Block Mode Operation

The basic terminal CYBER mode includes the capability to perform operator entry and editing on a page basis offline to the host. When the operator completes an activity, a block mode transmission is initiated by the operator to the host.

As alphanumeric keys are pressed, the associated 7-bit code is stored in display memory. Bit 2^7 in display memory will not be modified. Therefore, a graphic, PLATO, RAM generator character will be displayed if the previous code stored there was a graphic, PLATO, or RAM generator character. The attribute word will be stored in background memory with the modified bit set. The cursor will advance to the next position. If the cursor occupied a protected position, no action is performed and the alarm will sound.

3.9.2.3 (Contd)

As alphanumeric codes are received from the host they will be stored along with the new attribute bits, the modified bit will be cleared.

If the operator initiates a function which requires the clearing of data, the modified attribute bit will be set for each position cleared.

3.9.2.3.1 Host Communications

The host uses two commands to initiate and terminate block mode transmission:

- o Enter Block Mode - When block mode is active, the operator enters and/or changes data locally at the terminal on a page basis without host intervention. Block transmission is initiated by the operator when the current page activity is completed.
- o Exit Block Mode - Terminates local terminal activity.

Block mode selection can only be activated by host command. When the block mode operation is active, the host utilizes the following commands to properly support block mode operation.

- Enable/Disable Keyboard - Enables/disables operator keyboard entry during block mode transmission activity.
- Load/Define Function Keys - This allows the host to define any or all function keys to perform desired block mode code sequence or controlware sequence.

3.9.2.3.2 Terminal Block Mode Operation

When an enter block mode command is received, the terminal disables upline communication to the host. It performs all allowed operator actions, such as data-entry and editing functions locally (offline to the host). These actions are performed on a page basis.

The terminal remains in this state until the operator initiates a send function by activating anyone of the 15 function keys, 10 special action keys and INSERT/DELETE LINE. This indicates to the terminal that the operator has completed current page activity and requests transmission to the host. The terminal then performs the following:

- o Enables upline communication to the host.
- o Disables keyboard to the operator.
- o Saves the current cursor position.
- o Sends operator activated function code sequence.
- o Sends current cursor position.
- o Resets cursor to upper left.
- o Sends a XY position and all unprotected field data for each field with any modified data. Fields are limited by single line boundaries modified bits are cleared as codes are sent. Trailing unmodified locations are suppressed.
- o Sends a page block terminator to the host (CR).
- o Disables upline communication.
- o Restores the cursor then enables the keyboard.

3.9.2.3.3 Block Mode Keyboard Operation

Keyboard operation with block mode active is described in the following sections.

3.9.2.3.3.1 Alphanumeric and Control Code Entry

Alphanumeric key operation in block mode is the same as character and/or protect operation.

3.9.2.3.3.2 Unaffected Block Mode Keys

The following keys perform the same as described by character and/or protect operation with the exception that they are performed offline to the host:

- ⇧ (Shift) key
- ⊕ (Lock) key
- SETUP key
- MREL/BREAK key
- Cursor Control keys
- ← (Backspace) key
- NEXT/↵ key
- → (Forward Tab) key
- |← (Back Tab) key
- P/CLEAR/EOL key*
- ERASE key*
- PRINT key

*The modified bit is set (instead of cleared) in block mode for all locations that are cleared.

3.9.2.3.3.3 CTRL

The CTRL in conjunction with any key performs the same as for character and/or protect operation only locally.

3.9.2.3.3.4 Special Action Keys

Function keys F1 through F15 and Special Action Keys (+, -, X, %, HELP, EDIT, BACK, LAB, DATA, STOP) are used by the operator to initiate a block transfer to the host. The significance of any or all function keys is dependent only upon the host or host application.

3.9.2.3.3.5 L/INSRT/C and L/DLETE/C Keys

Unshifted the insert character or delete character action is performed the same as for standard character and/or protect mode operation.

Shifted the insert line or delete line action performs a pseudo send function key operation. The normal block transmission sequence is executed with the following special considerations:

- o Perform insert line or delete line operation*
- o Send insert line or delete line keycode sequence
- o Perform a standard block mode send. See Section 3.9.2.3.2

*The modified bit is set (instead of cleared) in block mode for all locations that are cleared.

3.9.2.4 Protect Operation

The basic terminal CYBER mode includes the capability to protect each character position selectively. This is used to prevent operator input or change at each desired character position. The terminal utilizes a protect attribute for each character position to provide this capability.

3.9.2.4.1 Host Communications

The host uses two commands to specify desired protect attribute bit conditions:

- Start Protect - Store protect bit for each succeeding character received.
- Clear Protect - Clear protect bit for each succeeding character received.

The state of the protect attribute bit by itself has no effect on normal terminal operation. The protect system active condition must be present before the terminal utilizes the protect attribute bit. The host uses two additional commands to select desired protect system conditions.

- Enable Protect System - All protected characters (protect attribute set) are protected from operator action and can only be changed by the host.
- Disable Protect System - All character positions can be entered/changed by operator action. If an operator changes a character location with its protect bit set, the character is entered and the current attribute word is stored.

3.9.2.4.2 Protect System Disable

In CYBER Mode with the protect system off, all terminal keyboard and communications operations are the same as the basic terminal CYBER Mode operation.

3.9.2.4.3 Protect System Enabled (Keyboard Operation)

Keyboard operation with the protect system enabled is described in the following sections.

3.9.2.4.3.1 Alphanumeric and Control Code Entry

For unprotected character locations, actuation of the alphanumeric or control code key causes the code for that key to be performed the same as the current mode operation.

For protected character locations, actuation of any alphanumeric causes an audible alarm to be generated with no additional terminal action taken. The cursor does not move when this condition occurs.

3.9.2.4.3.2 ⇧, ⊕, CTRL, M REL/BREAK, and SETUP Keys

The SHIFT, LOCK, Control, Release/BREAK, and SETUP keys perform the same function as the standard character mode operation for all character locations.

3.9.2.4.3.3 CR/DEL and LF/ESC Keys

- Activation of these keys cause the same action as for the current mode operation.

3.9.2.4.3.4 P/CLEAR/EOL (Erase Page and Erase End of Line) Key

When unshifted this key causes the entry of a space code into all unprotected display positions from, and including, the current cursor position to the end of line. The cursor is not moved. The modified attribute bit is cleared in character mode and set in block mode for all character locations cleared.

When shifted this key causes the entry of a space code into all unprotected display positions. The cursor is moved to the home position. The modified attribute bit is cleared in character mode and set in block mode for all character locations cleared.

3.9.2.4.3.5 →| , |← (Forward Tab and Back Tab) Keys

The →| (Forward Tab) key moves the cursor to the beginning of the next unprotected field, next column tab that is set or the home position if neither found.

The |← (Back Tab) key causes the cursor to move left to the beginning of the current unprotected field or next column tab that is set. If the cursor is at the beginning of an unprotected field or at a protected character location, the cursor will move to the beginning of the previous unprotected field or upper-left position if neither found.

3.9.2.4.3.6 Cursor Control Keys and ← Backspace Key

Five keys in the numeric cluster are used to enable cursor movement when enabled in conjunction with the SHIFT key and N PAD parameter. These are described as follows.

- Cursor Up - The shifted numeric 8 moves the cursor up one line. When the cursor up is activated in line 1, the cursor will move to the current column position in the last line. If the character position that the cursor is to occupy is protected, the cursor will move to the protected position.

- Cursor Down - The shifted numeric 2 key moves the cursor down one line. When the cursor down is activated and the cursor is in the bottom line, the cursor will move to the current column position in top line. If the character position that the cursor is to occupy is protected, the cursor will move to the protected position.

- Cursor Left or Backspace - The shifted numeric 4 key or Backspace key moves the cursor left one character position. If the cursor is in column 1 when the key is activated the cursor will move to the last column position up one line. If cursor is at upper left, it will move to last column of bottom line. If the position the cursor is to occupy is protected, the cursor will move to the protected position.

- Cursor Right - The shifted numeric 6 key moves the cursor right one character position. If the cursor is in the last column position when the key is activated the cursor will move to column 1 and down one line. If the cursor is at the last column of the bottom line, it moves to upper left if page operation is selected or causes the screen to scroll in roll operation. If the position the cursor is to occupy is protected, the cursor will move to the protected position.

- HOME - The shifted numeric 5 key moves the cursor to the home position as determined by the parameter bit setting. If the position the cursor is to occupy is protected, the cursor will move to the protected position.

3.9.2.4.3.7 NEXT/↵ (New Line) Key

The NEXT/New Line key moves the cursor to the first location in the lines below it.

Adv N - A carriage return is performed unless the Auto LF is disabled.

3.9.2.4.3.8 L/INSRT/C Key

When unshifted this key causes the entry of a space code in the present cursor position. The character that occupied that position and all characters to the right of the cursor are moved one position to the right. This character shift to the right is continued to the end of the line or to the end of the unprotected field whichever occurs first. The rightmost character is then lost. This key is ignored and the audible alarm is activated if the cursor currently occupies a protected position.

When shifted this key causes the entry of a line of space codes into the display line presently occupied by the cursor. The line of data that occupied the cursor line is then moved down one line position. This line shift is continued until the bottom line or until a line with protected data is encountered. The data in the bottom line, or just above the line with any protected data is lost. This shifted key is ignored and the audible alarm is activated if the cursor currently occupies a line with any protected character positions. The modified attribute bit is cleared in character mode and set in block mode for all character locations changed.

3.9.2.4.3.9 L/DLETE/C Key

Unshifted, this key causes the deletion of the character code in the present cursor position. The character code to the right of the cursor is moved one position to the left and this character shift to the left continues to the end of the unprotected field or to the end of the line, whichever occurs first. The rightmost position shifted left is then replaced with a space code. This key is ignored and the audible alarm is activated if the cursor currently occupies a protected position.

3.9.2.4.3.9 (Contd)

Shifted, this key causes the deletion of line of codes in the line presently occupied by the cursor. The lines below this line are then shifted up one line position. This shift continues until the bottom line or until a line with any protected data is encountered. The line position of the last line shifted up is then over replaced with space codes. This shifted key is ignored and the audible alarm is activated if the cursor currently occupies a line with any protected position.

3.9.2.4.3.10 ERASE Key

The ERASE key causes the entry of a space code into all unprotected display positions in the current unprotected field. This includes all unprotect positions from current cursor position to the beginning of the field or the beginning of the line and all unprotected positions from current cursor position to the end of the field or end of the line (whichever comes first). The cursor is moved to the beginning of the field. The modified attribute bit is cleared in character mode and set in block mode for all locations cleared.

If the cursor currently occupies a protected position, an audible alarm is activated, the cursor is left unchanged, and no additional action is taken.

3.9.2.4.3.11 Function Keys

The function keys generate the same basic code sequences as standard character mode operation and initiates the send in block mode operation.

3.9.2.4.3.12 PRINT Key

Unshifted this key operates the same as standard character mode operation.

3.9.2.4.3.12 (Contd)

Shifted this key operation is the same as previously defined except that dimmed or protected characters are replaced with space codes.

3.9.2.4.3.13 Special Action Keys (+, -, X, %, HELP, EDIT, BACK, LAB, DATA, STOP)

The special action keys operate the same as for the current mode operation.

3.9.2.4.4 Protect System Active Display Operation

Display operation is controlled by the character attributes (blink, protect, underscore, dim, inverse, and blank) the character set and Edit Control Commands (line drawing, external loadable characters, scroll/page field, line length and format).

The character attribute commands enable the video display characteristic named with the protect system active. The line drawing and extended character commands cause the display to substitute the selected character set for part of the standard ASCII set.

The line length command selects 80-or 132-character line operation - all other functions are not affected.

Protect mode operation allows some areas of the screen to be protected from operator entry. These areas are defined by the protected attribute bit.

3.9.2.5 CYBER Mode Host Received Commands

Table 3.9.13 summarizes all host-receive commands and I/O responses. Some host receive commands require a more detailed definition which can be found in this section.

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
NOOP	NUL	00	No operation performed.
Print Form	SOH	01	Transfers all nondimmed displayed data to printer from beginning of current line to end of page. Dimmed data is sent as space code (20). Keyboard locks, comm data is received but ignored until end of operation (not lost). Printing may be aborted by actuation of SHIFT/M REL. Print completion is signaled by terminal transmitting an 06 (ACK) or, if the operation is aborted due to no printer DTR or actuating SHIFT/M REL, by transmission of an 1E, 15 (RS, NAK) sequence. There is no completion response in large CYBER mode.
NOOP ADV Mode (small)	STX	02	No operation.
Write Cursor Address ADV N Mode (large)	STX	02	See Write Cursor Address (DLE).
Enable Blink	ETX	03	Blinks characters whose blink bit is set to 1 (refer to Start Blink command). Following power-up or page erase, blink is automatically enabled.
Disable Blink	EOT	04	Disables character blinking on display page.
Read Cursor Address	ENQ	05	Causes terminal to send cursor address header code (1F) followed by codes containing column and row address. Column position transfers first and is numbered from left to right (00 through 4F) for 80 column mode. In 132 column mode a 7E code preceeds the column position address producing a code sequence of

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
Read Cursor Address (Contd)			7E, 00, 00 through 4F for the first 80 columns 01, 00 through 34 for columns 81 through 132. The next code is line position numbering from top to bottom (00 through 1D). Row/ column addresses may be biased to avoid codes 00 through 1F by enabling code bias parameter selection. When CODE BIAS is enabled, cursor position 00 equals 20. Addressing continues in normal binary progression through 6F for 80 column mode. The 132 column mode sequence is 7E, 20, 20 through 7E, 21, 44 for columns 0 through 132 respectively. The line position address is 20 through 3D for both 80 and 132 column modes.
NOOP ADV Mode (small)	ACK	06	No operation.
Start Underline ADV N Mode (large)	ACK	06	Sets the underline attribute bit to 1.
Alarm	BEL	07	Sounds audible alarm for 250 milliseconds.
Home ADV Mode (small)	BS	08	Moves cursor to home position as defined by parameter setting.
Backspace ADV N Mode (large)	BS	08	Moves cursor left one character position and data is cleared.
X-On ADV Mode (small)	HT	09	Enables transmission to the host or initiates continuation of suspended transmission. See Section 3.9.2.5.4.

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
TAB ADV N Mode (large)	HT	09	Causes cursor to be advanced to the first position following the next low-intensity field or next column tab (whichever comes first) if protect is not enabled. Causes cursor to be advanced to the next unprotected field or next column tab (whichever comes first) if protect is enabled. Cursor will move to top of page if none present. Completion response is identical to Read Status response. No response sent in large CYBER mode.
New Line ADV Mode (small)	LF	0A	Moves cursor to first character position in next line.
Cursor Down ADV N Mode (large)	LF	0A	Moves cursor down one line while remaining in the same position. If on the last line, screen will scroll if roll enabled, cursor moves to top line if page enabled.
EOL (Erase to End of Line)	VT	0B	Erases all unprotected characters from, and including current cursor position to end of current unprotected field or the end of that line. Enters 20 in affected positions. Modified attribute bits for all cleared character positions are cleared in character mode, set in block mode.
EP (Erase Page)	FF	0C	Erases all unprotected characters on screen. Cursor moves to home position. Enters 20 in affected positions. Clears background memory and enables blink if previously disabled. Return to enter normal data (clears enter blink, underscore, reduced intensity, dim, and blank). Modified attribute bits are cleared in character mode, set in block mode.

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
Carriage Return	CR	0D	Moves cursor to first character position in line that it is on. If the Auto Line Feed parameter is selected a LF is performed.
Start Blink	SO	0E	Sets blink bit to 1 in those succeeding characters received and stored in terminal memory.
Stop Blink	SI	0F	Sets blink bit to 0 in succeeding characters received.
Write Cursor Address ADV Mode (small)	DLE	10	Interprets next characters as cursor column and row address. Cursor moves to position defined by addresses. Column address is numbered from left to right (00 through 4F) for 80 column mode. In 132 column mode, a 7E code preceeds the column position address producing a code sequence of 7E, 20, 00 through 4F for columns 0 through 80, and 7E, 21, 00 through 33 for columns 81 through 132. Line position is numbered from top to bottom (00 through 1D). If column position code is greater than 4F in 80 column mode or 01, 33 in 132 column mode, cursor control logic wraps around. Line position operates in a similar manner (e.g., 1F equals 01). Row and column addresses may be biased in same manner as described for Read Cursor Address.
NOOP ADV N Mode (large)	DLE	10	No Operation.
Page Print ADV Mode (small)	DC1	11	Transfers to printer all displayed data from current line to end of page. Keyboard is locked and received data ignored until end of operation (not lost). Printing may be

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
Page Print (Contd)			aborted by pressing SHIFT/M REL. Print completion is signaled by terminal transmitting an 06 or if the operation is aborted by actuating SHIFT/M REL (transmission of an 1E, 15 sequence). No completion response is sent in large CYBER mode.
X-On ADV N Mode (large)	DC1	11	Enables transmission to the host or initiates continuation of suspended transmission from the host. See Section 3.9.2.5.4.
Roll Enable	DC2	12	Enables roll mode; screen scrolls up one line each time cursor overflows bottom line or if a new line code is received when cursor is on bottom line, cursor moves to first character position on bottom line. Bottom line clears; top line is lost. Powering-on terminal enables scroll feature.
Roll Disable ADV Mode (small)	DC3	13	Enables page mode; moves cursor to home position when new line code is received and cursor is on bottom line.
X-Off ADV N Mode (large)	DC3	13	Causes the terminal to temporarily halt transmission to the host until the X-On is received. When sent to the host means data cannot be acted upon. See Section 3.9.2.5.4
Start Underscore ADV Mode (small)	DC4	14	Sets underscore bit to 1. Each succeeding displayed character received is underlined on the screen.
NOOP ADV N Mode (large)	DC4	14	No Operation.

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
End Underscore	NAK	15	Sets underscore bit to 0. Each succeeding displayed character received is not underlined.
X-Off ADV Mode (small)	SYN	16	Causes the terminal to temporarily halt transmission to the host until the X-On is received. When sent to the host means data cannot be acted upon. See Section 3.9.2.5.4.
Roll Disable ADV N Mode (large)	SYN	16	Roll disable (see DC3).
Cursor Up	ETB	17	Moves cursor up one line while remaining in same column (character) position. Stored data is not affected.
Skip	CAN	18	Moves cursor right one character position. Stored data is not affected.
Cursor Left ADV Mode (small)	EM	19	Moves cursor left one character position. Stored data is not affected.
Home ADV N Mode (large)	EM	19	Moves cursor to home as determined by the the parameter bit.
Cursor Down	SUB	1A	Moves cursor down one line while remaining in same column (character) position. If cursor is on the last line it will wrap around to the top. Stored data is not affected.
NOOP	ESC	1B	No operation.

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
Start Dim	FS	1C	Sets dim bit to 1. Each succeeding displayed character received is dimmed on the screen.
End Dim	GS	1D	Sets dim bit to 0. Each succeeding displayed character received is displayed at full intensity on the screen.
NOOP ADV Mode (small)	US	1F	No operation.
Cursor Left ADV N Mode (large)	US	1F	See Cursor Left (EM).
Print Form	RS, SOH	1E, 01	See Print Form (SOH)
Page Print	RS, STX	1E, 02	See Page Print (DC1)
Tab ADV Mode (small)	RS, EOT	1E, 04	If protect is not active, this will cause the cursor to advance to the first position following next low-intensity field or next column tab (whichever comes first). If none are present, moves to top of page. If protect is active, moves to the next unprotected area or column tab (whichever comes first). If none are present, moves to top of page. Completion response is identical to Read Status response. No response is sent in large CYBER mode.
NOOP ADV N Mode (large)	RS,EOT	1E,04	No operation.
Enable CR Delimiter	RS, ENQ,	1E, 05	Caused a CR delimiter (0D) to be added to certain Host responses.

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
Home	RS, BS	1E, 08	See Home BS, (08)
Define Function or Action Key Code Sequence or Controlware Sequence	RS, HT, (V), (W) (X), (Y...), (Z)	1E, 09, (V), (W) (X), (Y...), (Z)	Causes a code sequence or controlware sequence to be defined by the host. See Section 3.9.2.5.1. V = Key identifier and address pointer. W = Function. X = Address. Y = Code sequence or controlware Z = Specified delimiter. The terminal will respond with an ACK if all codes received okay and an RS, NAK if not. No response is sent in large CYBER mode.
Back Tab	RS, VT	1E, 0B	Causes the cursor to move back to the first position following a preceding low-intensity field, following a preceding protected field position, at preceding column tab or to Home position if none are encountered. See Back Tab key for more detailed definition. Completion response is identical to Read Status response. No response is sent in large CYBER mode.
Read Attribute	RS, SO (X), (Y)	1E, 0E (X) (Y)	Causes terminal to respond with two characters containing attributed character at cursor position. Cursor is not advanced; stored data is not affected. Data word one bit significance is: 2^0 - internal program use; 2^1 - underscore; 2^2 - blink; 2^3 - reduced intensity; 2^4 and 2^5 - set to logical 1. If data bit 2^6 is logical 1, character displayed at cursor position is not an alphanumeric or control character. Refer to Tables 3.9.1 and

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
Read Attribute (Contd)			3.9.2-8; if 2^6 is a logical 1 and data word at cursor position falls in columns 4, 5, 6, or 7,symbol is extended character. If data word falls in columns 2 or 3, symbol is one of line drawing set (Table 3.9.10). Data word two-bit significance is: 2^0 - modified position; 2^1 - protected position; 2^2 -blank; 2^3 - inverse; 2^4 and 2^5 - set to logical 1; 2^6 - set to logical 0.
Read Parameter	RS, SI	1E, 1F	See RS, DC3
Read Data	RS, DLE	1E, 10	Causes data word stored in memory at cursor position to be transferred to interface. Cursor is not advanced. Seven data bits are transferred. Determining if the code represents an alphanumeric character, line drawing, extended character, or control code requires that the attribute character be read. Refer to read attribute command and buffer mode operation.
Page Print ADV Mode (Small)	RS, DC1	1E, 11	See Page Print (DC1)
X-ON ADV N Mode (large)	RS, DC1	1E, 11	This is not a normal sequence. If the DC1 is following an RS the X-ON function will be performed (see DC1) but the next code received will be acted upon as if an RS preceded it.

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
Read Parameter ADV Mode (small)	RS, DC3	1E, 13	Causes terminal to transmit settings of terminal operating parameters. Settings are sent out in data words preceded by sequence 02, 06, 25 and terminated with a Read Status response. See Table 3.9.14. No response sent in large CYBER mode.
X-OFF ADV N Mode (large)	RS, DC3	1E, 13	This is not a normal sequence. If the DC1 is following an RS the X-ON function will be performed (see DC1) but the next code received will be acted upon as if an RS preceded it.
Read Status	RS, DC4	1E, 14	Causes terminal to respond 02, 06, 06 (STX, ACK, ACK) if all preceding self-test operations were completed successfully. The response 02, 06, 15 (STX, ACK, NAK) is transferred if any self-test failed.
Initiate Test	RS, SYN	1E, 16	Causes terminal to perform self-test (Test 2) operation; no response to further commands until self-test is completed. Terminal signals completion of self-test by automatically sending a Read Status response. Refer to Self-Test Routines paragraph for further description.
Skip	RS, CAN	1E, 18	See Skip (CAN, 18)
Backspace	RS, EM	1E, 19	See Backspace (EM, 19)
Cursor Down	RS, SUB	1E, 1A	See Cursor Down (SUB, 1A)

NOTE: Multiple words response sequences are subject to character pacing as described in Transmitted Data paragraph.

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
Line Drawing	RS, FS	1E, 1C	Causes terminal to interpret any following data words received from 20 to 3F as line drawing characters. Refer to Table 3.9.10 for codes.
Basic Char	RS, GS	1E, 1D	Causes terminal to interpret received data as normal characters.
NOOP	RS, SP thru RS, .	1E, 20 thru 1E, 2E	No operation.
NOOP	RS, ø thru RS, >	1E, 3ø thru 1E, 3E	No operation.
Clear field			
o Low Intensity	RS, ?	1E, 3F	Causes terminal to clear all unprotected data from cursor position to end of page for all data or only unprotected high- or low-intensity areas as selected. No response is provided to I/O commands during operation. Modified attribute bits for all cleared character positions are cleared. The "Read Status" is sent back to indicate operation complete. No response is sent in large CYBER mode.
o High Intensity	RS, @	1E, 40	
o All Data	RS, P	1E, 50	
Initiate Host DLL	RS, A	1E, 41	Initiates a host specified downline load (DLL). The host DLL command is followed by standard load blocks until all load blocks are loaded or an uncorrectable error occurs. If the load completes successfully, control is transferred to the loaded controlware. If unsuccessful, terminal responds with RS, NAK (1E, 05). See section 3.6 for ASCII Network Loader.

