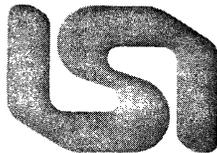


**ADM 31**  **Intermediate Terminal**  
**Video Display Unit**  
**Users Reference Manual**

**LEAR SIEGLER, INC.**  
**DATA PRODUCTS DIVISION**  
714 NORTH BROOKHURST STREET, ANAHEIM, CALIFORNIA 92803

**ADM-31  
data  
display terminal**



LEAR SIEGLER, INC.

**USERS REFERENCE  
MANUAL**

## TABLE OF CONTENTS

SECTION		PAGE
1	GENERAL DESCRIPTION.....	1-1
1.1	INTRODUCTION .....	1-1
1.2	PURPOSE AND USE.....	1-1
1.3	DESCRIPTION .....	1-1
1.4	SPECIFICATIONS .....	1-1
1.5	OPTIONS .....	1-1
	1.5.1 Printer Option .....	1-1
	1.5.2 Polling Option.....	1-1
	1.5.3 Alternate Character Generator Set Option.....	1-3
	1.5.4 Direct Connect Option .....	1-3
1.6	RELATED DOCUMENTS.....	1-3
2	INSTALLATION.....	2-1
2.1	INTRODUCTION .....	2-1
2.2	SAFETY REQUIREMENTS .....	2-1
2.3	SITE REQUIREMENTS .....	2-1
2.4	INITIAL PREPARATION .....	2-1
	2.4.1 Line Voltage Selection .....	2-1
	2.4.2 Configuration Control DIP Switch Settings .....	2-2
2.5	INTERFACE INFORMATION.....	2-2
	2.5.1 Standard or Extension RS-232 Interface .....	2-5
	2.5.2 Current Loop Interface .....	2-5
	2.5.3 Direct Connect Interface .....	2-7
	2.5.4 Printer Interface .....	2-7
2.6	INSTALLING THE ADM-31 .....	2-11
2.7	POWER TURN-ON.....	2-11

## TABLE OF CONTENTS (continued)

SECTION		PAGE
2.8	OPERATIONAL CHECK .....	2-11
2.8.1	Check of Displayable Character Keys.....	2-13
2.8.2	Check of Special Function Keys .....	2-13
2.9	POWER TURN-OFF .....	2-14
2.10	CARE OF THE ADM-31.....	2-14
2.10.1	Cleaning.....	2-14
2.10.2	Inspection .....	2-14
3	FUNCTIONAL DESCRIPTION.....	3-1
3.1	INTRODUCTION.....	3-1
3.2	OPERATIONAL DESCRIPTION .....	3-1
3.2.1	Switching Power Supply .....	3-1
3.2.2	Keyboard.....	3-1
3.2.3	Control Section (CPU).....	3-1
3.2.4	Video Logic and Control .....	3-3
3.2.5	Interface Section.....	3-3
3.2.6	System Configuration Switches.....	3-3
3.3	STANDARD CHARACTER FORMAT.....	3-3
3.4	ADM-31 WORD STRUCTURE.....	3-3
3.5	DATA TRANSMISSION CHARACTERISTICS .....	3-3
3.5.1	Conversation Mode Characteristics.....	3-6
3.5.2	Block Mode Characteristics .....	3-6
3.6	PRINT MODE TRANSMISSION CHARACTERISTICS.....	3-6
3.6.1	Formatted Print Mode .....	3-7
3.6.2	Unformatted Print Mode .....	3-7
3.6.3	Copy Print Mode .....	3-8
4	OPERATION .....	4-1
4.1	INTRODUCTION.....	4-1
4.2	CONTROL CODES AND OPERATING MODES .....	4-1
4.2.1	Standard Control Codes .....	4-1
4.2.2	Escape Sequences .....	4-1
4.2.3	Special Function Codes .....	4-4
4.2.4	Keyboard Enable/Disable.....	4-5

## TABLE OF CONTENTS (continued)

SECTION		PAGE
	4.2.5 Scrolling .....	4-5
	4.2.6 Display of Program Version.....	4-5
4.3	FORMAT CONTROL OPERATIONS .....	4-5
	4.3.1 Program Mode .....	4-5
	4.3.2 Protected Fields and Modes.....	4-5
	4.3.2.1 Write Protect Mode .....	4-5
	4.3.2.2 Protect Mode .....	4-5
	4.3.2.3 Designated Protected Field.....	4-5
	4.3.2.4 Selected Protected Field.....	4-6
	4.3.3 Auto Page Mode.....	4-6
	4.3.4 Limited Graphics Mode.....	4-6
4.4	CURSOR CONTROL OPERATIONS .....	4-7
	4.4.1 Non-Addressed Cursor Positioning.....	4-7
	4.4.2 Absolute Cursor Addressing.....	4-7
	4.4.2.1 Load Cursor Operations .....	4-10
	4.4.2.2 Read Cursor Operations .....	4-10
4.5	DATA EDITING CONTROL OPERATIONS.....	4-10
4.6	DATA TRANSMISSION CONTROL OPERATIONS .....	4-10
4.7	PRINT TRANSMISSION CONTROL OPERATIONS .....	4-10
4.8	PERSONALITY CONTROL OPERATIONS .....	4-10
	4.8.1 Display of Personality Attribute Codes.....	4-15
	4.8.2 DIP Switch Personality Control.....	4-15
	4.8.3 Dynamic Personality Change Operation Codes .....	4-15
	4.8.3.1 Modification of Escape Lead-In Character .....	4-15
	4.8.3.2 Modification of End of Block Character(s).....	4-15
	4.8.3.3 Modification of New Line Character(s).....	4-15
	4.8.3.4 Modification of Field Separator Character .....	4-17
	4.8.3.5 Modification of Function Lead-In Character .....	4-17
	4.8.3.6 Modification of Parity Error Replacement Character.....	4-17
	4.8.3.7 Modification of CLEAR/ERASE Replacement Character.....	4-17
	4.8.3.8 RTS ON Delay Control .....	4-17
	4.8.3.9 RTS OFF Delay Control .....	4-17

## TABLE OF CONTENTS (continued)

SECTION		PAGE
	4.8.3.10 Polling and Addressing Control .....	4-18
	4.8.3.11 Transmission Number Limit Control .....	4-18
4.9	VIDEO ATTRIBUTE CONTROL OPERATIONS .....	4-18
	4.9.1 DIP Switch Video Attribute Control .....	4-18
	4.9.2 Dynamic Video Attribute Control .....	4-20
5	POLLING AND ADDRESSING .....	5-1
5.1	STANDARD (ADM-31) POLLING .....	5-1
	5.1.1 Setting ADM-31 Address .....	5-1
	5.1.2 Setting Up Terminal for Polling .....	5-1
	5.1.3 Removing Terminal from Standard Polling Status...	5-2
	5.1.3.1 Enabling Keyboard .....	5-2
	5.1.3.2 Resetting Standard Polling Mode .....	5-2
	5.1.4 Initiating Standard Polling Sequence .....	5-2
	5.1.5 POLL Responses .....	5-3
	5.1.6 SELECT Responses .....	5-5
	5.1.7 SEQUENTIAL SELECT Responses .....	5-7
	5.1.8 FAST SELECT Responses .....	5-7
	5.1.9 BROADCAST SELECT Responses .....	5-7
	5.1.10 SEND Responses .....	5-7

## LIST OF FIGURES

FIGURE		PAGE
1-1	ADM-31 Data Display Terminal.....	x
1-2	ADM-31 Character Format (By Ascending ASCII Codes) With HEX Code.....	1-2
2-1	ADM-31 Mounting Requirements.....	2-2
2-2	Connector and DIP Switch Locations on Logic Board.....	2-3
2-3	Typical ADM-31 Interfaces.....	2-4
2-4	Typical Standard RS-232 and Extension Interface Logic .....	2-8
2-5	Typical Current Loop Interface Logic .....	2-9
2-6	Typical Direct Connect Interface Logic .....	2-10
2-7	Typical Printer Interface Logic .....	2-10
2-8	ADM-31 Rear Panel Controls .....	2-12
3-1	ADM-31 Data Flow Block Diagram.....	3-2
3-2	Displayable Character Set and Control Codes .....	3-4
3-3	Word Format Codes With DIP Switch Configurations .....	3-5
4-1	Chart of ADM-31 Escape Sequences.....	4-2
4-2	Limited Graphics Mode Symbols .....	4-7
4-3	Absolute Cursor Addressing Operation Codes .....	4-8
4-4	Display of Personality Attribute Codes .....	4-16
4-5	Polling and Addressing Personality Control Byte B .....	4-19
5-1	POLL Function Dialogue, Flow Diagram.....	5-4
5-2	SELECT Function Dialogue, Flow Diagram.....	5-6
5-3	SEQUENTIAL SELECT Function Dialogue, Flow Diagram.....	5-9
5-4	FAST SELECT Function Dialogue, Flow Diagram.....	5-10
5-5	BROADCAST SELECT Function Dialogue, Flow Diagram.....	5-11
5-6	SEND Function Dialogue, Flow Diagram.....	5-12

## LIST OF TABLES

TABLE		PAGE
1-1	ADM-31 Specifications .....	1-4
2-1	Configuration Control Switch Settings.....	2-5
4-1	Control Codes Recognized by Standard ADM-31 .....	4-3
4-2	Chart of Cursor Control Operations.....	4-9
4-3	Data Editing Control Operations .....	4-11
4-4	Data Transmission Control Operations.....	4-13
4-5	Print Transmission Control Operations .....	4-14
4-6	Dynamic Video Attribute Operation Codes .....	4-20

## APPENDIX

ASCII CONTROL CODE CHART .....	A-1
OPERATORS QUICK REFERENCE CHART OF DISPLAYABLE CHARACTER SET CODES .....	A-2
OPERATORS QUICK REFERENCE CHART OF VIDEO ATTRIBUTE CONTROL SEQUENCES .....	A-3
OPERATORS QUICK REFERENCE CHART OF PERSONALTIY CHANGE SEQUENCES.....	A-4
OPERATORS QUICK REFERENCE CHART OF ABSOLUTE CURSOR POSITIONS.....	A-6
OPERATORS QUICK REFERENCE CHART OF ESCAPE SEQUENCES .....	A-7

## INDEX

## PREFACE

*This Users Reference Manual describes the operational characteristics of the ADM-31 Data Display Terminal. The manual also provides information on the installation and care of the ADM-31. Emphasis is placed on the character and significanes of the various control codes required to exercise the great variety of ADM-31 features in non-standard applications. For details of ADM-31 keyboard operations, refer to Operators Quick Reference Guide, DP111.*