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
Exit Host DLL	RS, B	1E, 42	Reserved for host command to loaded controlware.
Model Report Request	RS, C,(n)	1E, 43, (n)	n = 30 Terminal installation parameters n = 31-36 Requesting that modes NVM only n = 37 Active status from RAM The terminal sends the following code sequence to the host system 1E Header Code 6F Header Code 23 Indicates model report request data follows 21 Indicates a Viking X terminal XXX Configuration Code; See Section 3.9.2.5.2 YYY Firmware code ZZZ Termination code NOTE: Terminal and NVM data is only valid while running in CYBER mode (Mode 1).
Start Inverse	RS, D	1E, 44	Set inverse bit of each succeeding character received to 1.
End Inverse	RS, E	1E, 45	Clear inverse bit of each succeeding character received.
Print I/O	RS, F	1E, 46	Causes terminal to direct all received data, and transmitted data in half duplex, or local, to printer interface. Completion response is identical to Read Status, No response is sent in large CYBER mode.
NOOP	RS, I	1E, 49	No operation.
NOOP	RS, J	1E, 4A	No operation.
Delete Character	RS, N	1E, 4E	Deletes one character. All characters to the right of the cursor are shifted left

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
Delete Character (Contd)			one position. If protect enable is active, shift occurs only up to protected data.
Insert Character	RS, 0	1E, 4F	Inserts one space character. Character in cursor position and all characters to the right of the cursor are shifted right one position. If protect enable is active, shift occurs only up to protected data.
Clear o All Data	RS, P	1E, 50	See Clear Fields.
Delete Line	RS, Q	1E, 51	Causes all unprotected line data and associated highlight fields below cursor and within the logical page or unprotected area limits to be moved up one position; current line is lost; buttom line is cleared. No response to I/O commands during operation. Completion response is identical to Read Status response. No response is sent in large CYBER mode. Modified attribute bits for all cleared character positions are cleared.
Insert Line	RS, R	1E, 52	Causes all unprotected line data and associated highlight field on current line to be relocated one line down; bottom line within logical page or unprotected area is lost; current line is cleared. No response to I/O commands is provided during operation. Insert line timing and completion response are identical to delete line. Modified attribute bits for all cleared character positions are cleared.

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
Load RAM Extended Character Generator*	RS,S,(W), (X), (Y), (Z)	1E, 53,(W) (X), (Y), (Z)	Causes the terminal to interpret the characters following the RS, S, [1E, 53 command (W) (X), (Y), (Z) as information concerning the RAM character generator. Loading the generator requires the character be specified (40 through 7F, six bits, 64 characters). It also requires the starting scan be specified (one of sixteen numbered top to bottom, four bits) the dot patterns may then be specified (eight possible dots); left to right, lowest to highest order bit position. The data words are formatted as follows: o Word 1 (W) - Character Code. Code must be between 40 through 7F. Codes outside this field cause an RS NAK to be sent to the host when the termination code is received. o Word 2 (X) - Start Scan Count. Bits 2^0 through 2^3 contain the start count. 2^4 must be 0, 2^5 must be 1, 2^6 must be 0. o Word 3 (Y) - Dot Pattern. Dot Patterns are sent in groups of 2. Bits 2^0 through 2^3 of the first word are the upper 4 dots and 2^0 through 2^3 of the second word are the lower 4 dots. Bit 2^4 must be 0, 2^5 must be 1, 2^6 must be 0 for first word and 1 for the second word. If an error is received an RS, NAK will be sent to host when the termination code is received. o Word 4 (Z) - Termination Code CR. An ACK will be sent to host if no errors received otherwise an RS, NAK is returned. No response is sent in large CYBER mode.

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
Extended Character*	RS, T,(X)	1E, 54,(X)	Causes terminal to interpret (X) as character to be displayed from RAM character generator. Code must be in field 40 through 7F. Codes outside of this field cause entry of parity error symbol. Restriction: Extended characters cannot be simultaneously displayed with PLATO characters
Field Scroll Up	RS, U	1E, 55	Causes each line to be relocated up one position between upper-and lower-field delimiters. Uppermost line in scroll field is lost; bottom line in scroll field is cleared. No response to I/O commands is provided during operation. Completion response is identical to Read Status. No response is sent in large CYBER mode.
Field Scroll Down	RS, V	1E, 56	Causes each line to be relocated down one position between upper-and lower-field delimiters. Lowest line is lost; uppermost line in scroll field is cleared. No response to I/O commands is provided during operation. Completion response is identical to Read Status. No response is sent in large CYBER mode.
Set Scroll Field	RS,W,(U,)(L)	1E, 57, U, L	Causes terminal to store upper- and lower-line addresses of scroll page field. Refer to X/Y position command for line addressing definition. Receipt of line numbers other than 1 through 30 causes entry of line 30 and 1. Address biasing is supported if selected.

NOTE: Multiple words response sequences are subject to character pacing as described in Transmitted Data paragraph.

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
NOOP	RS, X	1E, 58	No operation.
Erase	RS, Y	1E, 59	See RS,] 1E, 5D
NOOP	RS, Z	1E, 5A	No operation.
NOOP	RS, [	1E, 5B	No operation.
NOOP	RS, \	1E, 5C	No operation.
Erase	RS,]	1E, 5D	All character locations in the current unprotected field are cleared to spaces and the cursor is moved to the beginning of the unprotected field.
NOOP	RS, ^	1E, 5E	No operation.
NOOP	RS, _	1E, 5F	No operation.
Blind Printer	RS, DEL	1E, 7F	Causes terminal to stop transferring received and transmitted data to printer. Initial value selected by parameter. RS, DEL is transmitted to printer. The completion response is identical to Read Status. No response is sent in large CYBER mode.
NOOP	RS,DC2,SP thru RS,DC2,?	1E, 12, 20 thru 1E, 12, 3F	No operation.
Enter ADV mode (small)	RS, DC2, A	1E, 12, 41	Enter advanced (ADV) mode of operation.
Enter ADV N mode (large)	RS, DC2, B	1E,12, 42	Enter Advanced Native (ADV N) mode operation.

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
Clear Modified Bits	RS, DC2, C	1E, 12, 43	Clears all character modified bits on a display page that were set due to operator character entry.
Send Modified Data	RS, DC2, D	1E, 12, 44	The terminal sends only the data characters with their corresponding modified bit set. The modified bit is set due to operator entry at specific character locations. A physical field identifier (see Read Cursor Address) precedes each field sent. A delimiter indicates the end of operation.
Reserved	RS, DC2, E	1E, 12, 45	
Reserved	RS, DC2, F	1E, 12, 46	
Set 132 Character Line	RS, DC2, G	1E, 12, 47	Causes the terminal to display 132 characters/line. If the initial line length is 80 characters per line, the display is cleared and cursor is moved to Home.
Set 80 Character Line	RS, DC2, H	1E, 12, 48	Causes the terminal to display 80 characters/line. If the initial line length is 132 characters per line, the display is cleared and cursor is moved to Home.
Start Protect	RS, DC2, I	1E, 12, 49	Set Protect bit of each succeeding character received to a 1.
Clear Protect	RS, DC2, J	1E, 12, 4A	Clear Protect bit of each succeeding character received to a 0.
Enable Protect	RS, DC2, K	1E, 12, 4B	Protected characters (with their protect bit set) are protected from operator action and can only be changed by host action.

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
Disable Protect	RS, DC2, L	1E, 12, 4C	Disables protected characters on the display page. If an operator changes a character location, its protect bit is determined by the state of the start/clear protect bit flag.
Disable Keyboard	RS, DC2, M	1E, 12, 4D	Disable keyboard entry, until reenabled by host or a reset condition.
Enable Keyboard	RS, DC2, N	1E, 12, 4E	Enable keyboard entry.
Disable Display	RS, DC2, O	1E, 12, 4F	Disables change to display refresh memory for normal terminal operation. All incoming commands are ignored until the Enable Display is received.
Enable Display	RS, DC2, P	1E, 12, 50	Enables normal display operation.
Disable Touchpanel	RS, DC2, Q	1E, 12, 51	Disables input from the touchpanel.
Enable Touchpanel	RS, DC2, R	1E, 12, 52	Enables input from the touchpanel. (See Section 3.9.2.6)
Mode Select	RS, DC2, S, (n)	1E, 12, 53, (n)	Selects mode n = 30-37 (0-7) and transfers control to selected mode. Mode enable and mode security are by passed. See Auto-Select parameter in Terminal Installation parameter (3.3.3.1). If n is outside of range an RS, NAK is returned.
PLATO Character	RS, DC2, T, (X)	1E, 12, 54, (X)	Causes terminal to interpret (X) as PLATO character to be displayed. Code must be in field 40 thru 7F. Codes outside this

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
PLATO Character (Contd)			field will cause entry of parity error symbol. Restriction: Cannot simultaneously display extended and PLATO characters. See Table 3.9.11.
Select Bi-directional Port N	RS, DC2, U, (N)	1E, 12, 55, (N)	Selects bi-directional port N where N = 0-1. When selected the port can transmit transparent bi-directional data until a deselect is issued. See Section 3.9.2.5.3.
Write New Mode Parameters	RS, DC2, V, (Y), (Z)	1E, 12, 56, (Y), (Z)	Causes the terminal to write the RAM (dynamic) parameter memory specified. Y = Write data to parameter memory in format specified by Section 3.9.2.5.6. Note: Permanent NVM memory is not changed. Z = Delimeter. CR
Set Column Tab	RS,DC2,W,	1E, 12, 57,	Causes the terminal to set a column tab for the current column
Clear Column Tab	RS,DC2,X,	1E, 12, 58,	Causes the terminal to clear the column tab position of current column.
Clear All Tabs	RS,DC2,Y	1E, 12, 59	Clear all column tabs.
Disable CR Delimiter	RS, DC2, Z	1E, 12, 5A	Disables the CR delimiter for multiple code and controlware sequences.
Start Blank	RS,DC2,[	1E, 12, 5B	Set the blank attribute bit.
End Blank	RS,DC2,\	1E, 12, 5C	Clear the blank attribute bit.
Select 24 lines	RS,DC2,]	1E, 12, 5D	Set 24 lines.

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
Select 30 lines	RS,DC2,^	1E, 12, 5E	Set 30 lines.
Enter Block Mode	RS, DC2, a	1E, 12, 61	Enter block mode operation.
Exit Block Mode	RS, DC2, b	1E, 12, 62	Exit block mode operation.
Start Host Message	RS, DC2, c	1E, 12, 63	Causes the terminal to enable display of a host message on the last two lines of display. Current data is saved. Attribute bits are active and message is host defined. See Section 3.9.2.5.5 for more details. NOTE: Column tabs are affected as data is stored.
Clear Host Message	RS, DC2, d	1E, 12, 64	Clears host message displayed on last two lines and restores the saved data. See Section 3.9.2.5.5 for more details.
Turn On Indicator	RS, DC2, e, (N)	1E, 12, 65, (N)	Causes terminal to turn on indicator specified by (N). N = 30: Alert indicator N = 31: Programmable indicator 1 N = 32: Programmable indicator 2 N = 33: Programmable indicator 3 N = 34: Message indicator
Turn Off Indicator	RS, DC2, f, (N)	1E, 12, 66, (N)	Causes terminal to turn off indicator specified by (N). N = 30: Alert indicator N = 31: Programmable indicator 1 N = 32: Programmable indicator 2 N = 33: Programmable indicator 3 N = 34: Message indicator

TABLE 3.9.13. CYBER MODE RECEIVE AND I/O RESPONSES (CONTD)

COMMAND NAME	ASCII MNEMONIC	HEX CODE	TERMINAL RESPONSE
NOOP	RS, DC2, g	1E, 12, 67	No operation.
Driver Request	RS, DC2, h	1E, 12, 68	Causes the terminal to test for presence of a driver. A Status response is sent to the host or control is passed to the driver. o RS, NAK if transfer not successful. (See Section 3.9.2.7).
Enable Typamatic	RS, DC2, i	1E, 12, 69	Enable typamatic keys defined by Table 8.
Disable Typamatic	RS, DC2, j	1E, 12, 6A	Disable typamatic keys defined by Table 8.
Invert Numeric Pad	RS, DC2, k	1E, 12, 6B	Causes the numeric keypad to operate as follows: The cursor positioning keys operate without using the shift key, numbers operate when shift is depressed.
Normal Numeric Pad	RS, DC2 l	1E, 12, 6C	Returns the numeric keypad to normal operation.
Start Validation	RS, DC2 m	1E, 12, 6D	Sets the character validation attribute bit for each character stored.
End Validation	RS, DC2 n	1E, 12, 6E	Clear the character validation attribute bit for each character stored.

TABLE 3.9.14. READ PARAMETER DATA WORD FORMAT

	WORD 1	WORD 2	WORD 3	WORD 4	WORD 5
b0	0 = PAGE 1 = ROLL	0 = EOL BELL 1 = DISABLE BELL	0 = PAR ODD 1 = PAR EVEN	Baud Rate 2^3	1
b1	0 = HALF DUP 1 = FULL DUP	0 = AUTO LF 1 = Normal	0 = 2 STOP BITS 1 = 1 STOP BIT	Baud Rate 2^2	1
b2	PRINTER DSR (READY)	1	0 = PARITY DISABLE 1 = PARITY ENABLE	Baud Rate 2^1	0 = DTR SWITCHED 1 = DTR CONSTANT
b3	BI-DIRECTION PORT DSR (READY)	1	0 = DATA ONLY 1 = NORMAL	Baud Rate 2^0	0 = RTS SWITCHED 1 = RTS CONSTANT
b4	1	1	1	1	1
b5	1	1	1	1	1
b6	1	1	1	1	1

3.9.2.5.1 Host Specified Code Sequence/Controlware

The keyboard has 45 keys that can be redefined by the host. The host can specify if a key is to act as previously defined, send a different code sequence, or execute loaded controlware. A 2.3K block of RAM is reserved for this function (D000 to D8FF bank 4). If the disk controlware is not going to be used, the 4K between C000 to CFFF can be used for defining the keys. The last 144 locations make up a table used by the firmware to determine which operation is to be performed on each key.

	D000	START OF LOADED CODE SEQUENCES/CONTROLWARE		
	D86F	END OF LOADED CODED SEQUENCES/CONTROLWARE		
		FUNCTION	ADDRESS UPPER	ADDRESS LOWER
Key 1 VALIDATION	D870			
Key 2 F1	D873			
Key 3 F2	D876			
Key 45	D8F4			
46	D8F7			
47	D8FA			
48	D8FD			
	D900	START OF STATUS LINES		

- Host Interface - The host can specify keys and load code sequences or controlware in the following manner.

RS, HT, (V), (W), (X), (Y...), Z

V = Key identifier
W = Function
X = Address
Y = Code sequence or controlware code
Z = Terminator code

3.9.2.5.1 (Contd)

- V (Key Identifier)

30	VALIDATION						
31	F1	3E	F14 COPY	4B	LAB	58	7
32	F2	3F	F15 □	4C	DATA	59	8 ↑
33	F3	40	TAB →|	4D	STOP	5A	9
34	F4	41	TAB |←	4E	INSRT	5B	0
35	F5	42	NEXT ↵	4F	DLETE	5C	,
36	F6	43	+	50	CLEAR	5D	.
37	F7	44	-	51	PRINT	5E	
38	F8 ⇦	45	X	52	1	5F	
39	F9 SUPER	46	÷	53	2 ↓		
3A	F10 SUB	47	HELP	54	3		
3B	F11 MICRO	48	ERASE	55	4 ←		
3C	F12 FONT	49	EDIT	56	5 HOME		
3D	F13 TERM	4A	BACK	57	6 →		

- W (Function)

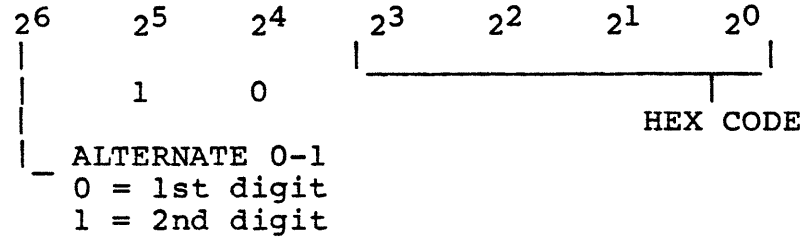
30 = Disable - send normal code - default value
31 = Host specified code sequence
32 = Host defined controlware
33 = Host Validation controlware

Default for all keys is 30.

- X (Address)

NOTE: This parameter is not required if W = 30.

This parameter is four codes wide. It contains the address where the code sequence/controlware starts. The address is converted to a modified hex value for each digit sending the highest digit first. The modified hex value is:



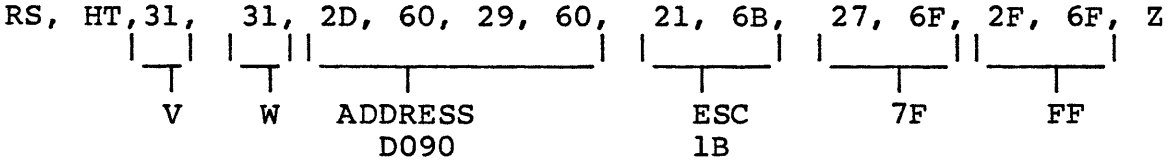
Example: Address D090 - RS, HT, V, W, 2D, 60, 29, 60

3.9.2.5.1 (Contd)

- Y (Code Sequence/Controlware Code)

Note: This parameter is not required if W = 30. This is the information that is stored in RAM starting at the address previously loaded. These words are formatted like the address.

o If information being loaded is a code sequence, the last word (two codes) will be a FF. Following is an example of how the host would change F1 to send ESC. 7F when pressed (store code at D090). The codes are stored in memory.



o If information being loaded is controlware, the FF is not needed. Information is stored until the termination code is detected.

If a parity error, framing error, or improper bit 6 occurs, data will be ignored until the termination code is received at which time an RS, NAK will be sent back to the host. If no error occurred, an ACK will be returned. No response will be returned in large CYBER mode.

-Z (Termination Code)

CR (0D) is the termination code.

o Keyboard Operation Character Mode

As each key is pressed it will be tested first to see if it is a key that the host can modify. If it is, the firmware will next test the function code in the table.

3.9.2.5.1 (Contd)

- If it is a disable code (30), the normal operation will be performed.
- If it is a host specified code sequence (31), the controlware will go to the address specified and send codes until the FF is found.
- If it is a host defined controlware (32), a call will be made to the address specified.

o Keyboard Operation Block Mode

As each key is pressed it will be tested first to see if it is a key that the host can modify. If it is, the firmware will next test the function code in the table.

- If it is a disable code (30), the normal operation will be performed.
- If it is a host specified code sequence (31) and the key is a function key, special action key or insert line or delete line, the new code sequence is sent to the host before the block send is initiated. If it is not one of the previously mentioned codes, the normal operation will be performed.
- If it is a host defined controlware (32), a call will be made to the address specified.

3.9.2.5.2 Model Report Request

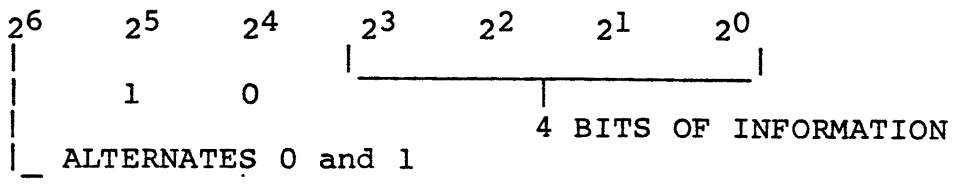
The host can request the terminals model, configuration, and parameters using this request (RS, C, (n)). The CYBER mode will respond to this request with the following:

3.9.2.5.2 (Contd)

```
1E      HEADER CODE
6F      HEADER CODE
23      INDICATES MODEL REPORT REQUEST DATA
21      INDICATES A VIKING X TERMINAL
XXX  |
 |   |
 |   |-- CONFIGURATION AND PARAMETERS
 |   |
XXX  |
 Y      FIRMWARE REVISION LEVEL
 Z      TERMINATION CODE
```

Each code sent contains 4 bits of information.

EXAMPLE



- Word 1

  2^0 , 2^1, 2^2 > Current Mode Active
  2^3 = 0

- Word 2

  2^0 = Not Used
  2^1 = Not Used
  2^2 = Battery Low
  2^3 = ROM PACK Option Installed

- Word 3

  2^0 = Channel A DSR
  2^1 = Channel A SCTS
  2^2 = Channel B DSR
  2^3 = Channel B SCTS
  > If no dual port present all bits = 0

3.9.2.5.2 (Contd)

- Word 4
  - 2^0 = Not Used
  - 2^1 = Not Used
  - 2^2 = Not Used
  - 2^3 = Not Used

The next 32 words are determined by the n value.

If n = 30 the Terminal Installation Parameters from NVM are sent.

If n = 31-36 the Mode Installation Parameters from NVM are sent.

If n = 37 the Active Mode Parameters from RAM are sent.

If n = 30 :

Terminal Parameters

- Word 5 - See F2, 1 thru 4, of Terminal Installation Parameters
- Word 6 - See F2, 5 and 6, and F3, 1 and 2 of Terminal Installation Parameters
- Word 7 - See F3, 3 thru 6, of Terminal Installation Parameters
- Word 8 - See F4, 1 thru 4, of Terminal Installation Parameters
- Word 9 - See F4, 5 and 6 and F5, 1 and 2, of Terminal Installation Parameters
- Word 10 - See F5, 3 thru 6, of Terminal Installation Parameters
- Word 11 - See F 6, 1, of Terminal Installation Parameters
- Word 12 - See F 6, 2, of Terminal Installation Parameters
- Word 13 - See F 6, 3, of Terminal Installation Parameters
- Word 14 - See F 6, 4, of Terminal Installation Parameters
- Word 15 - See AS-AUTO SELECT of Terminal Installation Parameters
- Word 16 - See X - Delta X of Terminal Installation Parameters
- Word 17 - See Y - Delta Y of Terminal Installation Parameters
- Word 18 - See L - Language of Terminal Installation Parameters
- Word 19-22 - See ID = Identification of Terminal Installation Parameters
- Word 23 - See PORT A - Parameters of Terminal Installation Parameters

3.9.2.5.2 (Contd)

- o Word 24 - See PORT A Baud of Terminal Installation Parameters
- o Word 25 - See PORT B - Parameter of Terminal Installation Parameters
- o Word 26 - See PORT B - Baud of Terminal Installation Parameters
- o Word 27-36 - Not Used

If n = 31 to 36 only that modes parameters are sent from NVM.
If n = 37 the active Mode Parameters are sent from RAM.

- o Word 5 - See F2 1 thru 4 of Mode Installation Parameter

  Word 6 - See F2 5 and 6, F3 1 and 2 of Mode Installation Parameter

  Word 7 - See F3 3 thru 6 of Mode Installation Parameter

  Word 8 - See F4 1 thru 4 of Mode Installation Parameter

  Word 9 - See F4 5 and 6, F5 1 and 2 of Mode Installation Parameter

  Word 10 - See F5 3 thru 6 of Mode Installation Parameter

  Word 11-14 - See OPR-DF of Mode Installation Parameter

  Word 15-26 - See A-DIAL of Mode Installation Parameter

  Word 27-28 - See DF of Mode Installation Parameter

  Word 29 - See T of Mode Installation Parameter

  Word 30 - See R of Mode Installation Parameter

  Word 31-34 - See ACCESS of Mode Installation Parameter

  Word 35-36 - Not Used

- o Y Firmware Revision Level - Two codes will be sent:

  - 1st code 1 to F = Release level; first release = 1
  - 2nd code 1 to F = Revision level; first revision = 1

- o Z Termination Code

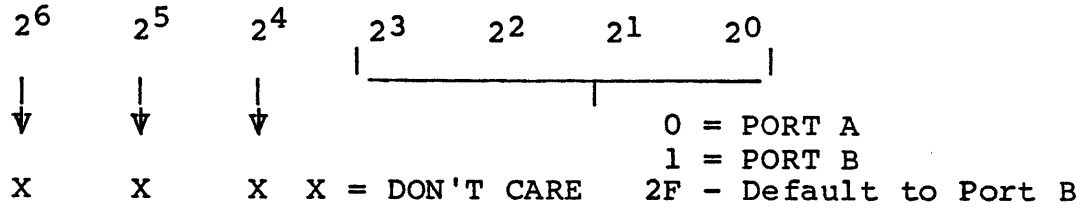
  - CR (0D)

.9.2.5.3 Host Select Bi-directional Port

In CYBER mode the host can select and send or receive information to either Port A or Port B of the optional bi-directional RS-232-C ports. The parameter bits for both ports must be set up before

3.9.2.5.3 (Contd)

entering CYBER mode. The host must make sure the transmit buffer is empty by ensuring X-On is active. When the terminal receives the host select bi-directional port sequence, it will interpret the next code (port and word size) as follows:



Ports A and B have no parameters to select word size. The default word size is 7 bits. The terminal will return an ACK to the host to indicate end of terminal data. The keyboard will be locked. DTR, RTS and CO will be sent to the selected port.