*This manual is applicable to ADM-31 Part Number 129880, containing firmware version V1211, Non-Polling, or V0200, with Polling Option installed. To verify that your terminal is equipped with the specified firmware, before using the terminal:*

*EXECUTE ESC o 9  
OBSERVE 1211 (Non-Polling)  
0200 (Polling)*

*The major topics described in this manual include:*

*Section 1 General Description  
Section 2 Installation  
Section 3 Functional Description  
Section 4 Operation  
Section 5 Polling and Addressing  
Operators Quick Reference Charts  
Index*

## SUMMARY OF CAUTIONS AND NOTES

### CAUTIONS

Page 2-1

*Allow warm up of unit when changing locations from one room to another, because condensation may develop in the unit, which may affect the operation of the device.*

Page 2-11

*When recycling power using the ON/OFF switch, wait 10 seconds between the OFF and ON operations to ensure complete reset of the terminal's electronics.*

Page 2-11

*To avoid damage to the CRT screen when the terminal is to remain On but unchanged for extended period of time, reduce the screen brightness using the BRIGHTNESS control.*

### NOTES

Page 2-2

*Execute terminal RESET after changing the setting of any DIP switch in order for the change to take effect.*

Page 2-11

*In Conversation Mode, if the Full-Duplex Mode is selected, typing at the keyboard will not display characters (Program Mode not set) unless echo-back from the host computer is provided. If Half-Duplex Mode is selected, data will be displayed as it is typed. Unless otherwise stated, the procedures which follow assume that Conversation Mode is set and the generated codes are properly echoed if Full-Duplex Mode is selected.*

Page 2-11

*The BAUD RATE switches are factory set as follows:*

Page 3-7

*A STOP (GS) code within the text will cause the printing to stop at that point.*

Page 4-4

*Control codes imbedded in the text in this manner are transmitted when the block of data is sent.*

Page 4-4

*CR, as specified above may be modified by a personality change sequence, described later, to be a different ASCII character.*

SUMMARY OF CAUTIONS AND NOTES (cont'd)

Page 4-10

*If DIP switch S3-SW7 at location 11C is set to OFF, no NULL codes will be displayed.*

Page 4-20

*When the optional Line Drawing character generator is installed, the Standard Character Generator is also available for use.*

Page 5-7

*Acceptance of FAST SELECT may be made conditional by executing an escape sequence for changing personality.*

Page 4-18

*For detailed information on Polling and Addressing, refer to Section V of this manual.*

Page 5-1

*This requirement may be modified by a dynamic personality change operation described in paragraph 4.8.*



*Figure 1-1. ADM-31 Data Display Terminal*

# SECTION I

## GENERAL DESCRIPTION

### 1.1 INTRODUCTION

This section contains an overall description of the Lear Siegler Data Display Terminal (see figure 1-1), along with its operating features.

### 1.2 PURPOSE AND USE

There are numerous applications of the ADM-31, all involving the transfer of data. Data transfer, in some applications, may be almost exclusively unidirectional, either from the ADM-31 to the host computer, or from the host computer to the ADM-31. The emphasis, in this manual, is the application in which an operator communicates with the ADM-31 via the host computer, and the terminal responds in accordance with the firmware installed.

### 1.3 DESCRIPTION

The ADM-31 Data Display Terminal is a complete self-contained unit. All circuitry, cabling, and all required hardware are enclosed within a two-section lightweight housing. The two sections are hinged together at the rear, where the interface connectors, baud rate switches, brightness/contrast controls, fuse, and power cord are located.

The display screen is a 12-inch diagonal CRT with a high-resolution matrix of 80 x 24 characters consisting of large letters, numbers, and other symbols. Figure 1-2 shows the standard 128-character format for the ADM-31.

### 1.4 SPECIFICATIONS

Table 1-1 lists the specifications of the ADM-31.

### 1.5 OPTIONS

The ADM-31 can be equipped with several options, each requiring additions and/or alterations to the standard terminal configuration. Special optional features such as Answerback Memory, Special Personality Programs, Special Keyboard layouts to specific customer requirements, are also available.

#### 1.5.1 Printer Option

The Printer Option allows the ADM-31 to connect to and operate as asynchronous serial printer. With this option, the printer used may be a character-by-character type or buffered type, may be operated independent of or in concert with the terminal, and may be operated in any one of several format modes. In addition, the printer may be operated at any one of 15 transmission rates independent of the transmission rate at which the terminal is operating.

#### 1.5.2 Polling Option

The Polling Option allows the ADM-31 to accommodate the following polling modes: Standard Poll, Select, Sequential Select, Fast Select, and Broadcast Select. Logic-

00 NUL .	01 SOH ␣	02 STX ␣	03 ETX ␣	04 EOT ␣	05 ENO ␣	06 ACK ␣	07 BEL ␣	08 BS ␣	09 HT ␣	0A LF ␣	0B VT ␣	0C FF ␣	0D CR ␣	0E SO ␣	0F SI ␣	} CTRL FUNCTIONS		
10 DLE ␣	11 DC1 ␣	12 DC2 ␣	13 DC3 ␣	14 DC4 ␣	15 NAK ␣	16 SYN ␣	17 ETB ␣	18 CAN ␣	19 EM ␣	1A SUB ␣	1B ESC ␣	1C FS ␣	1D GS ␣	1E RS ␣	1F US ␣			
20	21 !	22 "	23 #	24 \$	25 %	26 &	27 '	28 (	29 )	2A *	2B +	2C ,	2D -	2E .	2F /			
30	31 0	32 1	33 2	34 3	35 4	36 5	37 6	38 7	39 8	3A 9	3B :	3C ;	3D <	3E =	3F >		3F ?	} ESC FUNCTION
40	41 @	42 A	43 B	44 C	45 D	46 E	47 F	48 G	49 H	4A I	4B J	4C K	4D L	4E M	4F N		4F O	
50	51 P	52 Q	53 R	54 S	55 T	56 U	57 V	58 W	59 X	5A Y	5B Z	5C [	5D \ ]	5E ^	5F _			
60	61 `	62 a	63 b	64 c	65 d	66 e	67 f	68 g	69 h	6A i	6B j	6C k	6D l	6E m	6F n		6F o	
70	71 p	72 q	73 r	74 s	75 t	76 u	77 v	78 w	79 x	7A y	7B z	7C {	7D 	7E ~	7F %			

Figure 1-2. ADM-31 Character Format (By Ascending ASCII Codes) with HEX Code

board mounted DIP switches are provided to permit a user selected terminal address consisting of two ASCII characters which must be identical. When active in a polling environment, the ADM-31 is prevented from initiating transmission of data except under the control of the network control center. The Polling Option may be disabled by setting the appropriate DIP switch to OFF and re-setting the unit.

### 1.5.3 Alternate Character Generator Set Option

The Alternate Character Generator Set Option permits the ADM-31 to print and display data in many different fonts and languages. A user-programmed ROM may be selected which determines the font and/or language to be displayed on the CRT. When necessary, this option is supplemented by a replacement keyboard.

To provide the ADM-31 with a limited graphics capability, a standardized graphics PROM is available which permits the ADM-31 to create simple line drawings for display and transmission.

### 1.5.4 Direct Connect Option

The Direct Connect circuit contains a line interface used to connect CRT data terminals to computer I/O channels. The interface is operated in the half-duplex polling mode. It may be used with up to

nine additional interface circuits of the same type connected on one line.

#### RECEIVER PERFORMANCE

##### Input (DCLINE)

Maximum Receive Rate .....	9600 BAUD
Maximum Line Length .....	1000 FT.
Marking Signal Level .....	-12 ± 1V
Spacing Signal Level .....	0 +1/-2V
Receive Threshold .....	6 ± 1V

##### Output (DCRCV)

TTL Compatible ..... 2 LOADS

##### Gate Inputs (RTS/ & XRTS/)

TTL Compatible ..... 1 LOAD

#### TRANSMITTER PERFORMANCE

##### Input (DC SEND)

Maximum Transmission Rate.....	9600 BAUD
RS232 Voltage Levels .....	+ 6 To ± 12V

##### Output (DCLINE)

Maximum Line Length .....	1000 FT.
Marking Signal Level .....	-12 + 0.5/- 0V.
Spacing Signal Level .....	0 +0/-0.5 V.

## 1.6 RELATED DOCUMENTS

- a. ADM-31 Operators Quick Reference Manual DP111.
- b. ADM-31 Maintenance Manual DP310.

**Table 1-1. ADM-31 Specifications**

**DISPLAY**

**CRT SCREEN:** 12 inch diagonal, P4 Phosphor, etched faceplate.

**Refresh Rate:** 60Hz or 50Hz depending on line frequency.

**Two Page Display:** 1920 characters per page.

**Display Area:** 5.5" (13.9 cm) high x 7.75" (19.7 cm) wide.

**Display Format:** 80 character/line by 24 lines.

**Character Set:** 128 ASCII Characters. Upper, lower case & control characters.

**Character Font:**

**Character Matrix:** 7 x 9 dot matrix (plus full 2 dot descenders).

**Character Field:** 10 x 12 dot matrix (6 mm high x 3 mm wide).

**Cursor:** 10x12 dot matrix. Reverse Image block cursor.

**Cursor Controls:** Backspace, Forespace, Up, Down, Home, Tab, Return, New Line, Read Cursor & Cursor Addressing.

**Visual Attributes:** Blink, blank, reverse video, underline and protected fields displayed in reduced intensity.

**KEYBOARD FUNCTIONS**

**Keyboard:** 26 letter alphabet with upper and lower case, numeric 0 through 9. Punctuation, Caps Lock. All keys are auto repeating (15½ characters per second).

**Numeric Key Pad:** 15 keys, 0 through 9, Return, Tab, Comma, Period and Minus.

**Cursor Control:** Individual cursor control keys.

**Edit Keys:** Character insert, character delete, line insert, line delete, line erase, page erase and clear.

**Functional Command Keys:** ESCape, RUBout (delete), Break, Print, Send Line, Send Page, Tab/Back Tab, New Line, New Page, Control and Function.

**FORMATTING AIDS**

**Protect Mode:** Screen formatting of protected and unprotected fields displayed in dual intensity.

**Program Mode:** Displays all control characters.

**EDITING**

**Edit Operations:** Clear Entire Screen, Clear Unprotected Positions, and Character Typeover, Character Insert/Delete, Erase to End of Page, Erase Line/Field. All edit operations can be activated remotely by the host using ESCape sequence.