At this time all data received from the host will be sent to the selected port and will not be acted upon by the display. As data is received from the port it is placed into the comm output buffer to be sent to the host. The standard host communication protocol is used to send the data as if it came from the keyboard (Full/Half duplex, Constant/Switched RTS, Data Only).

If an RS is received from the host, it is not sent to the port. The next code is examined.

- If it is an RS, a single RS will be sent to the port, this allows the host to send an RS to the port.
- If it is a DC2, the bi-directional port will be deselected and the host interface will be returned to the parameter setting for word size and parity.
- If it is anything except the DC2, the code will be sent to the port and the previous RS ignored.
- If a parity error is received from the host, a 7F is sent to the port.

3.9.2.5.4 X-Off/X-On

- Receiving X-OFF/X-ON

Transmit off/Transmit on (X-Off/X-On) is supported by CYBER mode. Each operating mode is defined in the following text.

- Character mode - When the X-Off is received from the host, all codes being sent to the host will be placed in the comm output buffer until the buffer becomes full. At this time the keyboard is locked. When the X-On is received, the buffer will send and the keyboard unlocked.

- Block Mode - When the X-Off is received from the host, no information will be sent to the host; keyboard entry is still allowed. If a send function is initiated the comm output buffer will be filled and no other operations will be performed until the X-On is received. When X-On is received, transmission will continue; the keyboard will remain locked until cleared by the completion of block send.

- Bi-direction Port - When the bi-directional port is selected. X-On must be active.

- Sending X-OFF/X-ON

When the operator enters operator parameter entry mode, the X-Off is sent to the host. When the mode is exited, the X-On will be sent to the host if the on-line is still selected.

The terminal has a receive buffer of 992 characters. If this buffer ever reaches 768 characters the X-OFF will be sent to the host and the X-ON sent when the count goes down to 256.

3.9.2.5.5 Start Host Message/Clear Host Message

The host can interrupt operation and display a dual line of information in the last two lines without destroying any display information.

When CYBER mode receives the start host message command the following will occur.

- Locks the keyboard

- Lights the message indicator

3.9.2.5.5 (Contd)

- o Saves the current cursor position
- o Saves the current attribute word
- o Swaps the last two lines with cleared lines (additional line)
- o Selects a temporary character mode full-duplex operation
- o Places the cursor at start of new lines

The host can now enter information in the last lines.

Note: The host should not move the cursor from the last two lines or scroll the screen and must be responsible for clearing this operation. If the terminal is ever hung in this condition, the RESET will exit the operation.

When CYBER mode receives the clear host message command, the following will occur.

- o Swaps the last two lines with the original lines
- o Moves the cursor to its original position
- o Reselects the original attributes
- o Clears the temporary character mode operation
- o Clears the message indicator
- o Unlocks the keyboard

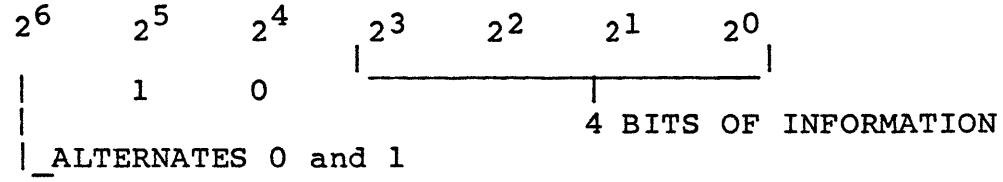
3.9.2.5.6 Write New Mode Parameters

The host can temporarily override the CYBER mode installation parameters by changing them in the active RAM table.

Note: The host cannot change the Nonvolatile Memory table.

3.9.2.5.6 (Contd)

When CYBER mode receives the write new mode parameter command, it will input up to 32 codes and replace the active mode parameter words with them. The 32 words correspond to the 32 groups found in Section 3.3.3.2 (Mode Installation Parameters). The 32 codes are received in the following format.



The first code received should have $2^6 = 0$. If an error is received during the code sequence, data will be ignored until the termination code is received at which time an RS, NAK is sent to the host. If no errors are detected, an ACK is sent to the host and control will be sent back to cause the new codes to be implemented. This will clear the screen and reset the cursor.

Note: No response is sent in large CYBER mode.

3.9.2.6 Touchpanel Operation/Raster Alignment

The basic terminal CYBER mode includes the capability to support touchpanel operation. General support is described as follows:

- The touchpanel has 16 vertical and 16 horizontal strips. Each strip is .5 inches wide. Where the vertical and horizontal strips intersect is a .5-inch square cell. With 80 characters per line, the cell covers two lines by four characters. With 132 characters per line, the cell covers two lines by 6.2 characters.

- Touchpanel activated selection to a defined single character position located within the activated cell. Normally, this is intended to be the bottom center character located in the touchpanel cell.

- The hardware supports the displaying of 32 lines. When 30 or 24 lines are displayed, they are centered on the screen.

Note: The displayable area of 30 lines by 80 characters is 7.5 inches high by 10 inches wide. The area covered by the touchpanel is 8 inches by 8 inches. This means one inch on each side and .25 inch on top and bottom is not covered by the touchpanel.

3.9.2.6 (Contd)

When 30 lines are displayed the top line is under the bottom half of the top strip of the touchpanel, and the last line is under the top half of the bottem strip. When 24 lines are displayed the top two and bottom two strips of the touchpanel have no data under them.

The following tables show the X and Y positions (decimal) that are used when positioning the cursor.

Char/ Line	TP STRIPS LEFT TO RIGHT															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
80	11	15	19	23	27	31	35	39	43	47	51	54	58	62	66	70
132	20	26	33	39	45	51	57	64	70	76	82	88	95	101	107	113

Lines/ Screen	TP STRIPS TOP TO BOTTOM															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
24	1	1	2	4	6	8	10	12	14	16	18	20	22	24	24	24
30	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	30

3.9.2.6.1 Host Communications

The host utilizes two special commands to support touchpanel operation. The host can enable or disable the function. If enabled, operation is supported by operator initiated selection input to the host. The host can request terminal configuration status to determine presence of the touchpanel option.

3.9.2.6.2 Terminal Operation

When a touchpanel operation is active, the following actions occur:

a. The operator determines desired position.
b. The operator activates touchpanel at the desired position.
c. The terminal computes X, Y position activated.
d. The terminal moves cursor to X, Y position activated.
e. The terminal sends a select function to the host. The select function sends an RS, M code (1E, 4D) sequence to the host.
f. The terminal sends a "Read Cursor Address" function to the host to specify X, Y cursor position. Refer to Table 3.9.13 for definition.

   o Sends termination character

     - CR (0D)

3.9.2.6.3 Keyboard Operation

Keyboard operation for touchpanel operation is identical to the operations previously described. It should be noted that the /CTRL/LAB key code sequence is the same as the touchpanel select function code sequence used to specify operator input. This allows keyboard simulation of a touchpanel.

3.9.2.7 Flexible Disk Operation

The flexible disk controlware is stored on disk on the auto-track of the diskette. The disk must be inserted and made ready before operation begins. The host or an operator can load the controlware.

The operator can load the controlware by simultaneously pressing CTRL/DATA. An X-OFF code will be sent to the host. If the controlware has not been loaded, a load is attempted. If the load fails a message DISK LOAD FAIL will be displayed and an X-ON sent to the host. If the controlware has been loaded or the load is completed control is transferred to the starting address + 3. When control is returned an X-ON is returned.

The host can initiate the load, (see CYBER Mode Receive and I/O Response table for code). If the controlware has not been loaded a load is attempted. If the load fails a message DISK LOAD FAIL will be displayed and an RS, NAK sent back to host. If the controlware has been loaded, control will be transferred to starting address.

3.9.3 Interfaces

CYBER mode will interface to a host using either the 1200/1200 internal modem, current-loop or host RS-232-C interface and to an operator using the keyboard or touchpanel.

3.9.4 Aborts and Recovery

A print operation can be aborted by pressing SHIFT/M REL.

A break can be transmitted to the host by pressing the BREAK key.

A terminal lock-up condition can be recovered by pressing the RESET switch and starting over.

3.9.5 Errors

If parity errors are received while alphanumeric display information is being received, a rubout character will be displayed.

If a parity error is received from the keyboard, the code is ignored.

3.9.6 Performance

CYBER mode should be able to receive information at 19.2K baud without any nulls inserted. If a printer is selected, data will be sent to the printer without any delays, the host must implement any timing restraints or deselect the printer and do a host command to print page.

3.9.7 Installation Parameters

The terminal installation and CYBER mode installation (mode 1) must be set up before operation begins.

4.0 PRODUCT-LEVEL DESCRIPTION

4.1 Publications Affected

CDC-PUB 62940020	Reference/On-Site HMM
CDC-PUB 62940034	Technical Support HMM
CDC-PUB 62940019	Operator's Guide/Installation Manual

4.2 Equipment Configuration

The minimum/target hardware configuration supported by this firmware is the Viking X terminal with no options running in CYBER mode. Operation with the Resident Firmware is not hardware configuration dependent.

The maximum configuration supported by this firmware is the Viking X terminal with the following options:

- ROM Pack Option
- Dual Serial I/O - ASCII Printer or bi-directional
- Parallel I/O - Flexible Disk Subsystem - Graphic Printer
- Touchpanel - Graphic Option Required
- 1200/1200 Internal Modem Interface
- Async/Current Loop Option

4.3 Interfaces to Software

4.3.1 Memory Layout

The terminal has more than 64K bytes of RAM and ROM in its maximum configuration, since a 16-bit address bus allows only 64K of direct addressing, memory bank controls are added.

Figure 4.3.1 shows all of the present memory broken up into 16K banks. The 64K of addressing is broken up in 4 blocks (see Figure 4.3.2). Block 0 starts at address 0000; block 4 starts at 4000; block 8 starts at 8000; and block C starts at C000. Banks can be selected into certain blocks to achieve the desired mode configuration. See Figure 4.3.3 for some mode configurations.

When the terminal is powered on or reset, banks 0, 6, 5 and 4 are selected in blocks 0, 4, 8, and C, respectively. The following bank selections will take place in the resident firmware depending upon type of load.

- CYBER Mode - No bank selection is performed.
- Load from ROM Pack - No bank selection is performed since ROM pack is selected in block 8.

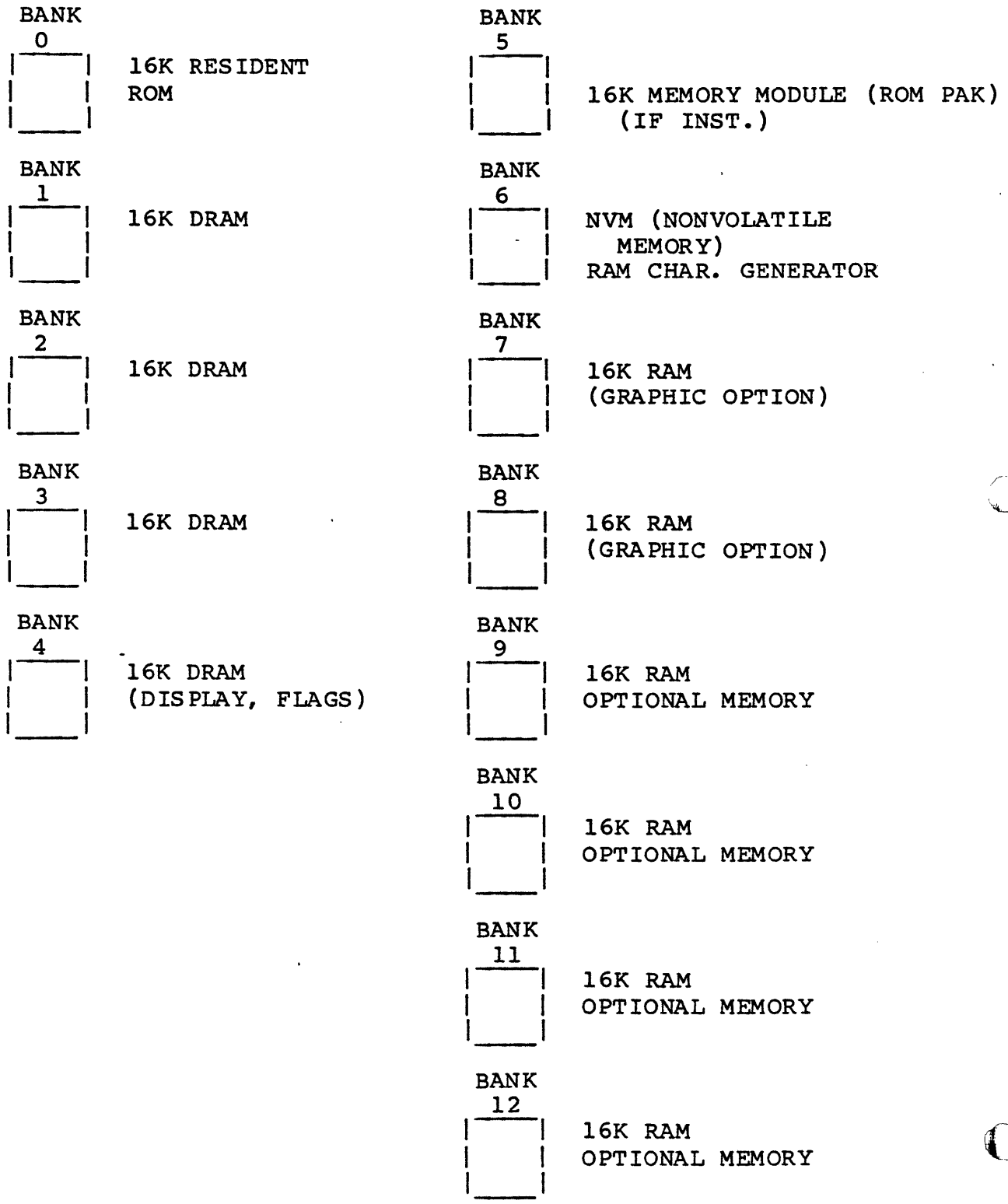
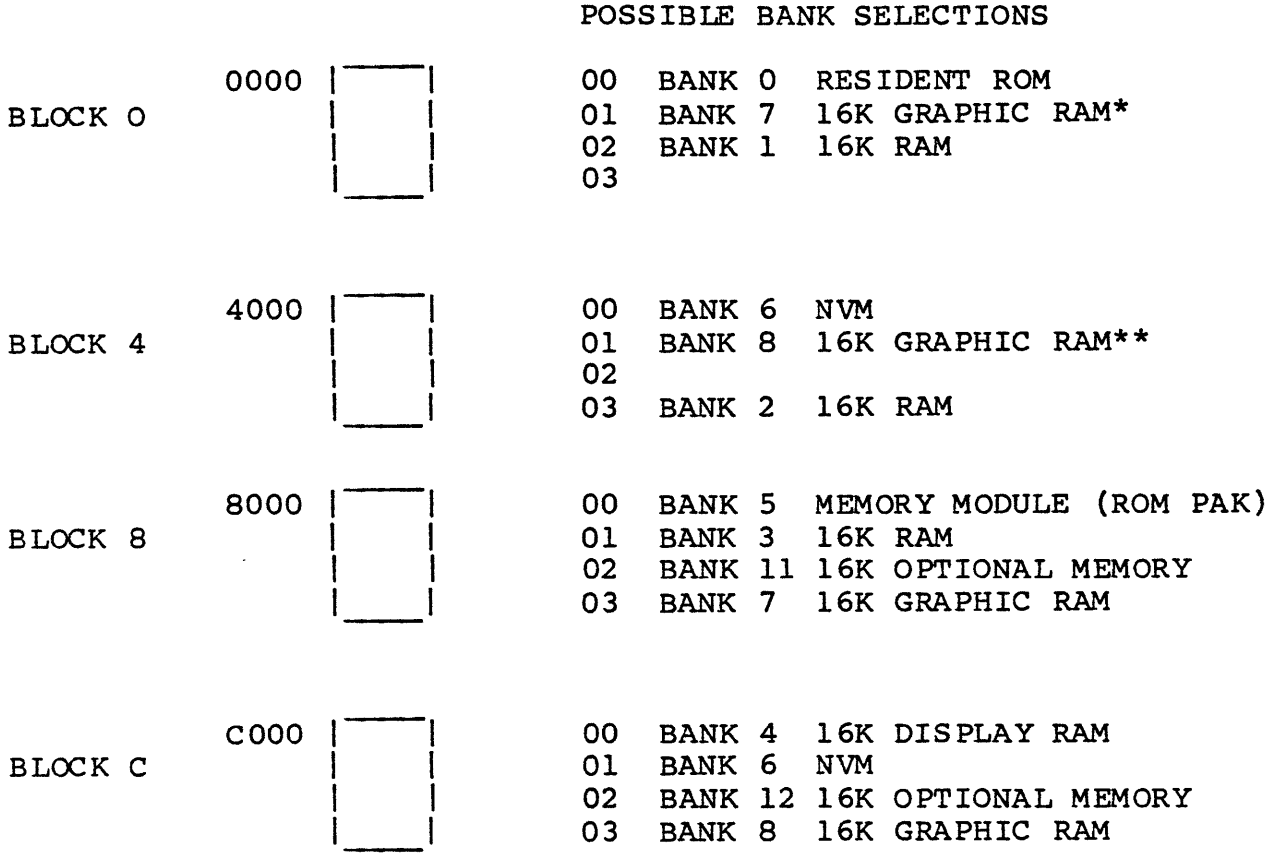


Figure 4.3.1. Bank Configurations



*DEFAULTS TO BANK 9 IF GRAPHIC OPTION NOT INSTALLED.

**DEFAULTS TO BANK 10 IF GRAPHIC OPTION NOT INSTALLED.

Figure 4.3.2. Block Configuration

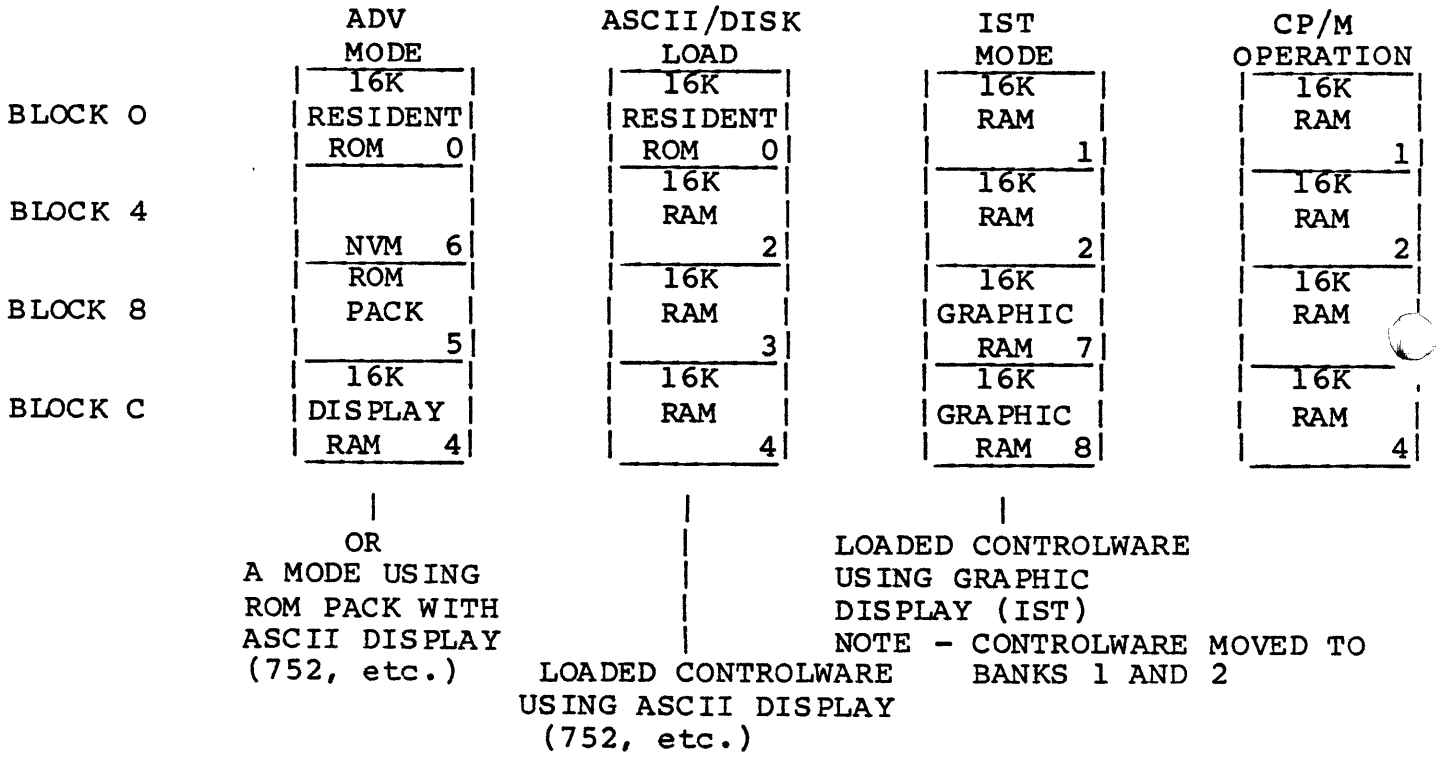


Figure 4.3.3. Memory Configurations

4.3.1 (Contd)

- Load from Host - When the ASCII loader is selected, banks 2 and 3 are selected in blocks 4 and 8, respectively. This could accommodate a load from 4000 of bank 2, and all of bank 3. At the completion of the load, control is tranferred to the first address designated in the load. If the loaded controlware does not want to use the ASCII display (banks 0 and 4), it must select the desired bank configuration.

- Load from Disk - When the disk loader is selected banks 2 and 3 are selected in blocks 4 and 8, respectively. At the completion of the disk load, control is transferred to the address specified by the first two words from the disk. If the loaded controlware does not want to use the ASCII display (banks 0 and 4), it must select the desired bank configuration.

  If the controlware being loaded is going to use the Graphic RAM, it must first move the controlware into banks 1 and 2 (block 0, 4), then select the Graphic RAM banks 7, 8 (block 8.C).

  EXAMPLE for loading PLATO:

  The resident loader will select banks 0, 2, 3, 4 in block 0, 4, 8, C respectively. The code would be loaded into banks 2, 3 (blocks 4,8) and control transferred to it. The loaded controlware would then disable ASCII video, select bank 1 (block 0) and move controlware from bank 2 to bank 1 and 3 to 2. It would then jump to entry point in bank 1 or 2 which would select banks 7 and 8 in block 8 and C.

Note: If PLATO is loaded from disk or in ROM PACK it must be moved according to above example.

4.3.2 Bank 4 Layout

Bank 4 contains 16K of dynamic random-access memory (DRAM). The ASCII display hardware uses this bank of memory for display refresh. The CYBER mode uses this bank also for flags, buffers, and stack pointer. Figure 4.3.4 shows the layout.

Bank 4 contains 16K of DRAM that is used by CYBER mode to display information. The data is arranged in lines. A line can be anywhere in the 16K area, but must start on an even address. The data is stored at even addresses and the attributes are stored at the next odd addresses.

ADDRESS		SIZE
C000 CFFF	DISK OPERATING CONTROLWARE	4096
D000 D86F	HOST LOADABLE CODES/CONTROLWARE	2160
D870 D8FF	HOST LOADABLE AREA TABLE	144
D900 DB0F	2 STATUS LINES	528
DB10 DB1F	KEYBOARD INPUT BUFFER	16
DB20 DEFF	COMM INPUT BUFFER	992
DF00 DFBF	COMM OUTPUT BUFFER	192
DFC0 DFFF	STACK POINTER	64
E000 E03B	DISPLAY TABLE	60
E03C E03F	LOAD FLAGS	4
E040 E0FF	ACTIVE RAM AND FLAGS	192
E100 E10F	INTERRUPT TRAPS	16
E110 FFFF	30 X 132 X 2 DISPLAY DATA	7920

Figure 4.3.4. Bank 4 Layout

4.3.2 (Contd)

A table is setup in the middle of the memory that tells the hardware where each line starts. See Figure 4.3.5 for an example of how the table and display DRAM are setup in CYBER mode.

4.3.3 User Interface to Resident Subroutines

The resident ROM firmware contains routines that can be used by user loaded controlware. A jump table has been placed at the beginning so that changes can be made to the resident firmware without requiring all external users to change their programs. The table in 4.3.3.1 shows the fixed address that an external user can call. Note: These addresses are to remain fixed and any new jumps are to be added to the end of the list.

4.3.3.1 Entry Point Jump Table

Address	Name	Description
0000	INIT	; INITIALIZATION
0003	INIT00	; INITIALIZATION 00
0006	INIT01	; INITIALIZATION 01
0009	INIT02	; INITIALIZATION 02
000C	CRT80	; SET CRT TO 80 CHR/LINE
000F	CRT132	; SET CRT TO 132 CHR/LINE
0012	CINIT	; COMM INITIALIZATION
0015	KINIT	; KEYBOARD INITIALIZATION
0018	PINIT	; PRINTER INITIALIZATION
001B	INTDIS	; INTERRUPT DISABLE
001E	INTENA	; INTERRUPT ENABLE
0021	CMTRAP	; COMM INTERRUPT TRAP
0024	KBTRAP	; KEYBOARD INTERRUPT TRAP
0027	TMTRAP	; TIMER INTERRUPT TRAP
002A	TPTRAP	; TOUCHPANEL INTERRUPT TRAP
002D	ADVCR	; ADVANCE CURSOR
0030	ADVMD	; ADVANCED MODE
0033	ALARM	; ALARM
0036	ALARMI	; ALARM IF ENABLED
0039	BDISPN	; DISPLAY B - PERFORM FUNCTION
003C	BFTB	; COMM BUFFER TO B
003F	BLDADD	; BUILD ADDRESS

4.3.3.1 (Contd)

Address	Name	Description
0042	CLEAR	; CLEAR
0045	CLREOL	; CLEAR TO END OF LINE
0048	CLREOP	; CLEAR TO END OF PAGE
004B	CRDOWN	; CURSOR DOWN
004E	CRGRTN	; CARRIAGE RETURN
0051	CRLEFT	; CURSOR LEFT
0054	CRLNFD	; CARRIAGE RETURN LINE FEED
0057	CRUP	; CURSOR UP
005A	DISPB	; DISPLAY B - STORE ON SCREEN
005D	DLYEN1	; DELAY ENABLE 1
0060	DLYEN2	; DELAY ENABLE 2
0063	DSTRNG	; DATA STRING
0066	HASCII	; HEX TO ASCII
0069	KBDAS	; CONVERT NEXT KEYBOARD CODE TO ASCII
006C	KBDASC	; KEYBOARD TO LOWERCASE ASCII
006F	KINPUT	; KEYBOARD INPUT
0072	MODENE	; DISPLAY MODE NOT ENABLED
0075	PABI	; PORT A BI-DIRECTIONAL
0078	PBBI	; PORT B BI-DIRECTIONAL
007B	PRINTB	; PRINT B
007E	RESET	; RESET
0081	SCROLL	; SCROLL
0084	SEND	; SEND NEXT CODE FROM COMM BUFFER
0087	SENDB	; STORE B IN COMM SEND BUFFER
008A	SETDE	; SET CURSOR TO DE
008D	SETCR	; SET CURSOR
0090	ST TM	; START DELAY TIMER
0093	TABBK	; TAB BACKWARDS
0096	TABFW	; TAB FORWARD
0099	TABCLR	; TAB CLEAR
009C	TABSET	; TAB SET
009F	TPINP	; TOUCHPANEL INPUT
00A2	SENDB8	; STORE B IN COMM SEND BUFFER
00A5	MNTOR	; USER ENTRY TO MONITOR
00A8	ADVINI	; ADVANCED MODE INITIALIZATION
00AB	KBDINP	; ADVANCED MODES KEYBOARD INPUT
00AE	CMTRPU	; COMM INTERRUPT TRAP-USER
00B1	KBTRPU	; KEYBOARD INTERRUPT TRAP-USER
00B4	TMTRPU	; TIMER INTERRUPT TRAP-USER
00B7	TPTRPU	; TOUCHPANEL INTERRUPT TRAP-USER
00BA	TIPRAM	; MOVE TERMINAL INSTALLATION
00BD	CRTOUT	; OUTPUT VALUES TO 5037 CRT CONTROLLER

ADDR V	TABLE		DISPLAY RAM	
E000	1 0		E110	
E001	E 1	LINE 1		DATA+ATTRI LINE 1
E002	1 8			
E003	E 2	LINE 2	E218	2
E004	20			
E005	E3	LINE 3	E320	3
E006	28			
E007	E4	LINE 4	E428	4
E008	30			
E009	E5	LINE 5	E530	5
E00A	38			
E00B	E6	LINE 6	E638	6
E00C	40			
E00D	E7	LINE 7	E740	7
E00E	48			
E00F	E8	LINE 8	E848	8
E010	50			
E011	E9	LINE 9	E950	9
E012	58			
E013	EA	LINE 10	EA58	10
E014	60			
E015	EB	LINE 11	EB60	11
E016	68			
E017	EC	LINE 12	EC68	12
E018	70			
E019	ED	LINE 13	ED70	13
E01A	78			
E01B	EE	LINE 14	EE78	14

Figure 4.3.5. Initial Display Memory Layout

E01C	80			
E01D	EF	LINE 15	EF80	15
E01E	88			
E01F	F0	LINE 16	F088	16
E020	90			
E021	F1	LINE 17	F190	17
E022	98			
E023	F2	LINE 18	F298	18
E024	A0			
E025	F3	LINE 19	F3A0	19
E026	A8			
E027	F4	LINE 20	F4A8	20
E028	B0			
E029	F5	LINE 21	F5B0	21
E02A	B8			
E02B	F6	LINE 22	F6B8	22
E02C	C0			
E02D	F7	LINE 23	F7C0	23
E02E	C8			
E02F	F8	LINE 24	F8C8	24
E030	D0			
E031	F9	LINE 25	F9D0	25
E032	D8			
E033	FA	LINE 26	FAD8	26
E034	E0			
E035	FB	LINE 27	FBE0	27
E036	E8			
E037	FC	LINE 28	FCE8	28
E038	F0			
E039	FD	LINE 29	FDF0	29
E03A	F8			
E03B	FE	LINE 30	FEF8 FFFF	30

Figure 4.3.5. Initial Display Memory Layout (Contd)

4.3.3.2 Common Variables

Common variables and flags are stored in Bank 4 and can be read or changed by the resident or user programs. They are broken up in terminal parameters, mode parameters and flags.

The terminal parameters are moved from NVM to the RAM area during initialization (before any mode is selected). The mode parameters are moved to the RAM area when the mode has been determined (before the mode has been loaded). The flags can be cleared by calling Advanced Mode Initialization (ADVINI).

4.3.3.3 Flag and Parameter Table

```
;*********************************************************
;
;          M O D E   I N S T A L L A T I O N   R A M / E Q U
;
;*********************************************************
E040    RAMST   .EQU    0E040H
E040    MBYTE1  .EQU    RAMST
0001    MODEEN  .EQU    01              ; MODE ENABLED
0002    SECEN   .EQU    02              ; SECURITY ENABLED
0004    OPSLSF  .EQU    04              ; OPERATOR SELECT SOURCE/FILE
0008    LDEN    .EQU    08              ; LOAD ENABLED (FROM HOST OR DISK)
E041    MBYTE2  .EQU    MBYTE1+1
0001    LDDISK  .EQU    01              ; LOAD FROM DISK
0002    INTMDM  .EQU    02              ; USE INTERNAL 1200-BAUD MODEM
0004    CLPEN   .EQU    04              ; CURRENT LOOP ENABLED
0008    AUTODL  .EQU    08              ; AUTO DIAL
E042    MBYTE3  .EQU    MBYTE2+1
0001    H8BIT   .EQU    01              ; HOST 8 BITS
0002    HPEN    .EQU    02              ; HOST PARITY ENABLED
0004    HPEVEN  .EQU    04              ; HOST PARITY EVEN
0008    H2STOP  .EQU    08              ; HOST 2 STOP BITS
E043    MBYTE4  .EQU    MBYTE3+1
0001    DTRSW   .EQU    01              ; DTR SWITCHED
0002    RTSSW   .EQU    02              ; RTS SWITCHED
0004    RPTDIS  .EQU    04              ; REPEAT DISABLED
0008    DTONLY  .EQU    08              ; DATA ONLY OPERATION
E044    MBYTE5  .EQU    MBYTE4+1
0001    HOMELL  .EQU    01              ; HOME LOWER LEFT
0002    AUTOLF  .EQU    02              ; AUTO LINE FEED ENABLED
0004    PACEEN  .EQU    04              ; PACING ENABLED
```

4.3.3.3 (Contd)

```
0008    BIASEN  .EQU   08              ; BIAS ENABLED
E045    MBYTE6  .EQU   MBYTE5+1
        ;               01              ; NOT USED
        ;               02              ; NOT USED
        ;               04              ; NOT USED
0008    RUNPAK  .EQU   08              ; 0 = RUN CYBER  1 = RUN ROM PACK
        ;*****************************************************
        ;               O P E R A T E R   P A R A M E T E R S
        ;*****************************************************
E046    OBYTE1  .EQU   MBYTE6+1
0001    LOCAL   .EQU   01              ; LOCAL
0002    PTSEL   .EQU   02              ; PRINTER SELECTED
0004    MRGEN   .EQU   04              ; MARGIN ALERT ENABLED
0008    ALERTL  .EQU   08              ; ALERT LOUD
E047    OBYTE2  .EQU   OBYTE1+1
0001    SFLOCK  .EQU   01              ; SHIFT LOCK
        ;       .EQU   02              ; NOT USED
0004    ROLLSC  .EQU   04              ; ROLL SCREEN
000B    PAGESC  .EQU   0BH             ; .PAGE SCROLL
0008    NATIVE  .EQU   08              ; NATIVE MODE / LARGE CYBER
E048    OBYTE3  .EQU   OBYTE2+1
0001    BGLITE  .EQU   01              ; BACKGROUND LIGHT
0002    CRBOX   .EQU   02              ; CURSOR BOX
0004    CRSLD   .EQU   04              ; CURSOR SOLID ON
        ;       .EQU   08              ; NOT USED
E049    OBYTE4  .EQU   OBYTE3+1
0001    FULL    .EQU   01              ; FULL DUPLEX
0002    CL132   .EQU   02              ; 132 CHARACTERS PER LINE
0004    LN30    .EQU   04              ; 30 LINES
0008    TRANS   .EQU   08              ; TRANSPARENT
        ;*****************************************************
        ;       M O R E   M O D E   P A R A M E T E R S
        ;*****************************************************
E04A    ADILE   .EQU   OBYTE4+1        ; AUTO-DIAL NUMBER
E056    DFILE   .EQU   ADILE+12        ; DEFAULT FILE NUMBER
E058    TBAUD   .EQU   DFILE+2         ; TRANSMIT BAUD RATE
E059    RBAUD   .EQU   TBAUD+1         ; RECEIVE BAUD RATE
E05A    SECURE  .EQU   RBAUD+1         ; SECURITY CODE
E060    OEND    .EQU   0E060H          ; END OF OPERATOR PARAMETERS
        ;*****************************************************
        ;       T E R M I N A L   P A R A M E T E R S
        ;*****************************************************
E060    TBYTE1  .EQU   OEND
0001    RAM64K  .EQU   01H             ; 64K RAM OPTION IN
0002    TPOPT   .EQU   02H             ; TOUCHPANEL OPTION IN
0004    DSOPT   .EQU   04H             ; DUAL SERIAL OPTION IN
0008    GPOPT   .EQU   08H             ; GRAPHIC PRINTER OPTION IN
```

4.3.3.3 (Contd)

```
E061    TBYTE2  .EQU   TBYTE1+1
0001    FDOPT   .EQU   01H          ; FLEXIBLE DISK OPTION IN
0002    PIOPT   .EQU   02H          ; PLATO INTERFACE OPTION IN
0004    IMOPT   .EQU   04H          ; INTERNAL 1200 MODEM OPTION IN
0008    ISOKBD  .EQU   08H          ; ISO 3243 KEYBOARD OPTION IN
E062    TBYTE3  .EQU   TBYTE2+1
0001    GOPT    .EQU   01H          ; GRAPHIC OPTION IN
0002    PAROPT  .EQU   02H          ; PARALLEL OPTION IN
0004    R232CL  .EQU   04H          ; RS-232-C/CURRENT LOOP OPTION IN
E063    TBYTE4  .EQU   TBYTE3+1
0001    ASELEN  .EQU   01H          ; AUTO SELECT ENABLE
0002    HZ50    .EQU   02H          ; 50 HZ POWER
E064    TBYTE5  .EQU   TBYTE4+1
E065    TBYTE6  .EQU   TBYTE5+1
E066    ASEL    .EQU   TBYTE6+1     ; AUTO SELECT 0-7 (DEFAULT MODE)
E067    XDELTA  .EQU   ASEL+1       ; SCREEN MOVE X DELTA
E068    YDELTA  .EQU   XDELTA+1     ; SCREEN MOVE Y DELTA 0-F
E069    LANG    .EQU   YDELTA+1     ; LANGUAGE 0-7
E06A    ID      .EQU   LANG+1       ; TERMINAL ID NUMBER 0000-FFFF
E06E    CHAPAR  .EQU   ID+4         ; CHANNEL A PARAMETERS
0008    BIDIR   .EQU   08H          ; BI-DIRECTIONAL PORT
0004    PARDIS  .EQU   04H          ; PARITY DISABLED
0002    PAREV   .EQU   02H          ; PARITY EVEN
0001    SB2     .EQU   01H          ; 2 STOP BITS
E06F    CHABD   .EQU   CHAPAR+1     ; CHANNEL A BAUD 0-F
E070    CHBPAR  .EQU   CHABD+1      ; CHANNEL B PARAMETERS
E071    CHBBD   .EQU   CHBPAR+1     ; CHANNEL B BAUD 0-F
E080    TEEND   .EQU   0E080H       ; TERMINAL EQUATE END
        ;*****************************************************
        ;       BI-DIRECTIONAL PORT
        ;*****************************************************
E080    BDATAR  .EQU   TEEND        ; BI-DIR DATA IN/OUT
0001    IER     .EQU   01H          ; INTERRUPT ENABLE REGISTER
0002    IIR     .EQU   02H          ; INTERRUPT ID REGISTER INPUT
0003    LCR     .EQU   03H          ; LINE CONTROL REGISTER OUTPUT
0004    MCR     .EQU   04H          ; MODEM CONTROL REGISTER OUTPUT
0005    LSR     .EQU   05H          ; LINE STATUS REGISTER INPUT
0006    MSR     .EQU   06H          ; MODEM STATUS REGISTER INPUT
        ;
        ;*****************************************************
        ;       COMM I/O STORED IN RAM
        ;*****************************************************
E081    CDATAR  .EQU   BDATAR+1     ; COMM DATA IN/OUT
        ;
```

4.3.3.3 (Contd)

```
        ;*********************************************************
        ;       PRINTER I/O STORED IN RAM
        ;*********************************************************
E082    PDATAR  .EQU    CDATAR+1        ; PRINTER DATA IN/OUT
        ;
        ;*********************************************************
        ;
        ;       I N P U T   B U F F E R S
        ;
        ;*********************************************************
E083    BFCNT   .EQU    PDATAR+1        ; NUMBER OF CHARACTERS IN COMM BUFFER
E085    BFINAD  .EQU    BFCNT+2         ; ADDRESS OF NEXT OPEN SLOT IN BUFFER
E087    BFOTAD  .EQU    BFINAD+2        ; ADDRESS OF NEXT CHARACTER TO BE TAKEN
        ;                                 FROM COMM INPUT BUFFER
E089    KBCNT   .EQU    BFOTAD+2        ; NUMBER OF CHARACTERS IN KEYBOARD
        ;                                 BUFFER
E08A    KBINAD  .EQU    KBCNT+1         ; ADDRESS OF NEXT OPEN SLOT IN BUFFER
E08C    KBOTAD  .EQU    KBINAD+2        ; ADDRESS OF NEXT CHARACTER TO BE TAKEN
        ;                                 FROM KEYBOARD INPUT BUFFER
E08E    TXCNT   .EQU    KBOTAD+2        ; NUMBER OF CHARACTERS IN TRANSMIT
        ;                                 BUFFER
E08F    TXINAD  .EQU    TXCNT+1         ; ADDRESS OF NEXT OPEN SLOT IN BUFFER
E091    TXOTAD  .EQU    TXINAD+2        ; ADDRESS OF NEXT CHARACTER TO BE TAKEN
        ;                                 FROM TRANSMIT BUFFER
        ;*********************************************************
        ;
        ;       D E L A Y S
        ;
        ;*********************************************************
E093    ALRACT  .EQU    TXOTAD+2        ; 250 MS ALARM DELAY ACTIVE
001F    ALRTM   .EQU    31              ; 31 X 8 = 248
E094    BRKACT  .EQU    ALRACT+1        ; 250MS. BREAK DELAY ACTIVE
001F    BRKTM   .EQU    31              ; 31 X 8 = 248
E095    KBDACT  .EQU    BRKACT+1        ; 1 SEC. KEYBOARD DELAY IS ACTIVE
007D    KBDTM   .EQU    125             ; 125 X 8 = 1 SEC
E096    KBRACT  .EQU    KBDACT+1        ; 60MS. KEYBOARD REPEAT IS ACTIVE
0008    KBRTM   .EQU    8               ; 8 X 8 = 64
E097    PCDACT  .EQU    KBRACT+1        ; 8 MS. PACING DELAY ACTIVE
E098    PNTACT  .EQU    PCDACT+1        ; 200MS. PRINTER DELAY ACTIVE
0019    PNTTM   .EQU    25              ;
E099    TXDACT  .EQU    PNTACT+1        ; 8MS. TRANSMIT DELAY IS ACTIVE
E09A    UD1ACT  .EQU    TXDACT+1        ; USER DELAY 1 ACTIVE
E09B    UD1ADD  .EQU    UD1ACT+1        ; USER DELAY 1 ADDRESS
E09D    UD2ACT  .EQU    UD1ADD+2        ; USER DELAY 2 ACTIVE
E09E    UD2ADD  .EQU    UD2ACT+1        ; USER DELAY 2 ADDRESS
```

4.3.3.3 (Contd)

```
        ;*******************************************************
        ;
        ;       I N T E R R U P T   M A S K
        ;
        ;*******************************************************
E0A0    INTMSK  .EQU    UD2ADD+2        ; INTERRUPT MASK
        ;
0001    INTCM   .EQU    01H             ; INT. 0 COMM MASK
0002    INT21   .EQU    02H             ; INT. 1 21 BIT (PCN) MASK
0004    INTDP   .EQU    04H             ; INT. 2 DUAL RS-232-C PORT MASK
0008    INTPP   .EQU    08H             ; INT. 3 PARALLEL PORT MASK
0010    INTTP   .EQU    10H             ; INT. 4 TOUCHPANEL MASK
0020    INTKB   .EQU    20H             ; INT. 5 KEYBOARD MASK
0040    INTTM   .EQU    40H             ; INT. 6 TIMER MASK
0080    INTPE   .EQU    80H             ; INT. 7 PARITY ERROR
        ;*******************************************************
        ;
        ;       K E Y B O A R D   T A B L E
        ;
        ;*******************************************************
E0A1    KNSNC   .EQU    INTMSK+1        ; ADDRESS OF NO SHIFT, NO CONTROL TABLE
E0A3    KSNC    .EQU    KNSNC+2         ; ADDRESS OF SHIFT, NO CONTROL TABLE
E0A5    KNSC    .EQU    KSNC+2          ; ADDRESS OF NO SHIFT, CONTROL TABLE
E0A7    KSC     .EQU    KNSC+2          ; ADDRESS OF SHIFT, CONTROL TABLE
        ;*******************************************************
        ;
        ;       D I S P L A Y   R A M
        ;
        ;*******************************************************
E0A9    ATTRIB  .EQU    KSC+2           ; ATTRIBUTES WORD.
0001    BLANK   .EQU    01H             ;   2**0=BLANK
0002    UNDLN   .EQU    02H             ;   2**1=UNDERSCORE
0004    INVERS  .EQU    04H             ;   2**2=INVERSE
0008    BLINK   .EQU    08H             ;   2**3=BLINK
0010    DIM     .EQU    10H             ;   2**4=DIM
0020    MODIFY  .EQU    20H             ;   2**5=MODIFIED DATA
        ;       .EQU    40H             ;   2**6
0080    PROTD   .EQU    80H             ;   2**7=PROTECT
E0AA    ATTSAV  .EQU    ATTRIB+1        ; A PLACE TO SAVE ATTRIB
E0AB    BLKMD   .EQU    ATTSAV+1        ; BLOCK MODE ACTIVE
E0AC    BLKSND  .EQU    BLKMD+1         ; BLOCK SEND ACTIVE
E0AD    BSCRPE  .EQU    BLKSND+1        ; BACKSPACE CURSOR IN PARAMETER ENTRY
        ;                                 MODE
E0AE    CCDSR   .EQU    BSCRPE+1        ; CURRENT COMM DSR
E0AF    CEOL    .EQU    CCDSR+1         ; 1= CLEAR TO EOL ACTIVE
E0B0    CHNCHG  .EQU    CEOL+1          ; CHANGE IN NUMBER OF CHARACTERS
E0B1    CHRCNT  .EQU    CHNCHG+1        ; CHARACTER COUNT 0-4F, 0-83
```

4.3.3.3 (Contd)

```
E0B2    CHRSAV  .EQU   CHRCNT+1     ; A PLACE TO SAVE CHARACTER COUNT
E0B3    CLRTYP  .EQU   CHRSAV+1     ; TYPE OF CLEAR
        ;                             00= ALL
        ;                             02= UNDERSCORE
        ;                             08= BLINK
        ;                             10= DIM
        ;                             1F= NORMAL
E0B4    COMPNT  .EQU   CLRTYP+1     ; COMM PRINT ACTIVE
E0B5    CONT    .EQU   COMPNT+1     ; 1=CONTROL KEY ACTIVE
E0B6    CPSLK   .EQU   CONT+1       ; 0=CAPS LOCK NOT ACTIVE
E0B7    CURSOR  .EQU   CPSLK+1      ; CURSOR ADDRESS
E0B9    DLMENA  .EQU   CURSOR+1     ; DELIMITER ENABLED
E0BA    DRVADD  .EQU   DLMENA+1     ; 0= DRIVER NOT LOADED, ELSE ADDRESS OF
        ;                             DRIVER
E0BC    DSPDIS  .EQU   DRVADD+2     ; DISPLAY DISABLED
E0BD    ERROR   .EQU   DSPDIS+1     ; 2**0 = SECURITY CODE INCORRECT
E0BE    FLDIDS  .EQU   ERROR+1      ; FIELD ID SENT
E0BF    FLDSCR  .EQU   FLDIDS+1     ; 1=FIELD SCROLL ACTIVE
E0C0    GRACHR  .EQU   FLDSCR+1     ; GRAPHIC CHARACTER
E0C1    HDCSER  .EQU   GRACHR+1     ; HOST DEFINED CODE SEQUENCE
E0C2    HMSGA   .EQU   HDCSER+1     ; HOST MESSAGE ACTIVE
E0C3    HMSGSV  .EQU   HMSGA+1      ; HOST MESSAGE STORAGE
E0C7    INDON   .EQU   HMSGSV+4     ; INDICATOR ON ACTIVE
E0C8    KBCODE  .EQU   INDON+1      ; KEYBOARD CODE FROM TABLE
E0C9    KBINP   .EQU   KBCODE+1     ; 1=KEYBOARD INPUT ACTIVE
E0CA    KBLKD   .EQU   KBINP+1      ; 2**0=KEYBOARD LOCKED
        ;                             2**1=COMM LOCKED
E0CB    LASTCD  .EQU   KBLKD+1      ; LAST CODE FROM KEYBOARD
E0CC    LASTKY  .EQU   LASTCD+1     ; LAST KEY FROM KEYBOARD
E0CD    LASTLN  .EQU   LASTKY+1     ; LAST LINE, 23 OR 29
E0CE    LIGHTS  .EQU   LASTLN+1     ; CURRENT LIGHTS, 1=ON 0=OFF
E0CF    LOCK    .EQU   LIGHTS+1     ; 1 = FIRST TIME DOWN, 2 = SECOND TIME
        ;                             DOWN
E0D0    LOCKLT  .EQU   LOCK+1       ; 0 = LOCK LIGHT OFF, 2 = LOCK LIGHT ON
E0D1    LNCNT   .EQU   LOCKLT+1     ; CURRENT LINE COUNT 0-17
E0D2    LNNCHG  .EQU   LNCNT+1      ; CHANGE IN NUMBER OF LINES
E0D3    LNSAV   .EQU   LNNCHG+1     ; A PLACE TO SAVE LINE COUNT
E0D4    LNSIZE  .EQU   LNSAV+1      ; LINE SIZE, 79 OR 131
E0D5    MLTCNT  .EQU   LNSIZE+1     ; THE COUNTER USED WHEN MULTIPLE INPUT-
        ;                             ACTIVE
E0D6    MLTACT  .EQU   MLTCNT+1     ; MULTIPLE CODE SEQUENCE ACTIVE
E0D7    MLTADD  .EQU   MLTACT+1     ; CALL ADDRESS STORED HERE
E0D9    MODEST  .EQU   MLTADD+2     ; MODE START IN CMOS OR RAM
E0DA    PCRLF   .EQU   MODEST+1     ; PRINT CR, LF
E0DB    PNTNXT  .EQU   PCRLF+1      ; THIS CODE IS TO BE PRINTED NEXT
E0DC    POSPRO  .EQU   PNTNXT+1     ; POSITION IS PROTECTED
```