**TRANSMISSION MODES**

**Block Mode:**

**Page Mode:** Send from the start of the page to the cursor.

**Line Mode:** Send from the start of a line to the cursor.

**Message Mode:** Send from previous end of message.

**Format Transmission:** Transmit format and text or text only.

**Control Characters:** Control characters may be transmitted to the computer and/or entered on the screen.

**Interfaces:** RS-232 point-to-point or 20mA current loop; RS-232 EXTENSION port

**Data rates:** 50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, 9600.

**Parity:** Even, odd or none.

Table 1-1. ADM-31 Specifications (continued)

OPTIONS

Serial printer port (RS-232C)  
Polling & Addressing  
Composite Video  
Answerback memory  
*Alternate Character Generators:*  
    United Kingdom  
    Limited Graphics: 11 special line-  
        drawing symbols  
PC-110 green phosphor  
Special Personality  
Micro Program Source Code Listing  
Output Cable  
Clear or Blank key caps  
Special Paint  
Special Keyboard layouts  
Special Character Generators  
Key locks

*Power Requirements:*

*Standard:* 115 volts, 60 Hz  
*Optional:* 230 V, 50 Hz  
              240 V, 50 Hz

*Heat Dissipation*

222 BTU/HR

*Dimensions:*

*Width:* 15.6 inches (39.6 cm)  
*Depth:* 20.2 inches (51.3 cm)  
*Height:* 13.5 inches (34.3 cm)

*Weight:* 32 pounds (14.4 Kg).

OPERATING ENVIRONMENT

5°C to 50°C (41° to 122°F): 5% to 95%  
relative humidity, without condensation.



## SECTION II INSTALLATION

### 2.1 INTRODUCTION

Installation procedures involving unpacking, initial set-up, and operational check-out of the ADM-31 Data Display Terminal are described in this section of the manual.

### 2.2 SAFETY REQUIREMENTS

No special safety precautions are required for ADM-31 installation.

### 2.3 SITE REQUIREMENTS

The ADM-31 Data Display Terminal may conveniently be used in a normal office environment, as no special mounting provisions are required. However, it is recommended that a weather protected environment with an ambient temperature range of 41°F to 122°F (5°C to 50°C), relative humidity not greater than 95% be maintained for equipment use.

Whenever the ADM-31 is physically moved from a cold location to a warmer environment, be sure to allow sufficient time for the equipment temperature to equalize with the warmer location before activating the terminal. Condensation developed by the temperature differential could possibly impair ADM-31 operation.

#### CAUTION

*Allow warm up of unit when changing locations from one room to another, because condensation may develop in the unit, which may affect the operation of the device.*

The physical dimension of the ADM-31 are shown in figure 2-1. The basic requirements for installation are the following.

- Table or desk mounting
- Standard three-pronged 115-volt (230-volt) power outlet
- Cable connection to the computer, modem, serial printer, or other auxiliary device. If connection to a remote computer is desired, a modem or data set is usually required.

### 2.4 INITIAL PREPARATION

#### 2.4.1 Line Voltage Selection

The ADM-31 is shipped connected for either 115-volt or 230-volt operation, as specified in the purchase order. Any change in line voltage requires circuit changes which can be accomplished only by authorized LSI maintenance personnel.