4.3.3.3 (Contd)

```
E0DD    PRINTA  .EQU   POSPRO+1      ; 1= PRINT ALL ACTIVE
        ;                            ; 3= PRINT NORMAL ACTIVE
E0DE    PROTE   .EQU   PRINTA+1      ; PROTECT IS ENABLED
E0DF    RPTACT  .EQU   PROTE+1       ; 1=REPEAT ACTIVE
E0E0    RSRCV   .EQU   RPTACT+1      ; RS LAST CODE RECEIVED
E0E1    RXOFF   .EQU   RSRCV+1       ; RECEIVED X-OFF
E0E2    SAVEA   .EQU   RXOFF+1       ; STORAGE LOCATION A
E0E3    SAVEB   .EQU   SAVEA+1       ; STORAGE LOCATION B
E0E4    SAVEHL  .EQU   SAVEB+1       ; STORAGE LOCATION HL
E0E5    SCRSV   .EQU   SAVEHL+1      ; STORAGE LOCATION FOR SCROLL
E0E6    SHIFT   .EQU   SCRSV+1       ; 2**0 = SHIFT KEY DOWN
        ;                              2**1 = SHIFT LOCK ACTIVE
E0E7    SPFLAG  .EQU   SHIFT+1       ; 1= LINE TESTED, NOT ALL SPACES TO EOL
E0E8    SRLFST  .EQU   SPFLAG+1      ; 1ST LINE OF SCROLL FIELD . 0-17
E0E9    SRLLST  .EQU   SRLFST+1      ; LAST LINE OF SCROLL FIELD . 1-18
E0EA    STALN   .EQU   SRLLST+1      ; STATUS LINE ACTIVE
E0EB    SXOFF   .EQU   STALN+1       ; SENT X-OFF
E0EC    TABLE   .EQU   SXOFF+1       ; 0 = ADV .TBL, 1=TABLE 1, 2=TABLE 2
E0ED    TABST   .EQU   TABLE+1       ; 1 = TAB SET ACTIVE
E0EE    TIPE    .EQU   TABST+1       ; TERMINAL INSTALLATION PARA . ENTRY
E0EF    TOGAL   .EQU   TIPE+1        ; 2**4=0, 2**5=1, 2**6=TOGAL
E0F0    TXEMPF  .EQU   TOGAL+1       ; TRANSMIT EMPTY
E0F1    XPOS    .EQU   TXEMPF+1      ; X POSITION FROM COMM
E0F2    BANKS   .EQU   XPOS+1        ; CURRENT BANKS SELECTED
E0F3    T3RUN   .EQU   BANKS+1       ; TIMER 3 RUNNING
E0F4    T3TCV   .EQU   T3RUN+1       ; TIMER 3 TIME CONSTANT VARIABLE
        ;*************************************************************
        ;
        ;       L O A D   F L A G S
        ;
        ;*************************************************************
        ;
E0FC    LINFO     .EQU   0E03CH      ; LOAD INFO
0001    ASCIIL    .EQU   01H         ; ASCII LOADER
0002    DISKL     .EQU   02H         ; DISK LOADER
0004    ROML      .EQU   04H         ; ROM PACK
0010    RS-232-C  .EQU   10H         ; USING RS-232-C HOST INT.
0020    CLINT     .EQU   20H         ; USING CURRENT LOOP HOST INT.
0040    I1200     .EQU   40H         ; USING INTERNAL 1200/1200
0080    P21 12    .EQU   80H         ; USING PLATO 21/12 BIT INT.
E0FD    FILEN     .EQU   LINF0+1     ; FILE NUMBER
E0FE    MDACT     .EQU   FILEN+1     ; MODE ACTIVE
0007    MD        .EQU   07H         ; MODE
E0FF    ERRORF    .EQU   MDACT+1     ; ERROR FLAG
0001    DERROR    .EQU   01H         ; DIAGNOSTIC ERROR
0002    BATTL     .EQU   02H         ; BATTERY LOW
FFFF    RAMEND    .EQU   0FFFFH
```

4.3.3.4 INIT Initialization

This routine is entered after power-on or depressing of the reset switch. See Section 3.1 for a definition of what this routine will do.

In general INIT will:

- Set up the 8255 to have all ports as outputs.
- Set the Stack Pointer to E000 hex.
- Select Banks 0, 6, 5, 4.
- Turn off alarm, enable ASCII video with internal clock, disable graphic video.
- Move terminal installation parameters from NVM to active RAM flags.
- Go to Test 1.
- After returning from Test 1.
- Select Bank 0, 6, 5, 4.
- Clear Flags - Except LIGHTS and ERROR F.
- Select Interrupt Mode 2.
- Enable Timer and Keyboard Interrupt.
- Test Error Flag
  - Go to Mode Select without clear if error set (MDSLNC).
- Test Auto Select
  - Go to Mode Select with clear if not enabled (MODESL).
  - Go to Default mode select if set (DFMODE).

4.3.3.5 INIT00 Initialization 00

This routine is used to set up for interrupts.

In general INIT00 will:

- Clear timer 3 of interrupts.
- Set (T3TCV) for 8 ms time constant.
- Call enable blink (ABLKE) output in 8255.
- Move the interrupt trap addresses to the interrupt trap table at E100 hex.
- Select Mode 2 interrupts.
- Call keyboard initialization (KINIT).
- Return.

4.3.3.6 INIT01 Initialization 01

This routine is used to set up the 5037 for 30 lines by 80 characters.

ENTRY: Called. Nothing required.
EXIT: Return.
ALTERS: All registers. Comm send and receive buffers.

In general INIT01 will:

- Turn off keyboard lock light.
- Call CRT80 to select 30 lines by 80 characters.
- Select blinking, box cursor with normal background.
- Calls INIT02 to clear comm send and receive buffers. See Section 4.3.3.7.
- Return.

4.3.3.7 INIT02 Initialization 02

This routine is used to reset comm send and receive buffers.

In general INIT02 will:

- Clear comm send and receive buffer counts (BFCNT, TXCNT).
- Set comm send and receive buffer pointers to start (BFINAD, BFOTAD, TXINAD, TXOTAD).
- Return.

4.3.3.8 CRT80 Set CRT to 80 Char/Line

This routine is used to set up the 5037 CRT controller chip for 80 characters per line.

4.3.3.8 (Contd)

In general CRT80 will:

- o Select 80 characters in Port C of the 8255.
- o Set (LNSIZE) = 4F hex (79).
- o Test (OBYTE4) for 24 or 30 lines
  - Output 7 values to the 5037 depending on 24/30 lines, (XDELTA) and (YDELTA).
- o Call clear screen (CLEAR).
- o Return.

4.3.3.9 CRT132 Set CRT to 132 Char/Line

This routine is used to set up the 5037 CRT controller chip for 132 characters per line.

In general CRT132 will:

- o Select 132 characters in Port C of 8255.
- o Set (LNSIZE) = 83 hex (131).
- o Test (OBYTE4) for 24 or 30 lines
  - Output 7 values to the 5037 depending on 24/30 lines, (XDELTA) and (YDELTA).
- o Call clear screen (CLEAR).
- o Return.

4.3.3.10 CINIT Comm Initialization

This routine is used to select and set up the proper 8250 UART for Comm interface. There are three possible Comm interfaces.

1. The Resident Data set.
2. Port B of the RS-232-C/Current Loop option card if Current Loop is selected.
3. The 1200/1200 Auto-Dial modem.

4.3.3.10 (Contd)

ENTRY: (MBYTE2), (TBYTE2), (TBYTE3), (TBAUD), (RBAUD), (MBYTE3), (MBYTE4), (OBYTE1), OBYTE4) must be set up.
EXIT: Return if okay. Mode not enabled (MODENE) if not.
ALTERS: All registers, (LINFO), TIMER 1, TIMER 2, (CDATAR), (LIGHTS), (CCDSR).

In general CINIT will:

- First determine which interface is going to be used. If the option card is not installed for the interface selected, control is sent to Mode Not Enabled (MODENE).
- The flag (CDATAR) is set to the device number for the 8250 selected. 40 = Resident Interface, 90 = Current Loop, C0 = Internal Modem.
- The interrupt trap table is set to CMTRAP. The transmit baud rate is sent to the 8250. Timers 1 and 2 are set for the receive baud rate. (Needed for resident only.)
- Output to the 8250 line control register LCR to select 7/8 bits, parity enabled/disabled, parity even/odd, and 1/2 stop bits.
- Enable receive data interrupt in the 8250.
- Light or clear the DSR indicator.
- Output to the 8250 modem control register MCR to select proper data terminal ready (DTR).
- Request to send (RTS) and secondary RTS (SRTS).
- Clear interrupts in the 8250.
- Delay about one half second to allow 8250 to settle.
- Return.

4.3.3.11 KINIT Keyboard Initialization

The routine is used to set up the 8250 UART to the keyboard.

In general KINIT will:

- Clear keyboard buffer count (KBCNT).
- Set buffer in and out addresses to start (KBINAD) (KBOTAD).
- Set 8250 to 9600 baud.
- Select 8 bits, 1 stop bit, odd parity.
- Select receive data interrupt in 8250.
- Output to the modem control register to select language and alert volumn.
- Call unlock keyboard (KBDVNL).
- Select the residents keyboard tables.
- Clear interrupts.
- Return.

4.3.3.12 PINIT Printer Initialization

This routine is used to set up the proper 8250 on the Dual Serial Board to talk to a serial printer.

In general PINIT will:

- Test (CHAPAR) if printer is on Port A
  - Set (PDATAR) = 80 if Port A - Jump over Test B.
- Test (CHBPAR) if printer is on Port B
  - Set (PDATAR) = 90 if Port B.
- If neither have a printer, clear printer selected flag (OBYTE1).
- Output baud rate to selected Port.
- Set up the Line Control Register LCR for 7/8 bits = 7 if parity enabled else 8 bits, parity enabled/disabled, paritiy even/odd and 1/2 stop bits.
- Set up the modem control register MCR with DTR, RTS and Carrier On.
- Disable interrupts in the 8250.
- Delay 1/2 second to settle the 8250.
- Return.

4.3.3.13 INTDIS Interrupt Disable

This routine will disable the mask for a specified interrupt.

In general INTDIS will:

- o Get the current interrupt mask.
- o Remove the proper mask bit.
- o Save new mask (INTMSK).
- o Output new mask to Port B of the 8255.
- o Return

4.3.3.14 INTENA Interrupt Enable

This routine will enable the mask for the device specified and store the address of the trap.

In general INTENA will:

- o Store DE in the proper interrupt trap table.
- o Get the current interrupt mask (INTMSK).
- o Add the proper bit in B.
- o Save new mask (INTMSK).
- o Output new mask to Port B of the 8255.
- o Return.

4.3.3.15 CMTRAP Comm Interrupt Trap

This routine will input one character from the Comm 8250, test it for errors and store the proper code in the receive buffer.

In general CMTRAP will:

- o Input the data from the proper Comm interface (CDATAR).
- o Accept the data only if
  - Data only is active
  - DSR and CO are active
  - DSR and Constant RTS are active
  - DSR and Switched RTS and full duplex.

4.3.3.15 (Contd)

- o If a Break is received
  - Sound the alarm
  - Drop RTS if needed
  - Clear send and receive buffers.
- o Place a parity error code (FF) in buffer if
  - Overrun error
  - Parity error
  - Framing error
  - Break received.
- o Enable interrupts.
- o Return.

4.3.3.16 KBTRAP Keyboard Interrupt Trap

This routine will input one code from the keyboard 8250 UART and place it into the keyboard buffer. If code has an error status set, the code is not put into the buffer.

4.3.3.17 TMTRAP Timer Interrupt Trap

This routine is entered whenever the timer interrupt occurs. It tests to see which delays are active. It will take the appropriate action when a delay has finished. If a delay is not finished the timer will be started again.

Each delay has a flag indiciating the delay is active. The number stored in an active flag is the number of times remaining to go through the timer before the delay is finished.

Example: The alarm is a 250 ms delay. The timer length set by CYBER mode is 8 ms. Therefore 250 divided by 8 equals 32. 32 decimal equals 20 hex. So to sound the alarm 250 ms:

- o The alarm must be turned on
- o 20 stored in the active flag (ALRACT)
- o The Start Timer (STTM) called.

4.3.3.17 (Contd)

The length of the timer can be changed by a user by storing the time constant in location (T3TCV) before calling (STTM).

Here is a list of delays and what happens when each times out.

- o User delay 2 (UD2ACT) - A call is made to address stored in (UD2ADD) when finished.
- o Keyboard delay (KBDACT) - This is a 1 second delay which starts the Keyboard Repeat delay when finished.
- o Keyboard Repeat delay (KBRACT) - A call is made to KBDRPT to process another character, and the Repeat delay is started again.
- o Alarm delay (ALRACT) - The alarm will be turned off when finished.
- o Transmit delay (TXDACT) - A call is made to SENDTM to drop RTS when finished.
- o Printer delay (PNTACT) - The (PNTACT) is cleared when finished.
- o Pacing delay (PCDACT) - The (PCDACT) is cleared when finished.
- o Break delay (BRKACT) - The Break signal is dropped from the Comm interface when finished.
- o User delay 1 (UD1ACT) - A call is made to address stored in (UD1ADD) when finished.

Note: A user can call DLYEN1 or DLYEN2 to start user delays 1 or 2.

4.3.3.18 TPTRAP Touchpanel Interrupt Trap

This routine will move the cursor under the area touched and send the XY position on the Comm line.

In general TPTRAP will:

- o Save all registers.
- o Call TPINP - See 4.3.3.57.
- o Move cursor to DE.
- o Send RS, M, X, Y and CR if enabled.
- o Restore all registers.
- o Return.

Note: The user can call TPINP if it is not desired to move the cursor and send the XY position.

4.3.3.19 ADVCR Advance Cursor

This routine will advance the cursor to the next position.

- The alarm is sounded when the cursor enters the eights position from end of line or last line and the margin alert is enabled.
- If cursor is at the end of line it is moved to the start of next line.
- If cursor is at the end of the last line:
  - its moved to upper left if page mode selected.
  - the screen is scrolled if scroll mode selected.

4.3.3.20 ADVMD Advanced Mode (CYBER Mode)

This is the entry point to advanced mode (CYBER Mode). It does not return if called. See the definition of CYBER Mode if needed.

4.3.3.21 ALARM Alarm for 250 ms

This routine will turn on the alarm and start the alarm delay for 250 ms.

4.3.3.22 ALARMI Alarm if Margin Bell Enabled

This routine will call ALARM if a keyboard input is active and the margin alert parameter flag is active.

4.3.3.23 BDISPN Display B

This routine will display (or process) the code in the B register. Function code will be processed.

4.3.3.24 BFTB Buffer to B

This routine will take the next code out of the Comm buffer and return with the code in the B register and interrupt disabled.

4.3.3.25 BLDADD Build Address

This routine will calculate the starting address of a line.

4.3.3.26 CLEAR Clear Screen

This routine will clear 30 lines by 132 character per line, enable the blink, and clear the attribute word. The cursor will be reset to home position.

4.3.3.27 CLREOL Clear to End of Line

This routine will clear data from current position to the end of line.

- o If protect is enabled - only unprotected data is cleared.
- o The background code is cleared - except in Block mode with keyboard input the modified bit is set.

4.3.3.28 CLREOP Clear to End of Page

This routine will clear data from current position to the End of Page.

- o If protect is enabled - only unprotected data is cleared.
- o The background code is cleared - except in Block mode with keyboard input the modified bit is set.

4.3.3.29 CRDOWN Cursor Down

This routine will move the cursor to the same relative position on the next line. If cursor is on the last line:

- Page mode - move cursor to top line.
- Roll mode - scroll screen and move cursor to start of last line.

4.3.3.30 CRGRTN Carriage Return

This routine will move the cursor to the beginning of the current line. If the Auto Line Feed parameter is active the cursor is moved to the beginning of the next line.

4.3.3.31 CRLEFT Cursor Left

This routine will move the cursor left one position. If in the first position of a line it will move to the last position of the line above. If in the first position of top line it will move to last position of last line.

4.3.3.32 CRLNFD Carriage Return Line Feed

This routine will move the cursor to the first position of current line and call CRDOWN. See 4.3.3.29.

4.3.3.33 CRUP Cursor Up

This routine will move the cursor up one line in the same relative position. If on the top line, cursor is moved to same position on bottom line.

4.3.3.34 DISPB Display the Code in B

This routine will store the code in the B register at the current cursor position and store the current attributes in the background memory:

- o If the current position is protected a keyboard input alarm will sound and code not stored.
- o If the graphic flag is active - 2**7 is added to codes between 20 and 3F hex.
- o If keyboard input is active the modified bit is added to the background code.

The cursor is advanced to next position if code was stored.

Note: Function codes are displayed.

4.3.3.35 DLTEN1 Delay Enable 1

This routine will save the number of times the user wants to go through the timer (8 ms if not modified) and save the address it will call when the delay is finished. When the delay is finished a call will be made to the user address and the user must do a return as soon as possible.

4.3.3.36 DLYEN2 Delay Enable 2

Sams as DLYEN1. See Section 4.3.3.35.

4.3.3.37 DSTRNG Data String

This routine will take data from memory starting at address in HL and call BDISPN (see Section 4.3.3.23). HL is incremented after each call until an FF HEX code is found.

4.3.3.38 HASCII Hex to ASCII Conversion

This routine will conver the lower 4 bits in the A register to its ASCII value.

4.3.3.39 KBDAS Keyboard to ASCII

This routine will wait for the next keyboard interrupt by calling KINPUT (see Section 4.3.3.41). If the code is not a Shift, Lock, or Control key the appropriate code will be taken from the keyboard table.

4.3.3.40 KBDASC Keyboard to Lower Case ASCII

This routine will select the proper code from the No Shift No Control keyboard table and return with code in A.

4.3.3.41 KINPUT Keyboard Input

This routine will loop waiting for a code in the keyboard buffer. It will input the to register B and return.

4.3.3.42 MODENE Mode Not Enabled

This routine will display "MODE NOT ENABLED" on line 27 and display the mode selection menu.

This routine must have 30 lines selected. This can be done by calling INIT01 (see Section 4.3.3.6) before jumping to MODENE.

This routine will not return, it requires the operator to fix any problem and select another mode.

4.3.3.43 PABI Port A Bidirectional

This routine will set up Port A as the bidirectional RS-232-C port. It requires HL to be present to BDATAR.

In general PABI will:

- o Store 80 at (HL).
- o Output baud rate to the 8250 UART.
- o Set up the Line Control (LCR) for
  - 7/8 bits = 7 if parity enabled also 8 bits
  - Parity enabled/disabled
  - Parity even/odd
  - One or two stop bits.
- o Set up the Modem Control Register (MCR) with DTR, RTS and Carrier On.

4.3.3.44 PBBI Port B Bidirectional

Same as PABI except for Port B is initialized. (See Section 4.3.3.43.)

4.3.3.45 PRINTB Printer Code in B Register

This routine will send the code in the B register to the printer if printer is selected and the UART has a data ready. It will loop waiting for data ready.

4.3.3.46 RESET Reset Cursor

This routine will move the cursor to the upper-left or lower-left depending on the cursor home parameter.

4.3.3.47 SCROLL Scroll Screen

This routine will scroll a field. The top and bottom lines must be preset.

(SRLFST) = Top line to scroll.
(SRLLST) = Bottom line to scroll.
(FLDSCR) = Direction of Scroll 0 = scroll up, 1 = scroll down. The cursor is moved to lower left if total scroll up.

4.3.3.48 SEND Send Next Code From Comm Buffer

This routine will send one byte of data if:

- o Pacing delay not active.
- o The host has not sent an X-OFF code.
- o UART Has a data ready.
- o Data only parameter active.
- o DTR and DSR and RTS and CTS are active.
  - If DSR is not active the keyboard is locked.

The routine will first send data from transmit buffer. If nothing is in the buffer the send is assumed to be a block mode send and the code is then taken from the screen.

4.3.3.49 SENDB Send the Code in B Register

This routine will place the code in the B register into the transmit buffer if online is active.

Return with NZ if local.
Return with Z if online and code is in buffer.

Before placing the code in the buffer bit 7 is cleared if space parity selected or set if mark parity selected.

Note: This routine will only send a 7-bit code. To send 8-bits see SENDB8 (Section 4.3.3.58).

4.3.3.50 SETDE Set Cursor to Location in DE

This routine will move the cursor to location specified by DE. D = Character Count, E = Line Count.

4.3.3.51 SETCR Set Cursor

This routine will move the cursor to the location specified by Character Count (CHRCNT) and Line Count LNCNT).

4.3.3.52 STTM Start Timer

This routine will start the delay timer by outputing the variable count stored in (T3TCV). This location is set for 8 ms during initialization. If the timer is currently running it will not be restarted.

4.3.3.53 TABBK

This routine will move the cursor backwards to the next tab set position or to the start of the next non-dim field if protect is disabled or to the start of the next unprotected field if protect is enabled. The cursor will stop at upper-left if no found. If the cursor is at upper-left it will start search from lower-right corner.

4.3.3.54 TABFW Tab Forward

This routine will move the cursor forward to the next tab set position or to the next non-dim position following a DIM position of protect is disabled or to the next unprotected position following a protected position if protect is enabled. The cursor will be moved to upper-left if none are found.

4.3.3.55 TABCLR Tab Clear

This routine will clear the current column as a tab stop.

4.3.3.56 TABSET Tab Set

This routine will set the current column as a tab stop.

4.3.3.57 TPINP Touchpanel Input

This routine will input touchpanel data and return with the actual data in B, the character count in D and the line count in E.

4.3.3.58 SENDB8 Send the 8-Bit Code in B Register

This routine will place the code in the B register into the transmit buffer if online is active.

Return with NZ if local.

Return with Z if online and code in buffer.

4.3.3.59 MNTOR User Entry to Monitor

This entry will make one pass through the MDNITOR Routine and return. The monitor will:

- Print one character if print is active.
- Process one character if data in receive buffer.
- Process one keyboard code if data in keyboard buffer.
- Send one code if data in send buffer.
- Send one code if block mode send active.
- Update the DSR indicator.

4.3.3.60 ADVINI Advanced Mode Initialization

This routine will do the following initialization before returning:

- o Clear RAM flags and host load table.
- o Set up to use resident keyboard tables.
- o Turn off keyboard lock light.
- o Set up the 5037 according to 24/30 lines and 80/132 characters.
- o Select cursor type.
- o Call INIT00 (see Section 4.3.3.5).
- o Call INIT02 (see Section 4.3.3.7).
- o Call PINIT (see Section 4.3.3.12).
- o Select keyboard and timer interrupt masks.
- o Call CINIT (see Section 4.3.3.10).

4.3.3.61 KBDINP Keyboard Input (CYBER Mode)

This routine will process the next keyboard code using all of the CYBER mode function table.

In general it will:

- o Input the next code.
- o Convert code using tables.
- o Send the proper CYBER mode code(s) by placing them in the send buffer.
- o If half duplex - process code(s) internally.

4.3.3.62 CMTRPU Comm Interrupt Trap for User

This routine does the same as CMTRAP (see Section 4.3.3.15) except it will not enable interrupts before returning.

4.3.3.63 KBTRPU Keyboard Interrupt Trap for User

The routine is the same as KBTRAP (see Section 4.3.3.16) except it will not enable interrupts before returning.

4.3.3.64 TMTRPU Timer Interrupt Trap for User

This routine does the same as TMTRAP (see Section 4.3.3.17) except registers must be saved before calling and it will not enable interrupts before returning.

4.3.3.65 TPTRPU Touchpanel Interrupt Trap for User

This routine does the same as TPTRAP (see Section 4.3.3.18) except it will not enable interrupts before returning.

4.3.3.66 TIPRAM Move Terminal Installation Parameters to RAM

This routine will move the terminal installation parameters from NVM to there active locations in RAM.

Bank 6 must be selected in Block 4 and Bank 1 must be selected in Block C before call this routine.

4.3.3.67 CRTOUT CRT Output

This routine will output seven values to the 5037 CRT controller chips. A register pair is used to point to the starting value in memory.

4.3.4 Application Notes

4.3.4.1 General Guidelines

1. Get a listing from the printroom under the part numbers associated with the firmware chips. This will give you entrys, exits, and details on operation.

2. Never read from or write into NVM directly. Always use Bank 4 parameters.

3. All user callable routines will not enable or disable interrupts (except BFTB will return with interrupts disabled).

4. All user callable routines will not change interrupt mask (except interrupt enable and disabled).

5. All user callable routines will not change bank selects (except the initialization routines).

6. Bank 0 must be selected in Block 0 and Bank 4 must be selected in Block C when using any callable routines.

4.3.4.2 Position the Cursor

There are many ways to position the cursor to a desired position.

1. SETDE - Place the character count in Register D, the line count in Register E and call SETDE.

2. DSTRNG - In a display string of data the X, Y positioning can be used. Example using a system configured to small CYBER, 80 characters per line, bias off. Move cursor to line 4, character 0 and display HELP.

   ASCII - DLE, X, Y, H, E, L, P
   HEX - 10 00 03 48, 45, 4C, 50, FF

   Load (HL) will starting address of hex codes in memory and call DSTRNG.

4.3.4.2 (Contd)

3. CRDOWN - Call CRDOWN to do DOWN ARROW.
4. CRGRTN - Call CRGRTN to do carriage return.
5. CRLEFT - Call CRLEFT to backspace.
6. CRLNFD - Call CRLNFD to do carriage return and line feed.
7. CRUP - Call CRUP to do up arrow.

4.3.4.3 Displaying One Character

There are two ways to display a character.

1. DISPB - To display the code in B without reacting to control codes call DISPB.
2. BDISPN - To display to code in 13 while reacting to control codes (see Table 3.9.13) call BDISPN.

4.3.4.4 Display a String of Characters

Store the message in memory, terminating with properly. Call DSTRNG.

4.3.4.5 Get one Code From Keyboard

When it has been determined their is something in the keyboard buffer:

1. KINPUT - Call this to get the raw code from the keyboard.
2. KBDAS - Call this to convert the raw code into an ASCII code.

4.3.4.6 Transmit Data

Transmitting data is a two step operation.

1. SENDB - Call this routine to place the code in Register B into the transmit buffer.

2. SEND - If there is something in the transmit buffer call this routine to send the next code if conditions are ready.

4.3.4.7 Receive Data

The initial set up has the host receive interrupt enabled. The interrupt (CMTRPU) will input one code and put it into the receive buffer.

BFTB - This route can be called to take the next code from the buffer and put it into B.

4.3.4.8 Delays

There are two user delays. A timer is run that has a user defined time constant. The user defines the number of times through the timer and the address to be called when finished.

1. The timers time constant is initialized to 8 ms. This can be changed by storing a new time constant variable at (T3TCV). Example for a 5 ms time constant: 5000 000 = 42666 · T3TCV
   117 = T3TCV

2. DLYEN1 or DLYEN2 - Call these routines with the proper register set to number of times through the timer and the proper registers set to address to call when finished.

4.4 Restrictions and Limitations

This firmware does not support the 21-bit PCN option card or loader. It is intended to have the PLATO loader in a ROM pack. This firmware does not support the Graphic option. It is intended to have a ROM pack or external loaded controlware to support the Graphic option.

This resident firmware does not support the Graphic or IST PLATO load option. It is intended to have a ROM pack or external loaded controlware to support them.

Certain tables and variables described in Section 4.3 are in fixed memory locations and cannot be moved.

4.5 Reliability, Availability, and Maintainability Requirements

- Built in Tests - See Section 3.2 Resident Diagnostics
- Performance, Errors, Installation parameters. Aborts and recoveries are covered in each section of this ERS.
- Error/Failure Detection - Test 1 is run when unit is powered on to detect any failures. This includes running of diagnostics that are contained in a present ROM PAK. The hardware has a RAM memory parity checking circuit but it is not used in CYBER mode.
- Function Enble/Disable - All options are selectively enabled or disabled in the Parameter Selection Entry mode. See Section 3.3
- See hardware specification, CDC-SPEC 16042886, for the remainder of requirements.

15051290

CONTROL DATA CORPORATION

CDC® MATRIX PRINTER

GENERAL DESCRIPTION
INSTALLATION AND PACKAGING
PERFORMANCE FEATURES AND CONTROL CODES
OPERATING PROCEDURES
INTERFACES
OPERATOR MAINTENANCE

OPERATOR INSTALLATION AND REFERENCE MANUAL

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CONTROL DATA CORPORATION
East European Peripherals
8100 34th Avenue South
Minneapolis, Minnesota 55440
U.S.A.

or use Comment Sheet in the back of this manual.

MANUAL TO EQUIPMENT LEVEL CORRELATION SHEET

This manual reflects the equipment configurations listed below.

EXPLANATION: Locate the equipment type and series number, as shown on the equipment FCO log, in the list below. Immediately to the right of the series number is an FCO number. If that number and all of the numbers underneath it match all of the numbers on the equipment FCO log, then this manual accurately reflects the equipment.

EQUIPMENT TYPE	SERIES	WITH FCOs	COMMENTS
CK1A4-A	01		
CK1A4-B	01		
CK1A4-C	01		
CK1A4-D	01		
CK130-A	01		
CK130-B	01		

PREFACE

This manual contains the information required to install and operate the CDC® Matrix Printer. In addition, information is provided for routine operator maintenance and troubleshooting. For maintenance and repair actions beyond those intended for the operator, service personnel are referred to the CDC Matrix Printer Hardware Maintenance Manual, publication number 15051295. Publications may be obtained from Control Data Corporation sales offices or from:

Control Data Corporation
Literature and Distribution Services
304 North Dale Street
St. Paul, Minnesota 55103

CONTENTS

FIGURES

TABLES

GENERAL DESCRIPTION 1

INTRODUCTION

The product is a table-top printer intended for general matrix printing applications. Control signals and data to be printed are transmitted via an input/output (I/O) cable.

PRODUCT DESCRIPTION

The product is a dot matrix impact printer with a speed of 150 characters per second. The tractor-feed mechanism uses continuous forms with paper entry at either the front or bottom of the cabinet. Printing is bidirectional under control of the microprocessor electronics.

PHYSICAL

Height	200 mm (7.9 in)
Width	622 mm (24.5 in)
Depth	406 mm (16 in)
Weight	20 kg (44 lbs)

ELECTRICAL

Voltage	230± 10% or 115 ± 10%
Frequency	50 Hz or 60 Hz
Phase	Single
Power	70 w

FORMS

Multiple Copy	Up to 5 parts
Width	51 mm to 406 mm (2 in to 16 in)
Length	Standard 279 mm or 305 mm (11 in or 12 in) Electronic Vertical Format Unit (EVFU) used to define other lengths
Paper Weight	9 lbs to 24 lbs
Carbon Weight	8 lbs for 2 to 3 part forms 6 lbs for 4 to 5 part forms

RIBBON CASSETTE

The printer uses either of the following ribbon cassettes.

Part Number 79020
Data Packaging Corporation
205 Broadway
Cambridge, Massachusettes 02139

Part Number 426-4000-415
Sercomp Corporation
21624 Marilla
Chatsworth, California 91311

CAUTION

Before replacing the ac power line fuse, disconnect the power cord and/or switch power off. See figure 4-1 for the fuse and power switch locations at the rear of the printer. The red "O" is visible on the power switch when power is off.

INSTALLATION AND PACKAGING 2

UNPACKING

The printer is shipped in a paperboard container and protected by packing material (figure 2-1). Unpack the printer as follows:

1. Open the top side of the container.
2. Remove the paperboard protector post from each corner of the container and the two foam end pieces.
3. Remove the printer from the container and then remove the two foam pieces from the printer.
4. Remove the accessory pack taped to the bottom of the container.
5. See figure 2-1. Remove the four shipping hold-down screws from the underside of the cabinet.
6. Remove the banding straps from the cabinet.
7. Inspect the printer exterior for any damage that may have occurred in shipment. Raise the top cover and inspect the interior for damage. Remove the tie-down strap holding the print head assembly to the frame. Manually move the print head assembly along the shaft to check for binding.
8. If any damage is observable, immediately file a claim with the carrier and save all of the original packing material. It is advisable to save the original packing material for any future reshipment of the printer.

INSTALLATION PRECAUTIONS

Observe the following precautions when installing the printer at the designated location.

- Allow 100 millimetres minimum air space at the top, back, and sides of the printer for adequate cooling.
- Avoid installing the printer close to areas of high electro-magnetic interference such as radio transmitters, radar, radio frequency industrial machines, and high-energy power lines.
- Avoid areas where particulate, liquid, or gaseous atmospheric contaminates may exist, such as in some process industries.

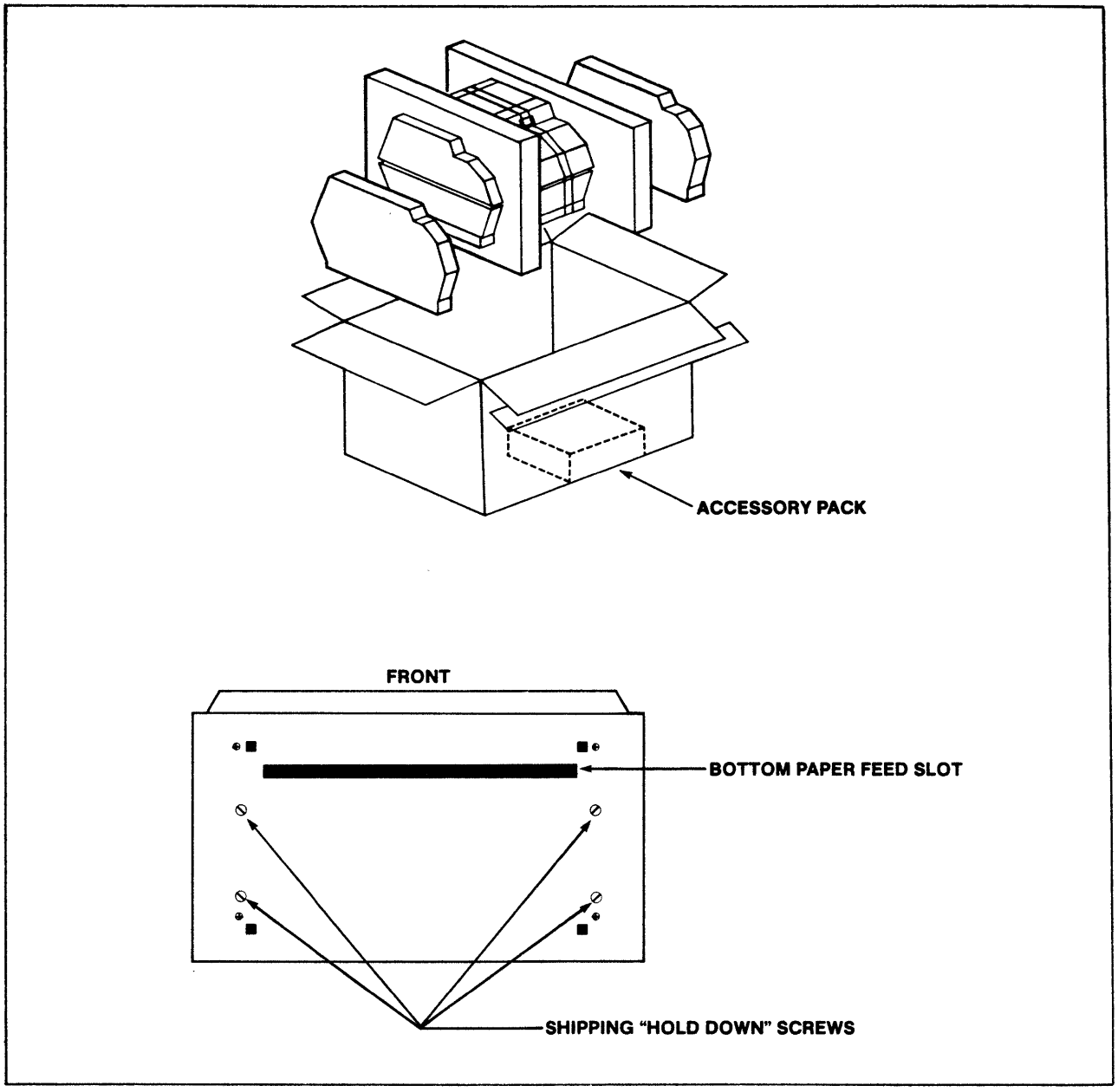


Figure 2-1. Packaging

CABLING AND CONNECTIONS

The power cord and the interface cable are the only connections required. Proceed as follows:

1. Insert the power cord at the rear of the printer and in the electrical supply outlet.

2. The printer has either a parallel or a serial type interface. The interface cable is not supplied. The mating connector is supplied if ordered as an option (refer to section 5). Insert the interface cable connector into the mating interface connector at the rear of the printer. Maintain a minimum distance of 50 millimetres between this cable and any electrical supply lines and locate the cable so as to relieve strain on the connector.

ENVIRONMENT

Subject to the installation precautions, the printer will operate in any normal working environment. Temperature and humidity requirements are as follows:

Operating Temperature	10°C to 40°C (50°F to 104°F)
Operating Humidity	20% to 80% R.H., noncondensing
Storage Temperature	-10°C to 50°C (14°F to 122°F)
Storage Humidity	10% to 90% R.H., noncondensing

INITIAL OPERATION

Sections 3 and 4 describe the performance features and operating instructions for the printer. Read these sections before operating the printer.

REPACKING

Repack the printer by following the unpacking procedure in reverse order. To protect the printer from damage in transit, always prepare it for shipment using only approved materials and procedures. If the original packing materials are not available, additional materials may be obtained by contacting the nearest CDC representative, or:

Control Data Corporation
Corporate Traffic
8100 34th Avenue South
Minneapolis, Minnesota 55440

CONTROL CODES

Table 3-1 lists the control codes to which the printer will respond.

TABLE 3-1. CONTROL CODES

Code Function	ASCII Name	Binary Code
Audible Alert	BEL	0000111
Line Feed	LF	0001010
Vertical Tab	VT	0001011
Form Feed	FF	0001100
Carriage Return	CR	0001101
< START Elongated Characters	SO	0001110
> STOP Elongated Characters	SI	0001111
START EVFU Format Load	RS	0011110
EVFU Channel 1	DLE	0010000
EVFU Channel 2	DC1	0010001
EVFU Channel 3	DC2	0010010
EVFU Channel 4	DC3	0010011
EVFU Channel 5	DC4	0010100
EVFU Channel 6	NAK	0010101
EVFU Channel 7	SYN	0010110
EVFU Channel 8	ETB	0010111
EVFU Channel 9	CAN	0011000
EVFU Channel 10	EM	0011001
EVFU Channel 11	SUB	0011010
6 Lines per inch	ESC 4	0011011, 0110100
8 Lines per inch	ESC 5	0011011, 0110101
10 Characters per inch Standard Density	ESC 6	0011011, 0110110
/ 16.5 Characters per inch Standard Density	ESC 7	0011011, 0110111
(13.6 Characters per inch Standard Density	ESC 8	0011011, 0111000
) 10 Characters per inch Double Density	ESC 9	0011011, 0111001
$ Standard Character Set	ESC @	0011011, 1000000
= Alternate Character Set	ESC A	0011011, 1000001
) Superscript Print	ESC B	0011011, 1000010
• Subscript Print	ESC C	0011011, 1000011
* Default Conditions	ESC R	0011011, 1010010

STANDARD OPERATING FEATURES

Standard operating features are defined as a specified set of performance features at which the printer will operate unless commanded otherwise by control codes from the data source.

These specified features are determined by settings made at the factory and are identified on the feature label attached to the front frame of the printer. The feature label is illustrated in figure 3-1, and these features are described in the following paragraphs.

FORM LENGTH

Set for either 12 inches or 11 inches. The paper will advance the specified number of inches upon receipt of the FORM FEED (FF) code. At either setting there is no specific control code that will override and set the other form length. However, the operating protocol will cause the form length setting to be ignored when a specific EVFU format has been loaded.

CHARACTER PITCH

Set for either 10, 13.6 or 16.5 characters per inch at standard print density or 10 characters per inch at double print density. Use the designated control code in table 3-1 to override this setting and select the desired character pitch.

LINE SPACING

Set for either 6 or 8 lines per inch. Use the designated control code in table 3-1 to select the alternate line spacing.

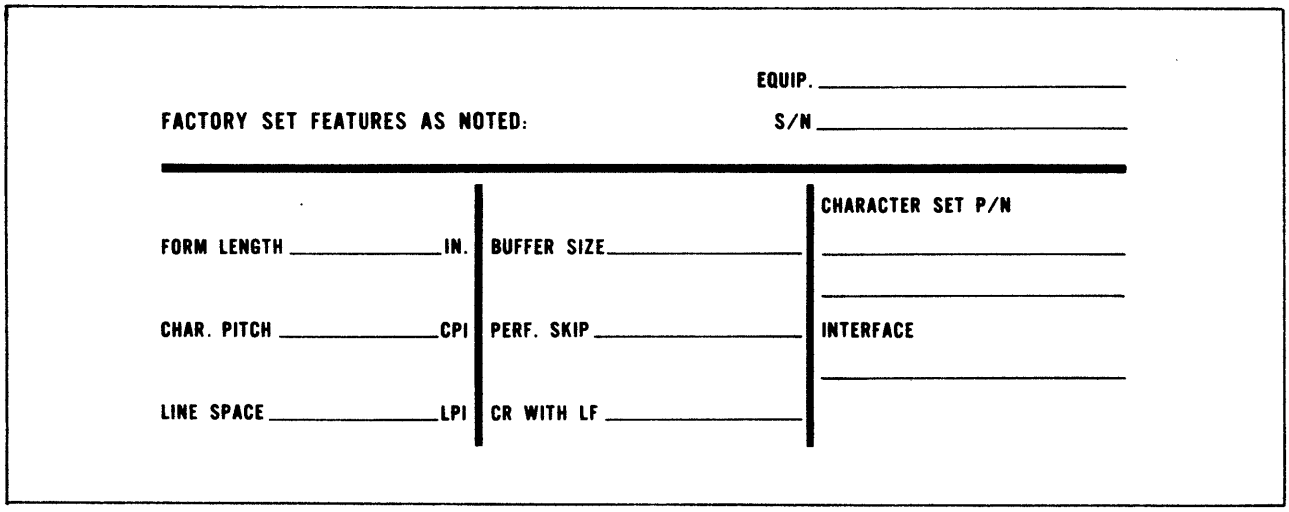


Figure 3-1. Feature Label

PERFORATION SKIP

Set to either skip or not skip one inch at the end of the defined form length. Although there is no specific control code that will override this setting, the operating protocol will cause this setting to be ignored when a specific EVFU format has been loaded.

CARRIAGE RETURN (CR)

Set to either a one-line or no-line paper advance on receipt of a CR code. The CR code always terminates the line of data in the buffer and, when set for no paper advance, underlining or overprinting can be performed for the line just printed.

CHARACTER SET

The standard character set is identified on the feature label as the first set listed and will be automatically selected. If an alternate character set is installed, this set will be listed second on the feature label and may be selected with ESC A control code.

INTERFACE

The feature label identifies the installed interface as either parallel or serial.

BUFFER SIZE

The feature label identifies the maximum buffer capacity.

The operating program stored in the printer will automatically establish the standard operating features as specified on the feature label, as previously described, under any of the following conditions.

- At printer power on
- When the control panel RESET button is pressed
- When the ESC R code is sent, causing program default to standard operating features

The settings for these features are to be specified when the customer orders. In the absence of customer specifications, these features will be set to the most common standard operating features as shown in table 3-2.

TABLE 3-2. TYPICAL STANDARD OPERATING FEATURES

Feature	Standard Factory Setting
Form	12 in
Character Pitch	10 cpi, standard density
Line Spacing	6 lpi
Perforation Skip	No skip
Carriage Return	No line feed
Character Set	Order must specify one or two (second is option) sets for language desired. First listing on feature label is standard set.
Interface	Order must specify parallel or serial.
Buffer Size	256 characters standard, option up to 3.3K maximum.

PERFORMANCE FEATURES

This section describes all of the performance features of the printer.

AUDIBLE ALERT OPTION

The BEL code will sound an audible alert of approximately 200 milliseconds duration. The alert will also sound automatically at the paper-out condition.

LINE FEED (LF)

The LF code acts as a line teminator and advances the paper one line.

VERTICAL TAB (VT)

The VT code acts as a line terminator and advances the paper to the next vertical tab location. Vertical tab locations are defined by the EVFU format (see the EVFU description later in this section).

FORM FEED (FF)

The FF code acts as a line terminator and advances the paper to the next top-of-form location, as defined by the EVFU format.

CARRIAGE RETURN (CR)

The CR code acts as a line terminator with no paper advance, allowing underlining or overprinting of the line just terminated. (If the printer has been set at the factory to advance the paper one line with a CR code, then underlining or overprinting of a line cannot be performed.)

ELONGATED CHARACTERS

Elongation causes characters to be printed at twice the normal width. Elongation will operate on the character pitches of 10, 13.6 or 16.5 characters per inch, resulting in elongated character pitches of 5, 6.8, or 8.25 characters per inch, respectively. Elongation will not operate with the 10 characters per inch double print density. Elongated characters can be started and stopped any number of times within a line and thus can be intermixed with standard width characters. After receipt of an SO code, characters within a line will be printed in elongated form until termination by an SI code, any line terminator code, or if the maximum line length is exceeded.

LINE SPACING

Line spacing can be set at 6 lines per inch or 8 lines per inch. The line spacing under standard operating features is set at the factory and always occurs at power on, after RESET, or after an ESC R code. The alternate line spacing can always be implemented with the designated control code, ESC 4 code for 6 lines per inch or ESC 5 code for 8 lines per inch.

CHARACTER PITCH/PRINT DENSITY

Character pitch can be 10, 13.6, or 16.5 characters per inch with the standard print density. For more dense characters, 10 characters per inch can be selected at double print density. The character pitch under standard operating features is set at the factory and always occurs at power on, after RESET, or after an ESC R code. The alternate pitches can be implemented with the respective control codes as shown in table 3-1, and the pitch selected will be maintained until the program is returned to standard operating features. Because the last character pitch code received for a line of data acts on the entire line, different character pitches cannot be intermixed within the same line.

CHARACTER SET

The standard configuration includes one character set. If the optional second character set is installed, this is designated as the alternate character set. The character set designated as standard will always occur under standard operating features. Either set can be selected with the respective control code as shown in table 3-1. Printing from either character set can be started and stopped any number of times within a line; thus, character sets can be intermixed within a single line.

SUPERSCRIPT PRINT

This feature allows characters to be printed above the position of the normally spaced line. The superscript code, ESC B, acts as a line terminator and must be sent at the end of the normally spaced line previous to the next line in which the superscript characters are to appear. Upon termination of the first line, the paper will advance to the superscript position of the next line. All superscript characters for which data has been sent will then be printed in one pass. Upon termination of the superscript line by an LF code, the paper will then advance to the normal line position. Because the superscript characters and the normally positioned characters are printed as two separate lines, the superscript characters must be spaced properly to appear in their proper location when the normally positioned characters are printed.

SUBSCRIPT PRINT

This feature allows characters to be printed below the position of the normally spaced line. Subscript works in a manner similar to superscript except that the subscript characters are printed after the normally positioned line of characters has been printed. The subscript code, ESC C, acts as a line terminator and is sent at the end of the line of data in which the subscript positioned characters are to appear. The paper will then advance to the subscript position of that line. Upon termination of the subscript line by an LF code, the paper will advance to the next normally spaced line position.

DEFAULT CONDITIONS

The ESC R code resets the printer to the standard operating features. This reset is initiated with and affects the line of data in which it is sent. This code has the same effect as pressing the RESET control button or powering the printer on.

ELECTRONIC VERTICAL FORMAT UNIT (EVFU)

When power is switched on the EVFU is automatically loaded in a standard format as part of the standard operating features. The first line is defined as channel 1; this line also becomes the top-of-form location based on the

existing vertical positioning of the form relative to the printhead. The next four lines are each defined as channel 11. The sixth line is defined as channel 10. This sequence is repeated throughout the length of the 12-inch form, with the following exceptions.

- Only the first line is defined as channel 1 (top-of-form); thereafter, every sixth line is defined as channel 10.
- The last possible line (line 72 on a 12-inch form at 6 lines per inch spacing) is not included in the format to allow perforation clearance when the form is to be used for the maximum number of lines.