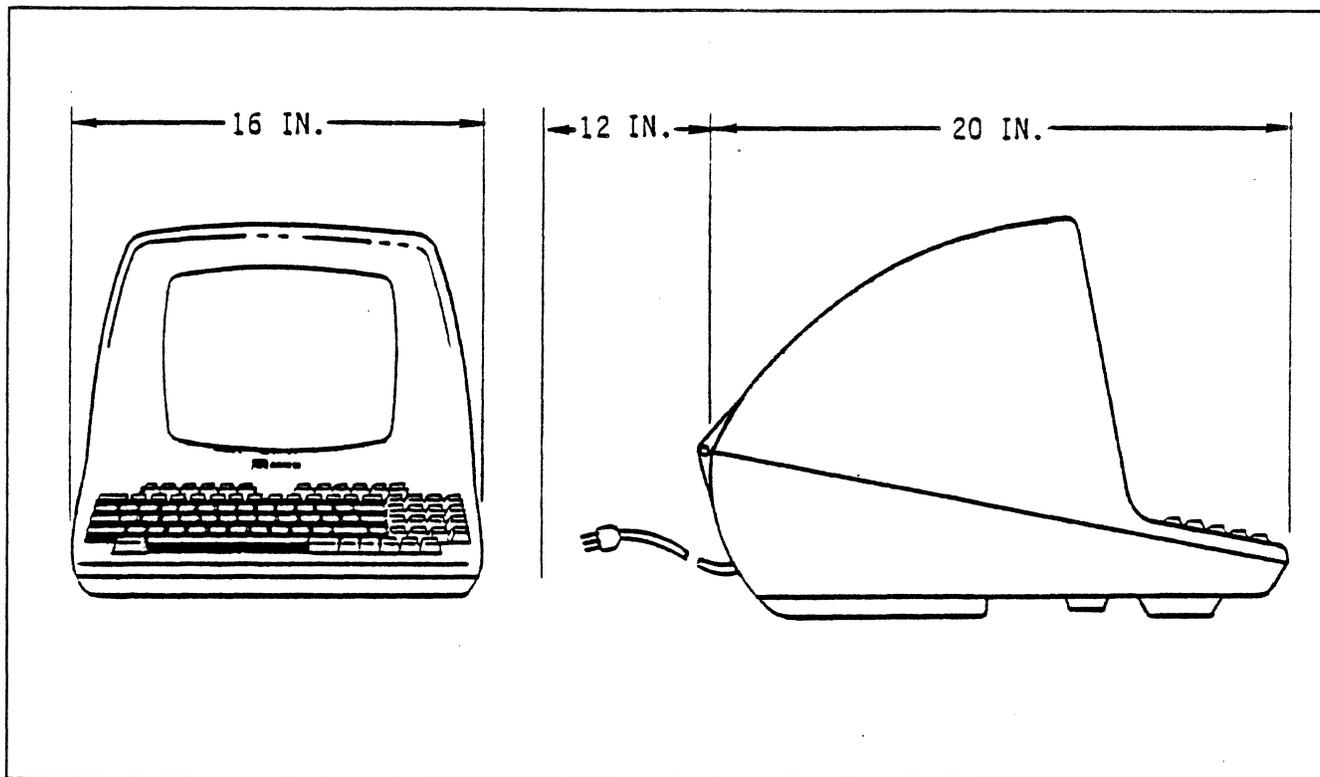


Figure 2-1. ADM-31 Mounting Requirements

## 2.4.2 Configuration Control DIP Switch Settings

Several banks of DIP switches are provided to establish the power-up initialization or default characteristics of the ADM-31 personality. Figure 2-2 shows the locations of these switch banks as well as the default settings. Functions of the individual switches are summarized in table 2-1. The switches can be reached by opening the ADM-31 cover, as follows:

1. Remove the two slot-head screws located under the front corners of the terminal base.
2. Lift the cover upwards and rearwards from the front until it rests on the table or desk.

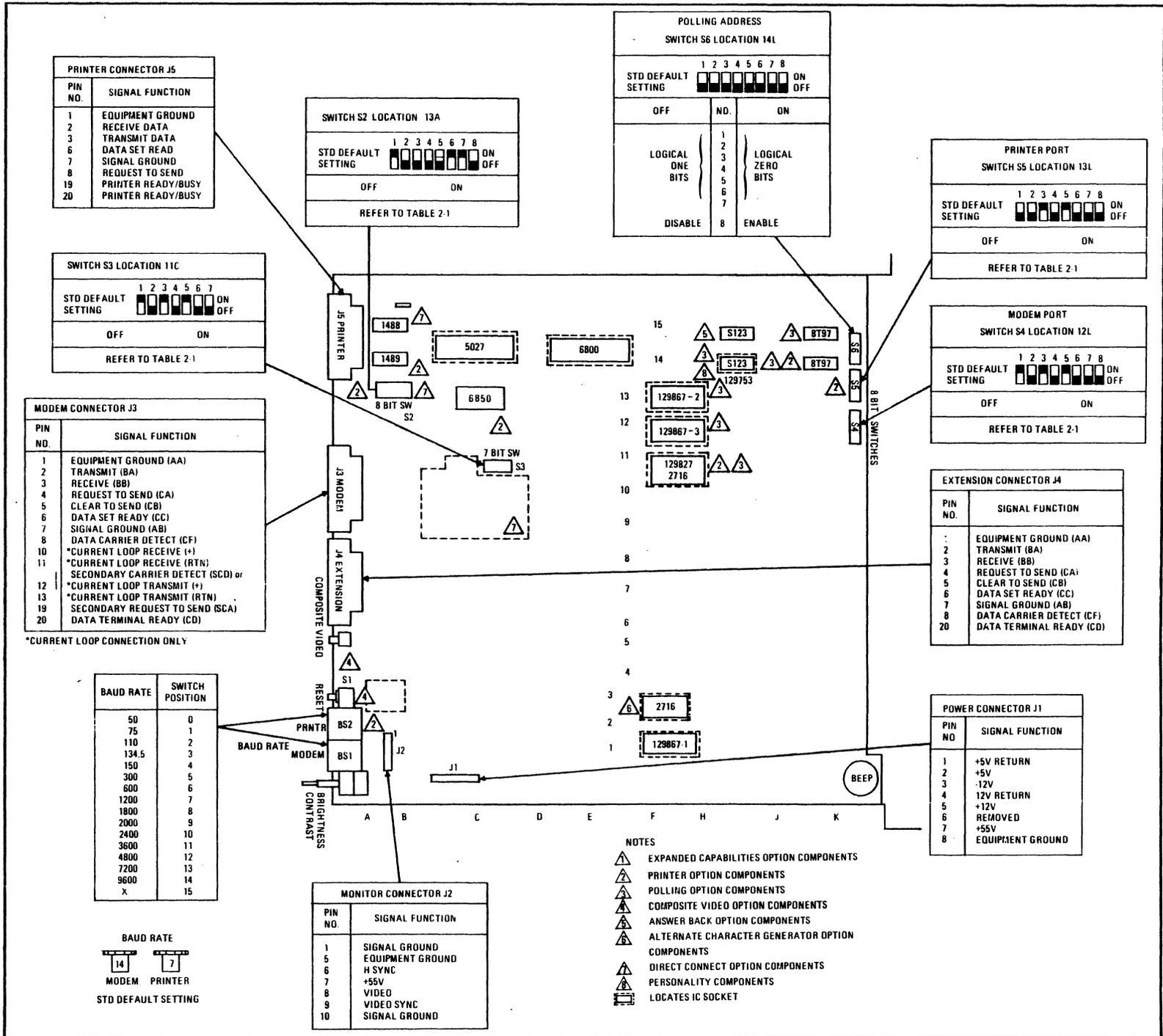
### Note

*Execute terminal RESET after changing the setting of any DIP switch in order for the change to take effect.*

## 2.5 INTERFACE INFORMATION

The ADM-31 may be cabled directly to a local computer, serial printer, or other auxiliary device; or it may be connected via telephone data lines to a remote computer located anywhere in the world. Remote computer connections require the use of a modem or data set. Figure 2-3 shows some typical ADM-31 interfaces.

Figure 2-2. Connector and DIP Switch Locations on Logic Board



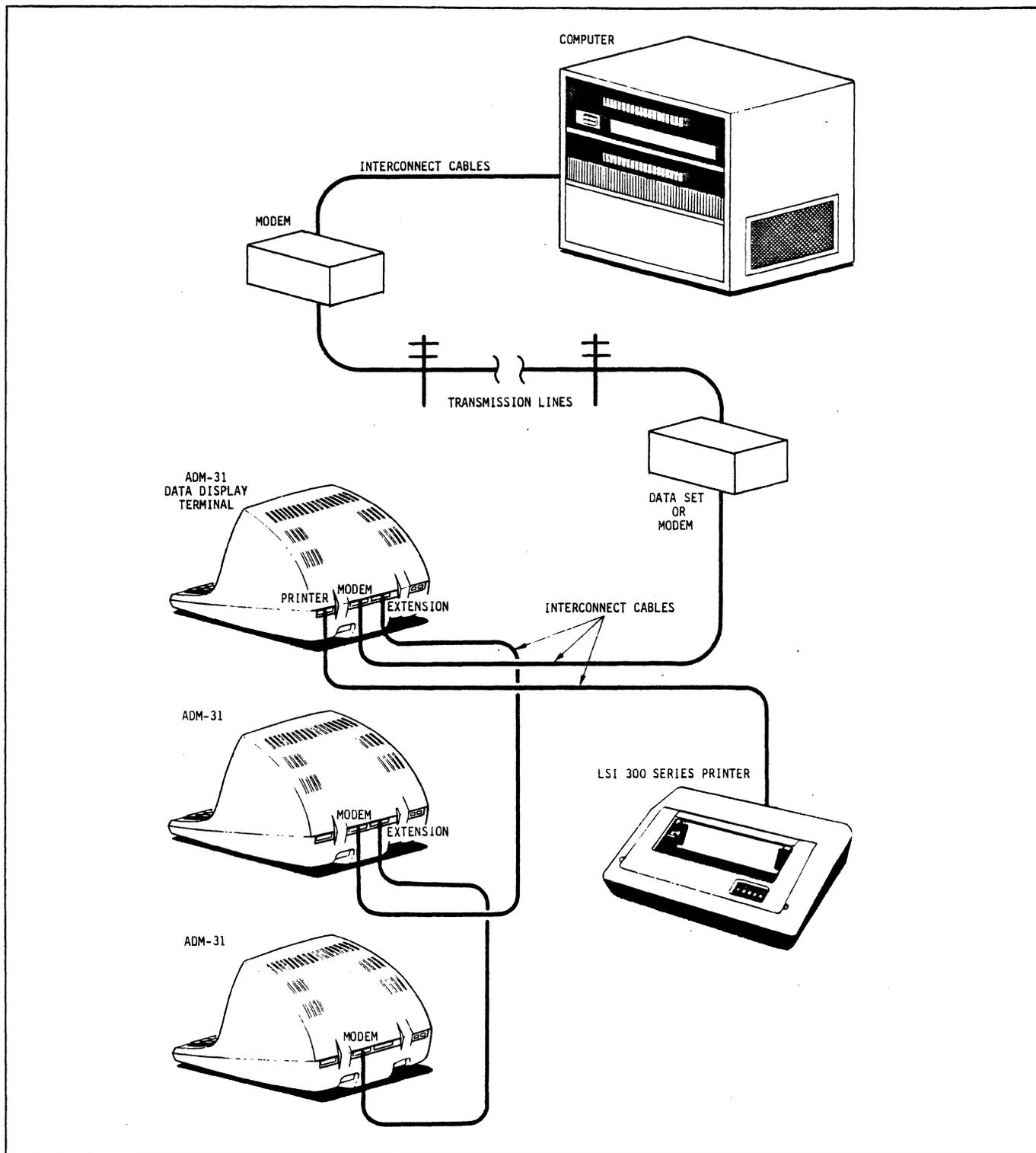


Figure 2-3. Typical ADM-31 Interfaces

### 2.5.1 Standard or Extension RS-232 Interface

The Standard RS-232 interface consists of connecting a computer directly to the ADM-31 through the MODEM port. The RS-232 extension interface requires the use of the MODEM port. Through the EXTENSION port several terminals or other devices may be daisy-chained, usually in a polling environment. Figure 2-4 shows typical logic associated with these inter-

faces. Refer to table 2-1 for the settings of DIP switches in switch banks S2 and S3, which are required to enable these interfaces.