The format just described is based on factory settings for form length and line spacing at 12 inches and 6 lines per inch, respectively as the standard operating features. Considering factory settings of 11 inches for form length or 8 lines per inch for line spacing, there are four combinations of these two features which may constitute the standard operating features. Table 3-3 illustrates the four possible standard EVFU formats, one of which will be automatically established at power on.

TABLE 3-3. STANDARD EVFU FORMATS

12-Inch Form 6 lpi		12-Inch Form 8 lpi		11-Inch Form 6 lpi		11-Inch Form 8 lpi	
Line	Channel	Line	Channel	Line	Channel	Line	Channel
1	1	1	1	1	1	1	1
2	11	2	11	2	11	2	11
3	11	3	11	3	11	3	11
4	11	4	11	4	11	4	11
5	11	5	11	5	11	5	11
6	10	6	11	6	10	6	11
7	11	7	11	7	11	7	11
8	11	8	10	8	11	8	10
9	11	9	11	9	11	9	11
10	11	10	11	10	11	10	11
11	11	11	11	11	11	11	11
12	10	12	11	12	10	12	11
		13	11			13	11
7-12 Repeats		14	11	7-12 Repeats		14	11
		15	11			15	11
67	11	16	10	61	11	16	10
68	11			62	11		
69	11	9-16 Repeats		63	11	9-16 Repeats	
70	11			64	11		
71	11	89	11	65	11	81	11
End of form		90	11	End of form		82	11
		91	11			83	11
		92	11			84	11
		93	11			85	11
		94	11			86	11
		95	11			87	11
		End of form				End of form	

After the printer is powered on, any specific EVFU format can be loaded subject to the following operating rules.

- Each line of the desired format must have a channel number assigned.
- A maximum of 132 lines can be specified.
- Each channel number, 1 through 11, can be assigned to as many lines as desired up to the 132 line maximum.
- Channel 1 should always be assigned only once per format to define the first line as the top-of-form location. Channel 1 is the only channel that will respond to the FF code.
- If a channel number code is sent that has not been assigned to any line, the paper will advance to the top-of-form location of the next form.
- A vertical tab code will advance the paper to the next channel 10 line, or to the next channel 1 line if it occurs before a channel 10 line.
- After the EVFU is loaded, setting a control code to change the line spacing will cause errors in the line spacing of the loaded format. The EVFU must be reloaded if the line spacing is changed.

The format is loaded by sending the START EVFU control code (RS). A channel number code is then sent to define each line of the desired format. Format loading is terminated by receipt of any non-EVFU code or printable character. After format loading is terminated, the channel number codes act as line terminators and will advance the paper to the next line with the assigned channel number. After the EVFU format has been loaded, the factory settings for form length and performation skip are inoperative. The loaded EVFU format completely defines the form length, up to 132 lines maximum. Table 3-4 shows one example of a user-defined EVFU format. In this 9-line form example, channel 1 defines the top-of-form line. The channel 2 lines are to be skipped with no printing. Data is printed on the channel 3 lines. The channel 4 lines are to be skipped, and printing occurs again on the channel 5 lines. After the last channel 5 line (line 9) is printed, an FF code will advance the paper to channel 1 of the next form.

TABLE 3-4. EVFU FORMAT EXAMPLE

Line Number	Channel Number
1	1
2	2
3	2
4	3
5	3
6	4
7	4
8	5
9	5

INTRODUCTION

This section describes the printer operation using the defined switches, indicators, and controls. In addition, refer to section 5 for interface information.

OPERATING PRECAUTIONS

The following precautions should be observed.

- Before replacing the AC power line fuse, disconnect the power cord and/or switch power off. See figure 4-1 for the FUSE and POWER switch locations at the rear of the printer. The red "O" is visible on the power switch when power is off.
- Before operating the printer for an extended period, perform the print impression adjustment procedure (described at the end of this section) to obtain the proper print head-to-platen spacing. Improper adjustment for extended periods of operation may reduce the print head life.
- Use the manual paper advance knob only when power is off. Do not advance the paper manually when power is on because this action works against the motor holding voltage. When power is on, the paper may be advanced with either the STEP or FORM switch as described later in this section under Switches, Indicators and Controls.

SWITCHES, INDICATORS, AND CONTROLS

Refer to figures 4-1 and 4-2 for the locations of the switches, indicators, and controls described in this section.

POWER SWITCH

This rocker-type switch is located at the rear of the printer and turns the power on or off. Power is off when the red "O" shows on the top of the switch.

HOLD SWITCH AND INDICATOR

This two-position push-button switch puts the printer into either the on-line or the off-line mode. When HOLD is in the up position, the printer is on-line and will communicate only with an external system through the printer interface, except that the RESET switch will perform the reset function. The other two control panel switches, STEP and FORM, have no effect on printer operation when HOLD is in the up position. When HOLD is in the down (depressed) position, the printer is off-line and will accept commands only from the other control panel switches (RESET, STEP, FORM). The HOLD switch is normally lit, indicating that the operating program is running.

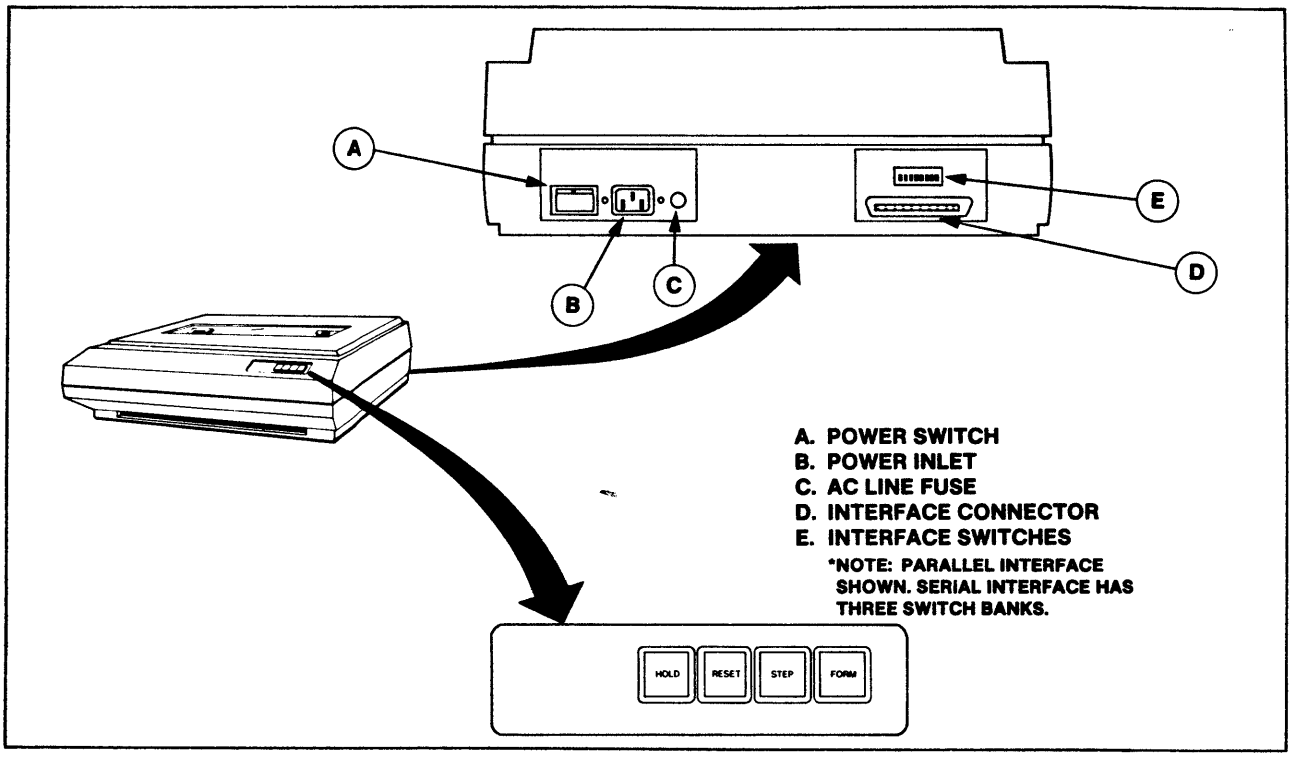


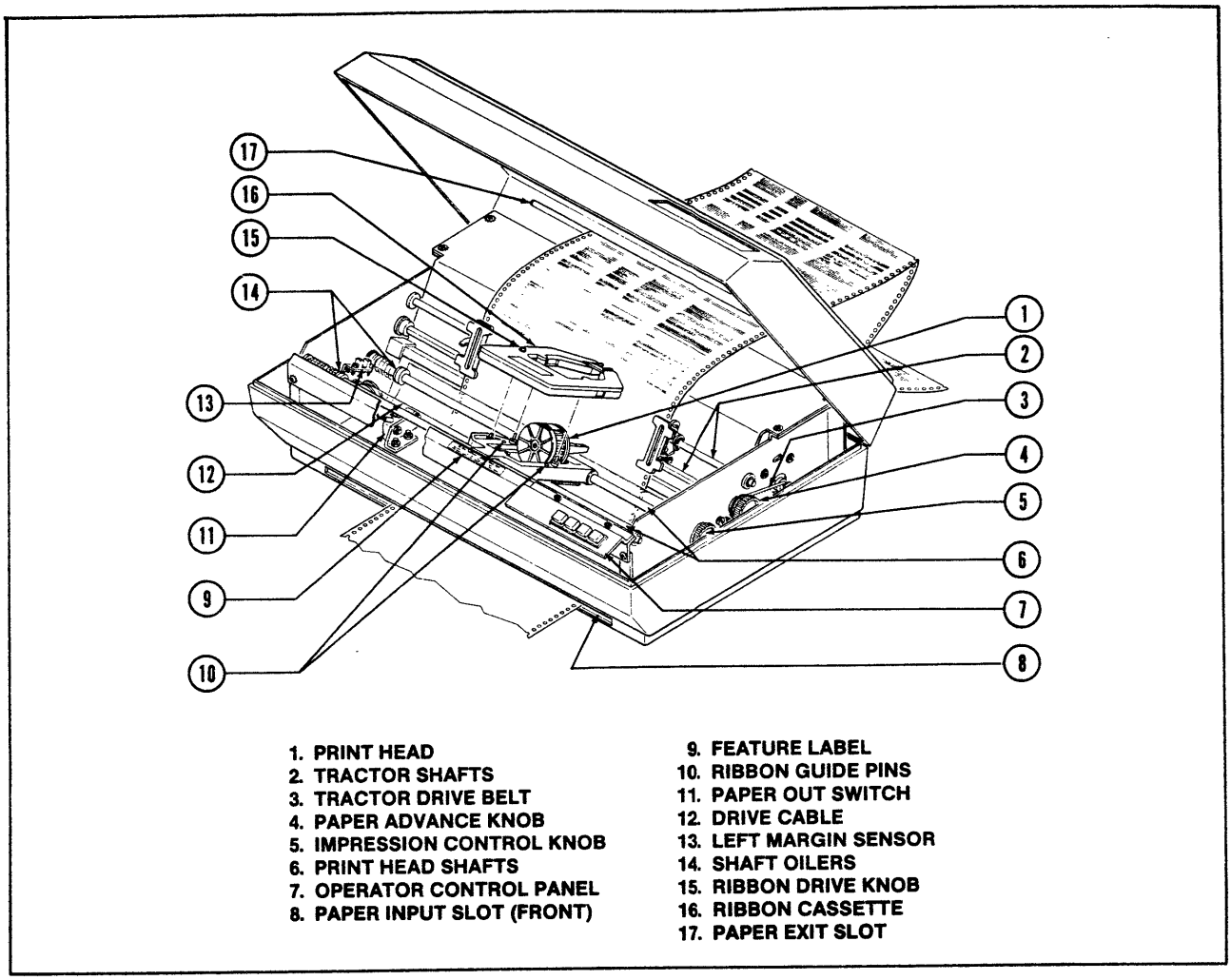
Figure 4-1. General Configuration and Operator Controls

RESET SWITCH AND INDICATOR

This momentary push-button switch clears all printer buffer memory and sets the top-of-form location at the present paper position. RESET is normally not lit; illumination indicates a paper-out condition. When paper-out occurs, RESET will be illuminated in either the on-line or off-line mode.

STEP SWITCH AND INDICATOR

This momentary push button switch advances the paper; however, the top-of-form location will be lost and must be set with the RESET switch. When STEP is depressed for less than 1/2 second, the paper will advance 1/48 inch per step for fine position adjustments. The paper will advance continuously while STEP is held down. STEP is functional only when HOLD is in the down position. The STEP switch is normally lit, indicating that the operating program is running.



1. PRINT HEAD
2. TRACTOR SHAFTS
3. TRACTOR DRIVE BELT
4. PAPER ADVANCE KNOB
5. IMPRESSION CONTROL KNOB
6. PRINT HEAD SHAFTS
7. OPERATOR CONTROL PANEL
8. PAPER INPUT SLOT (FRONT)
9. FEATURE LABEL
10. RIBBON GUIDE PINS
11. PAPER OUT SWITCH
12. DRIVE CABLE
13. LEFT MARGIN SENSOR
14. SHAFT OILERS
15. RIBBON DRIVE KNOB
16. RIBBON CASSETTE
17. PAPER EXIT SLOT

Figure 4-2. Operational Features

FORM SWITCH AND INDICATOR

This momentary push button switch advances the paper to the next top-of-form location. FORM is functional only when HOLD is in the down position. The FORM switch is normally lit, indicating that power is on.

IMPRESSION CONTROL KNOB

This control knob varies the spacing between the print head and the platen. Counter-clockwise rotation increases the spacing (thicker forms), and clockwise rotation decreases the spacing (thinner forms).

PAPER ADVANCE KNOB

This control knob allows the paper to be advanced manually only when power is off. Do not attempt to advance the paper with this knob when power is on. With power on and HOLD down, either the STEP or FORM switch will advance the paper.

OPERATING INSTRUCTIONS

The operating instructions are described in a typical sequence of a daily operating routine.

RIBBON CASSETTE REPLACEMENT

The disposable ribbon cassette snaps over the print head and engages a ribbon drive pin on the print head assembly. Refer to figure 4-2 and replace the ribbon cassette as follows:

1. Switch printer power off.
2. Raise top cover to open position.
3. Manually move the print head assembly along the shaft until it is clear of either tractor.
4. Rotate the impression control knob to the full counter-clockwise position, providing maximum spacing between the print head and platen. (The readjustment procedure is described later in this section.)
5. Lift the ribbon cassette up and off the print head assembly.
6. Place a new ribbon cassette into position, using the two guide pins on the print head assembly. Ensure that the ribbon drive is engaged by turning the small knob on the cassette in the direction indicated until the drive feels engaged and the cassette feels completely seated on the print head assembly.

PAPER LOADING

Figure 4-2 shows the paper loaded through the front feed slot. Use the slot on the underside of the printer to bottom paper feed.

1. Switch printer power off.
2. Raise top cover to open position.
3. Move the left tractor along the shaft to the position desired for the left edge of the paper. The tractor is unlocked by pulling the tab on the outside edge of the tractor forward. The tractor may now be freely moved along the shaft. When the tractor is in the desired position, press the tab back to lock it.
4. Move the right tractor to the approximate desired position but do not lock it.
5. Open both tractor gates by pulling forward.

6. Insert the paper into either the front or bottom feed slot. Bring the paper through the printer and feed the leading edge through the rear exit slot in the top cover.

7. Fit the paper holes onto the tractor sprockets and close the tractor gates.

8. Use the right tractor to make the paper taut across the platen and lock the right tractor with the tab.

POWER ON

1. With the ribbon cassette installed and the paper loaded, close the top cover of the printer.

2. Plug the power cord into the printer and the proper electrical outlet.

3. Place the power switch to the on position.

4. With power on, the print head will automatically move to the left margin. The HOLD, STEP, and FORM indicators will be illuminated. With paper loaded, the RESET indicator will not be illuminated.

TOP-OF-FORM LOCATION

To establish the desired top-of-form location in the printer memory, proceed as follows:

1. Put the printer into the off-line mode by placing the HOLD switch in the down position. The RESET, STEP, and FORM switches are now functional.

2. Hold the STEP switch down until the paper moves to the position where the desired top-of-form location is directly behind the print head.

3. Momentarily depress the RESET switch. Top-of-form is now established at this location on the paper. Whenever the FORM switch is pressed, the paper will advance to the same location on the next form.

TEST PRINT

Test print is a standard feature that allows the complete character set to be printed out in the off-line mode. This feature is convenient for setting the impression adjustment control and for checking printer operation prior to the printing of the actual data. Test print is accomplished with the following combination of control panel switches.

1. Depress the HOLD switch to the down position.

2. Simultaneously press the STEP and FORM switches until printing starts and then release these two switches.

3. To stop test print, release the HOLD switch to the up position.

PRINT IMPRESSION ADJUSTMENT

This control knob must be adjusted properly for the thickness of form being printed. Print head-to-platen spacing that is too close will cause ink smears and may tear the paper or damage the ribbon. Spacing that is too great may reduce print head life if such an adjustment is used continually. For proper adjustment of the impression control knob, proceed as follows:

1. Ensure that a ribbon cassette is installed, paper is loaded, and power is on. The top cover must be raised to the open position for access to the knob.

2. Initiate either test print or on-line printing.

3. If the print density is too light, rotate the knob clockwise until the desired density is obtained. If ink smearing appears, the knob must be rotated counter-clockwise.

ON-LINE OPERATION

With the foregoing procedures completed and the interface cable connected, the printer is ready for on-line operation. With the HOLD switch in the up position, the printer will now receive and print data.

INTERFACES 5

GENERAL INFORMATION

Printer functions are controlled by the electronics located on the controller board. The communications between the controller board and the external data source are provided by the interface board. The printer contains either a parallel interface board or a serial interface board. See the feature label, location illustrated in figure 4-2, to determine the type of interface board installed. The basic sequence of accepting and printing data, with either type of interface, is described as follows:

- The controller samples the interface approximately 2000 times per second to determine if data is available.
- When data is available, the interface is commanded to send this data to the controller.
- Upon receipt, the data is analyzed by the controller. The data to be printed (characters and spaces) is stored in the buffer. Control codes that are within the command discipline of the controller (see table 3-1) are acted upon. Control codes not recognized by the controller are discarded.
- When the data has been processed by the controller, a signal is sent to the interface and the sequence is repeated.
- Printing starts on receipt of a line termination code or receipt of 136 characters. A space is considered a character.

PARALLEL INTERFACE

The parallel interface is Centronics compatible. Data transfer from the source to the printer is illustrated in figure 5-1 and described as follows:

- Source data is placed on seven data lines to the interface, represented by the DATA signal in figure 5-1.
- When data is on the data lines, the source must generate a STROBE signal to inform the interface that the data is stabilized and ready to be received.
- The printer responds with a BUSY signal that remains on the line until the data is stored in the controller buffer.
- After the data has been stored and the BUSY signal dropped, the printer will send the ACKNOWLEDGE signal to indicate that the data transfer is completed.
- This data transfer sequence is repeated for each data byte.

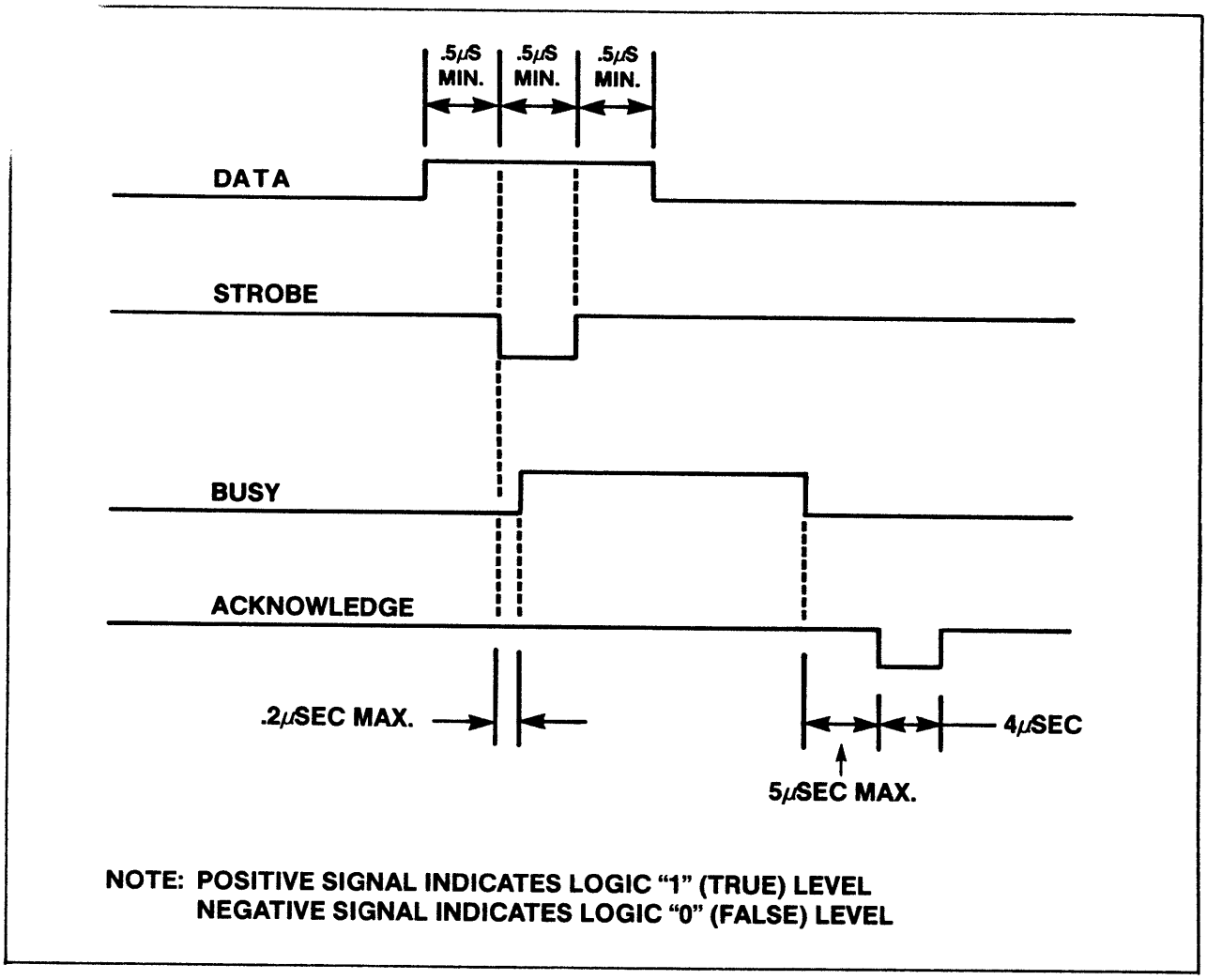


Figure 5-1. Parallel Interface Timing

SIGNAL LEVELS

Signal level requirements between the parallel interface and the data source are as follows:

- Logic "1" is + 2.4 to +5.0 volts, not to exceed + 5.5 volts. Defined as a logic true signal.
- Logic "0" is + 0.0 to + 0.4 volt, not to exceed a negative voltage of -0.5 volt. Defined as a logic false signal.

SIGNAL DEFINITIONS AND SWITCH CONTROLS

Definitions of signals between the data source and the parallel interface are given in this section.

Data Bits 1 through 7

Seven lines transmit data (characters and control codes) from the data source to the interface. This data must be placed on the data lines 0.5 microsecond before the STROBE signal starts and must remain until 0.5 microsecond after the STROBE signal ends.

STROBE

STROBE is a signal from the data source informing the interface that data is on the data lines ready to be received.

BUSY

BUSY is a signal from the interface informing the data source that data is being transferred from the interface to the printer controller for processing and storage in the controller buffer. BUSY starts within 0.2 microsecond after STROBE is received. The parallel interface will send the BUSY signal to the data source under the following conditions.

- On a byte-by-byte basis as illustrated in figure 5-1.
- BUSY is sent when the printer controller buffer is full. When the buffer has emptied (to print) to the point where it contains approximately one maximum line length of characters, BUSY is dropped.
- When the HOLD switch is depressed to the off-line mode, the current line of printing will be completed and printing will then stop. The interface will continue to accept data until the buffer is full, and then BUSY will be sent. When the HOLD switch is released to the on-line mode, data stored in the buffer will be printed, and BUSY will be dropped when the buffer contains approximately one maximum line length of characters.

- When the paper-out condition occurs, the current line of printing will be completed, and printing will then stop. The interface will continue to accept data until the buffer is full, and then BUSY will be sent. While the paper-out condition remains, a single line of data will be printed from the buffer each time the STEP switch is pressed. When the paper-out condition is cleared, data stored in the buffer will be printed, and BUSY will be dropped when the buffer contains approximately one maximum line length of characters.

ACKNOWLEDGE

ACKNOWLEDGE is a signal from the interface informing the data source that the printer is no longer busy and that the next data byte may be sent. This signal occurs within 5 microseconds after BUSY is dropped.

Simulated Printer Status Signals

In addition to the active signals previously described, four printer signals are simulated at static voltage levels. These static signals do not indicate actual printer status but are simulated to provide for the requirements of the data source. The static signal levels are controlled by a miniature switch bank accessible at the rear of the printer, as illustrated in figure 4-1. Switch numbers are illustrated in figure 5-2. These static signals may be set to either the true or false logic condition as shown in table 5-1.

TABLE 5-1. PARALLEL INTERFACE SWITCH CONTROLS

Static Signal	Voltage Level	Logic Condition	Switch Number ON	Switch Number OFF
Paper Out	+5	True	7	8
Paper Out	0	False	8	7
Printer Select	+5	True	5	6
Printer Select	0	False	6	5
Fault	+5	True	3	4
Fault	0	False	4	3
Light Detect	+5	True	1	2
Light Detect	0	False	2	1
For Centronics interface compatibility, set switch numbers 2, 3, 5, 8 to ON and 1, 4, 6, 7 to OFF.				

CONNECTOR AND CABLE

The parallel interface has a 36-pin connector, Amphenol part number 57-40360-12. The recommended mating connector is Amphenol part number 57-30360. The interface connector pin assignments are listed in table 5-2; the pins not used are not listed. Connector pin array is illustrated in figure 5-2. The data source cable should not exceed a maximum length of 8

meters or approximately 25 feet. The printer conforms to the Federal German Republic (FGR) electromagnetic compatibility requirements when operated with a data source cable that is shielded. If a nonshielded cable is used, there may be electromagnetic emissions above the specified FGR limits.

TABLE 5-2. PARALLEL INTERFACE CONNECTOR PIN ASSIGNMENTS

Signal Description	Pin Number Signal	Return
STROBE	1	19
DATA 1	2	20
DATA 2	3	21
DATA 3	4	22
DATA 4	5	23
DATA 5	6	24
DATA 6	7	25
DATA 7	8	26
ACKNOWLEDGE	10	28
BUSY	11	29
PAPER OUT	12	-
PRINTER SELECT	13	-
GROUND	14	-
GROUND	16	-
+5V	18	-
FAULT	32	-
LIGHT DETECT	33	-

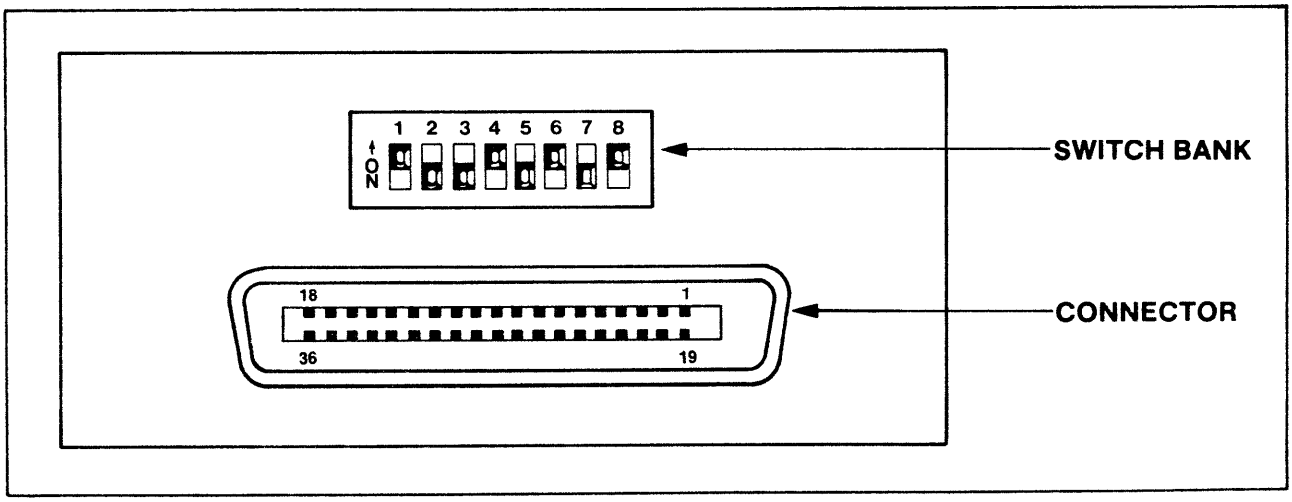


Figure 5-2. Parallel Interface Switch Controls and Connector

SERIAL INTERFACE

The serial interface meets the minimum requirements for an asynchronous RS-232C interface. Data transfer from the source to the printer is illustrated in figure 5-3 and described as follows:

- Source data is transmitted to the interface in a serial mode.
- Data reception starts when a START bit occurs on the RECEIVED DATA line.
- The next seven bits are latched by the interface and sent to the printer controller, upon request, in a parallel mode. The interface accepts the most significant bit (MSB), but no parity check is made.
- The stop bit signals the end of the data byte.
- Transmission can continue without loss of data as long as the data source observes the selected printer protocol as defined later under Signal Definitions and Switch Controls.

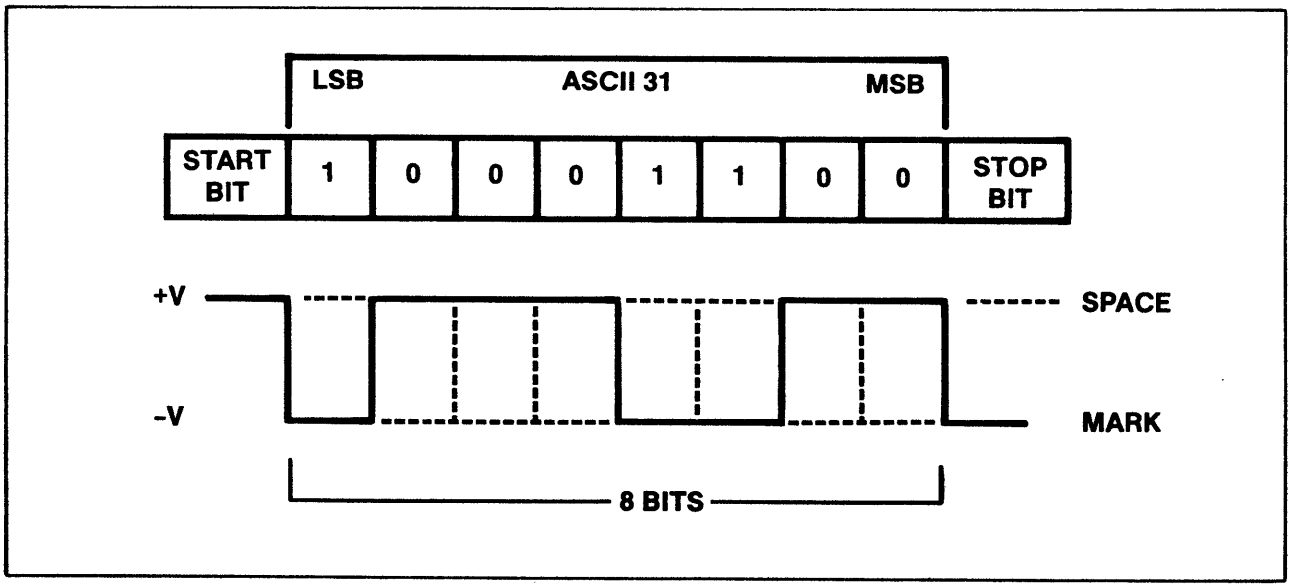


Figure 5-3. Serial Interface Timing

SIGNAL LEVELS

Signal level requirements between the serial interface and the data source are as follows:

- Signals received by the interface between -3 and -27 volts are recognized as MARK, logic "1". Signals between +3 and +27 volts are recognized as a SPACE, logic "0".
- The interface transmits a MARK, logic "1", at -12 volts. A SPACE, logic "0", is transmitted at +5 volts.

SIGNAL DEFINITIONS AND SWITCH CONTROLS

Definitions of signals between the data source and the serial interface are given in this section. The serial interface will operate with any one of three different protocols: (1) X-ON/X-OFF, (2) BUFFER BUSY, or (3) CHARACTER BUSY. The selected protocol is established via switch banks A and C adjacent to the interface connector. Switch bank B is used to set the Baud rate and the number of STOP bits and DATA bits. The three switch banks are illustrated in figure 5-4 and switch functions are identified in table 5-3. Each of the three protocols is distinguished by the type of signal transmitted by the printer and informing the data source to either start or stop data transmission. Following are definitions of these three signals and of the other signals that are common to the three protocols.

X-ON/X-OFF

The X-ON/X-OFF protocol is established by setting the interface switches as shown in table 5-4. When the printer buffer is within 100 characters of being full the interface will transmit the X-OFF signal as a DC3 code, informing the data source that a maximum of 100 additional characters will be accepted without loss of data. As printing occurs and the buffer is emptied to the point where it contains approximately one maximum line length of characters the interface will transmit the X-ON signal as a DC1 code, informing the data source that transmission may be resumed. If the HOLD switch is depressed to the off-line mode, or if the paper-out condition occurs during data transmission the current line of printing will be completed and printing will stop. The interface will continue to accept data until the 100 character margin is reached and then the X-OFF signal will be sent. When the HOLD switch is released to the on-line mode, or when the paper-out condition is cleared, the stored data will be printed and the X-ON signal will be sent when the buffer has emptied to the point where it contains approximately one maximum line length of data. Also, during the paper-out condition a single line of stored data will be printed out each time the STEP switch is momentarily depressed.

BUFFER BUSY

The BUFFER BUSY protocol is established by setting the interface switches as shown in table 5-5. This protocol operates identically to the X-ON/X-OFF protocol except that the BUFFER BUSY signal replaces the X-ON and X-OFF signals as follows:

- BUFFER BUSY is transmitted as a -12V level signal informing the source that data transmission must stop after a maximum of 100 additional characters, replacing the X-OFF signal.

- The absence of BUFFER BUSY is transmitted as a +5V signal informing the source that data transmission can resume, replacing the X-ON signal.

CHARACTER BUSY

The CHARACTER BUSY protocol is established by setting the interface switches as shown in table 5-6. This protocol operates identically to the BUFFER BUSY protocol with the additional feature that the interface transmits a CHARACTER BUSY signal to the data source after the receipt and acceptance of each character.

Received Data

The data received by the interface from the source is illustrated in figure 5-3. Each data byte must be preceded by a START bit. See table 5-3 and set switch B-7 for either 1 or 2 STOP bits and set switch B-8 for either 7 or 8 DATA bits. Set only one of the switches, B-1 through B-6, to the ON position for the Baud rate being transmitted.

SIMULATED PRINTER STATUS SIGNALS

Three printer status signals can be simulated with a constant +5V. These signals do not indicate actual printer status but can be simulated to provide for the requirements of the data source. The three simulated signals and their controlling interface switch are:

- REQUEST TO SEND, switch A-5

- DATA TERMINAL READY, switch A-6

- SECONDARY REQUEST TO SEND, switch C-9

TABLE 5-3. SERIAL INTERFACE SWITCH CONTROLS

Switch Number	Switch Position	Function
A-1	ON	Connects SIGNAL GROUND to FRAME GROUND
A-2	ON	RECEIVED DATA on pin 2
A-3	ON	RECEIVED DATA on pin 3
A-4	OFF	X-ON/X-OFF enabled
A-5	ON	Constant +5V on pin 4, simulated REQUEST TO SEND
A-6	ON	Constant +5V on pin 20, simulated DATA TERMINAL READY
A-7	ON	X-ON/X-OFF transmitted on pin 2
A-8	ON	X-ON/X-OFF transmitted on pin 3
B-1	ON	9600 Baud
B-2	ON	4800 Baud
B-3	ON	2400 Baud
B-4	ON	1200 Baud
B-5	ON	300 Baud
B-6	ON	110 Baud
B-7	ON	1 STOP bit
B-7	OFF	2 STOP bits
B-8	ON	7 DATA bits
B-8	OFF	8 DATA bits
C-1	ON	BUSY on pin 11
C-2	ON	BUSY on pin 19
C-3	ON	BUSY on pin 4
C-4	ON	BUSY on pin 20
C-5	ON	CHARACTER BUSY -
C-6	ON	CHARACTER BUSY +
C-7	ON	BUFFER BUSY -
C-8	ON	BUFFER BUSY +
C-9	ON	Constant +5V on pin 19, simulated SECONDARY REQUEST TO SEND
C-10	ON	Constant +5V on pin 11

Notes:
1. For switch numbers B-1 through B-6, only one switch can be ON.
2. For switch banks A and C, see tables 5-4, 5-5, and 5-6 for permitted combinations based on selected protocol.

TABLE 5-4. X-ON/X-OFF PROTOCOL SWITCH POSITIONS

Procedure - Select One Combination Of Switch Positions Under Each Step	Switch Positions	
	ON	OFF
1. Select grounding configuration		
SIGNAL GROUND to FRAME GROUND	A-1	-
SIGNAL GROUND not to FRAME GROUND	-	A-1
2. Select data pin assignments		
RECEIVED DATA pin 3, X-ON/X-OFF pin 2	A-3, A-7	A-2, A-8
RECEIVED DATA pin 2, X-ON/X-OFF pin 3	A-2, A-8	A-3, A-7
3. Enable X-ON/X-OFF	-	A-4
4. Disable BUSY	-	C-1 through C-8
5. Simulate REQUEST TO SEND pin 4		
simulate with constant +5V	A-5	-
no simulation	-	A-5
6. Simulate DATA TERMINAL READY pin 20		
simulate with constant +5V	A-6	-
no simulation	-	A-6
7. Simulate SECONDARY REQUEST TO SEND pin 19		
simulate with constant +5V	C-9	-
no simulation	-	C-9
8. Apply constant +5V pin 11		
voltage applied	C-10	-
no voltage	-	C-10

TABLE 5-5. BUFFER BUSY PROTOCOL SWITCH POSITIONS

Procedure - Select One Combination Of Switch Positions Under Each Step	Switch Positions	
	ON	OFF
1. Select grounding configuration		
SIGNAL GROUND to FRAME GROUND	A-1	-
SIGNAL GROUND not to FRAME GROUND	-	A-1
2. Select data pin assignment		
RECEIVED DATA pin 3, no Loop-Back	A-3	A-2, A-7, A-8
RECEIVED DATA pin 2, no Loop-Back	A-2	A-3, A-7, A-8
RECEIVED DATA pin 3, Loop-Back pin 2	A-3, A-2	A-7, A-8
RECEIVED DATA pin 2, Loop-Back pin 3	A-3, A-2	A-7, A-8
3. Disable X-ON/X-OFF	A-4	-
4. Disable CHARACTER BUSY	-	C-5, C-6
5. Select pin 4 assignment		
BUFFER BUSY	C-3	A-5
simulate REQUEST TO SEND at +5V	A-5	C-3
6. Select pin 11 assignment		
BUFFER BUSY	C-1	C-10
+5V	C-10	C-1
7. Select pin 19 assignment		
BUFFER BUSY	C-2	C-9
simulate SECONDARY REQUEST TO SEND at +5V	C-9	C-2
8. Select pin 20 assignment		
BUFFER BUSY	C-4	A-6
simulate DATA TERMINAL READY at +5V	A-6	C-4
9. Select BUFFER BUSY polarity		
BUFFER BUSY +	C-8	C-7
BUFFER BUSY -	C-7	C-8

Note: To implement this protocol, BUFFER BUSY must be selected under one of the step numbers 5, 6, 7 or 8.

TABLE 5-6. CHARACTER BUSY PROTOCOL SWITCH POSITIONS

Procedure - Select One Combination Of Switch Positions Under Each Step	Switch Positions	
	ON	OFF
1. Select grounding configuration		
SIGNAL GROUND to FRAME GROUND	A-1	-
SIGNAL GROUND not to FRAME GROUND	-	A-1
2. Select data pin assignment		
RECEIVED DATA pin 3, no Loop-Back	A-3	A-2, A-7, A-8
RECEIVED DATA pin 2, no Loop-Back	A-2	A-3, A-7, A-8
RECEIVED DATA pin 3, Loop-Back pin 2	A-3, A-2	A-7, A-8
RECEIVED DATA pin 2, Loop-Back pin 3	A-3, A-2	A-7, A-8
3. Disable X-ON/X-OFF	A-4	-
4. Disable BUFFER BUSY	-	C-7, C-8
5. Select pin 4 assignment		
CHARACTER BUSY	C-3	A-5
simulate REQUEST TO SEND at +5V	A-5	C-3
6. Select pin 11 assignment		
CHARACTER BUSY	C-1	C-10
+5V	C-10	C-1
7. Select pin 19 assignment		
CHARACTER BUSY	C-2	C-9
simulate SECONDARY REQUEST TO SEND AT +5V	C-9	C-2
8. Select pin 20 assignment		
CHARACTER BUSY	C-4	A-6
simulate DATA TERMINAL READY at +5V	A-6	C-4
9. Select CHARACTER BUSY polarity		
CHARACTER BUSY +	C-6	C-5
Character Busy -	C-5	C-6

Note: To implement this protocol, CHARACTER BUSY must be selected under one of the step numbers 5, 6, 7 or 8.

CONNECTOR AND CABLE

The serial interface has a 25-pin connector, ITT-Cannon part number DB-25S. The recommended mating connector is ITT-Cannon part number DB-25P. The interface connector pin assignments are listed in table 5-7, and the pins not used are not listed. Connector pin array is illustrated in figure 5-4. The cable from the data source should not exceed a maximum length of 15 meters or approximately 50 feet. The printer conforms to the FGR electromagnetic compatibility requirements when operated with a data source cable that is shielded. If a nonshielded cable is used, there may be electromagnetic emissions above the specified FGR limits.

TABLE 5-7. SERIAL INTERFACE CONNECTOR PIN ASSIGNMENTS

Signal Description	Standard Designations		Pin Number/s (Note)	
	EIA	CCITT	Standard	Alternate
FRAME GROUND	AA	-	1	-
TRANSMITTED DATA (X-ON/X-OFF)	BA	103	2	3
RECEIVED DATA	BB	104	3	2
RECEIVED DATA Loop-Back	-	-	-	2, 3
REQUEST TO SEND (+5V)	CA	105	4	-
SIGNAL GROUND	AB	102	7	-
+5V	-	-	-	11
SECONDARY REQUEST TO SEND (+5V)	SCA	120	19	-
DATA TERMINAL READY (+5V)	CD	108/2	20	-
BUSY	-	-	-	4, 11, 19, 20

Note: For switching signals to pin indicated, see tables 5-4, 5-5, and 5-6, for permitted combinations based on selected protocol.

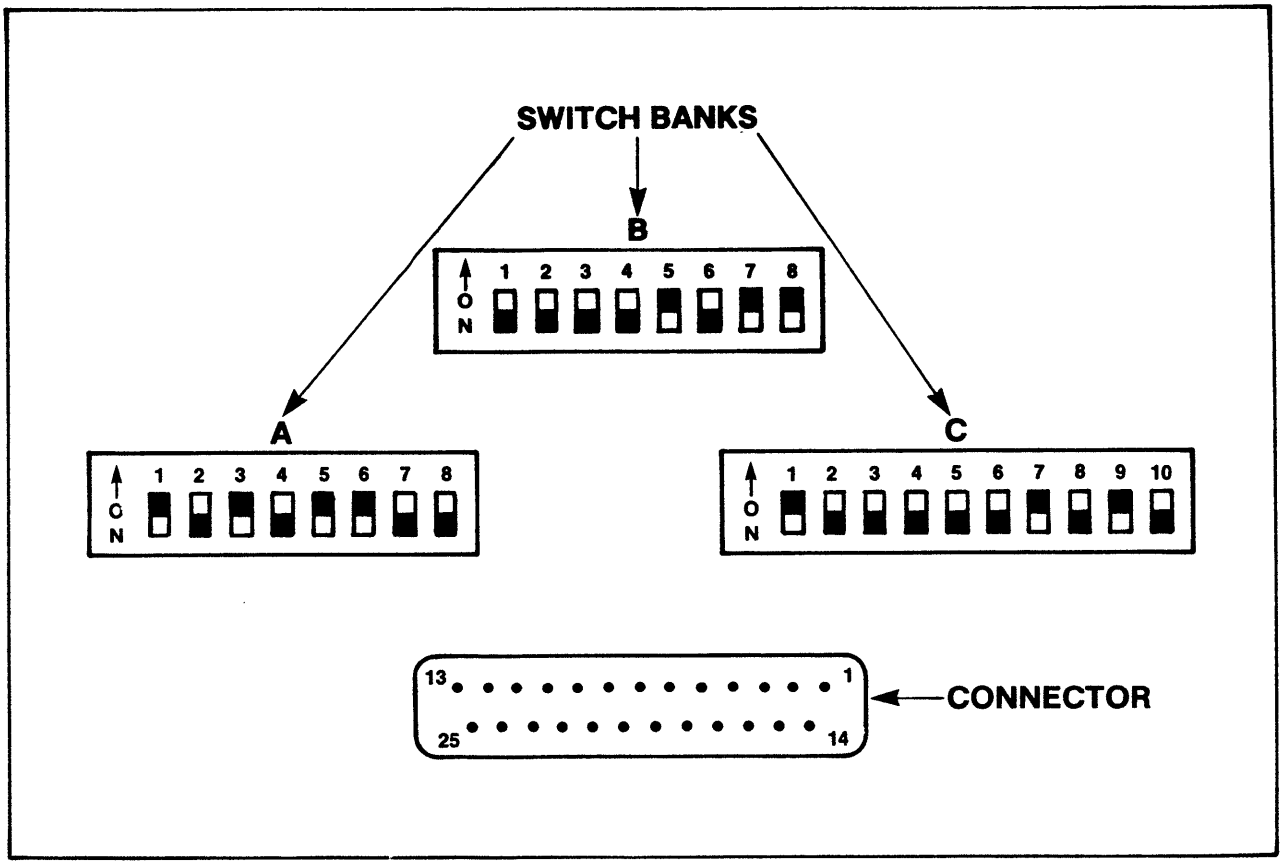


Figure 5-4. Serial Interface Switch Controls and Connector

ROUTINE MAINTENANCE

Regular cleaning extends the service life of the printer. Clean equipment also promotes a pleasant and professional atmosphere. Clean the printer weekly under normal conditions or as the printing volume and physical environment requires. Always ensure that the power cord is disconnected when performing the procedures described in this section.

CABINET EXTERIOR

Clean the cabinet exterior with a soft, lint-free cloth. The cloth may be moistened with a mild soap and water solution if required. Do not use cleaners that contain ammonia or bleach because these cleaners will discolor the finished surface.

WINDOW

Clean the window with a soft, lint-free cloth and a quality glass cleaner. Spray the cleaner onto the cloth and not directly onto the window because any liquid dripping into the interior could cause damage to the mechanism.

INTERIOR

See figure 4-2 and use the following procedure to clean the interior.

1. Remove the ribbon cassette.
2. Vacuum the printer interior, particularly around the left margin sensor, paper tractors, and paper-out switch.
3. Clean the front end of the print head and the four shafts with a clean, lint-free cloth. To avoid possible mechanism damage, do not use any cleaning solutions in the printer interior.
4. Replace the ribbon cassette.

NOTE

Once a year apply four to five drops of light (SAE 10), nondetergent machine oil to the two shaft oiler felt pads. These pads are encased in plastic with a hole for oiling and are identified as item number 14 in figure 4-2.

TROUBLESHOOTING

Table 6-1 describes symptoms, probable causes, and corrective actions for some problems which the operator may encounter. If the indicated corrective action does not solve the problem, contact the next level of service assistance.

TABLE 6-1. OPERATOR TROUBLESHOOTING

Symptom	Probable Cause	Correction
FORM, STEP, and HOLD indicators do not light with power on.	• No ac power • Line fuse (ac) blown • Defective lamps	• Check power cord connections • Replace fuse • Replace lamps
Print head does not move to left margin on power-up or reset.	• No ac power • Line fuse (ac) blown	• Check power cord connections • Replace fuse
RESET light stays on.	• Printer out of paper	• Load paper
RESET not lit when paper is out.	• Defective lamp	• Replace lamp
Printing is too light.	• Print impression incorrectly adjusted • Worn or jammed ribbon • Ribbon not advancing	• Adjust print impression correctly • Replace ribbon cassette • Ensure that ribbon cassette is fully seated on print head assembly
No TEST PRINT.	• HOLD switch not depressed	• Depress HOLD switch
No printing in on-line mode.	• HOLD switch depressed • Interface switches set incorrectly • Missing interface signal	• Release HOLD switch • Set interface switches correctly • Check interface connection and cable
Prints incorrectly in on-line mode.	• Interface switches set incorrectly	• Set interface switches correctly

COMMENT SHEET

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