### 2.5.2 Current Loop Interface

The ADM-31 can be configured for current loop using the MODEM port, without interfering with normal RS-232 signals required for asynchronous operation. The current loop interface increases

**Table 2-1. Configuration Control Switch Settings**

SWITCH S2 @ 13A INTERF/PRTR/ATTRIB			OPERATION
<u>SW1</u>	<u>SW2</u>	<u>SW3</u>	
OFF	OFF	OFF	BUSY not active*; Carrier Detect (DCD) disabled
OFF	OFF	ON	BUSY not active*; Carrier Detect enabled
OFF	ON	OFF	BUSY active on J5-20; Carrier Detect disabled
OFF	ON	ON	Not allowed
ON	OFF	OFF	BUSY active on J5-19; Carrier Detect disabled
ON	OFF	ON	BUSY active on J5-19; Carrier Detect enabled
*If S2 SW 6 is set to OFF, ADM-31 senses printer as never BUSY			
All other SW1, SW2, SW3 combinations not allowed			
SW4			Used in conjunction with S3 @ 11C
SW5			Secondary Channel Control (Hardware implementation only)
SW6			ON enables printer BUSY active LOW; OFF enables printer BUSY active HIGH.
SW7			ON causes cursor video to remain steady; OFF causes cursor video to blink.
SW8			ON causes selected personality attribute character to be displayed; OFF causes SPACE to be displayed instead of character.

**Table 2-1. Configuration Control Switch Settings (continued)**

SWITCH S2 @ 13A	SWITCH S3 @ 11C MODEM INTERFACE				OPERATION
<u>SW4</u>	<u>SW1</u>	<u>SW2</u>	<u>SW3</u>	<u>SW4</u>	
OFF	ON	OFF	ON	OFF	Enable Standard RS-232. Direct Connect disabled
ON	ON	OFF	ON	OFF	Enable Current Loop interface; Direct Connect disabled
OFF	OFF	ON	OFF	ON	Enable Direct Connect interface; Standard RS-232, Extended RS-232, and Current Loop disabled
All other SW1, SW2, SW3, SW4, and SW2 SW4 combinations not allowed					
SW5					OFF enables dot stretching; ON disables mode
SW6					ON enables blanking function; OFF enables underline function
SW7					ON causes NULLS to be displayed as NULLS; OFF causes NULLS to be displayed as SPACES
S4 @ 12L WORD STRUCTURE			OPERATION		
SW1			ON enables BREAK key; OFF disables BREAK key		
SW2			ON selects 50 Hz monitor refresh rate; OFF selects 50 Hz monitor refresh rate		
<u>SW3</u>	<u>SW4</u>	<u>SW5</u>	<u>MODEM PORT SELECTIONS</u>		
ON	ON	ON	Selects 7 DATA bits, even parity, 2 STOP bits		
OFF	ON	ON	Selects 7 DATA bits, odd parity, 2 STOP bits		
ON	OFF	ON	Selects 7 DATA bits, even parity, 1 STOP bit		
OFF	OFF	ON	Selects 7 DATA bits, odd parity, 1 STOP bit		
ON	ON	OFF	Selects 8 DATA bits, no parity, 2 STOP bits		
OFF	ON	OFF	Selects 8 DATA bits, no parity, 1 STOP bit		
ON	OFF	OFF	Selects 8 DATA bits, even parity, 1 STOP bit		
OFF	OFF	OFF	Selects 8 DATA bits, odd parity, 1 STOP bit		
SW6			Reserved		
SW7			ON selects Block Mode; OFF selects Conversation Mode		
SW8			ON selects Full Duplex operation; OFF selects Half Duplex operation when in Conversation Mode		

**Table 2-1. Configuration Control Switch Settings (continued)**

SWITCH S5 @ 13L PRINTER			OPERATION
SW1			Reserved
SW2			Reserved
<u>SW3</u>	<u>SW4</u>	<u>SW5</u>	<u>PRINTER PORT SELECTIONS</u>
ON	ON	ON	Selects 7 DATA bits, even parity, 2 STOP bits
OFF	ON	ON	Selects 7 DATA bits, odd parity, 2 STOP bits
ON	OFF	ON	Selects 7 DATA bits, even parity, 1 STOP bit
OFF	OFF	ON	Selects 7 DATA bits, odd parity, 1 STOP bit
ON	ON	OFF	Selects 8 DATA bits, no parity, 2 STOP bits
OFF	ON	OFF	Selects 8 DATA bits, no parity, 1 STOP bit
ON	OFF	OFF	Selects 8 DATA bits, even parity, 1 STOP bit
OFF	OFF	OFF	Selects 8 DATA bits, odd parity, 1 STOP bit
			} Bit 8 = $\emptyset$
SW6			Reserved
SW7			Reserved
SW8			(Polling Only) ON enables PRINTER port buffer; OFF disables PRINTER port buffer
SWITCH S6 @ 14L POLLING			OPERATION
SW1 thru SW7			Establish ASCII character which designates terminal polling address, ON = logic 0; OFF = logic 1
SW8			ON enables Polling Option; OFF disables Polling Option

the maximum permissible distance between the terminal and connected device from 50 feet to approximately 2000 feet. Figure 2-5 shows typical logic associated with passive and active current loop interfaces. Refer to table 2-1 for the settings of DIP switches in switch banks S2 and S3 which are required to enable Current Loop operation.

### 2.5.3 Direct Connect Interface

The Direct Connect interface using the MODEM port, is used with many Burroughs-type computer systems operating in Half-Duplex Mode, in a polling environment. The interface can accommodate up to nine terminals connected to

the line pair (AWG #24 twisted pair, or larger) having a maximum length of 1000 feet. Figure 2-6 shows typical logic associated with this interface. Refer to table 2-1 for the settings of DIP switches in switch bank S3, which are required to Direct Connect.

### 2.5.4 Printer Interface

The PRINTER port is used for connecting serial printer to the terminal. Figure 2-7 shows typical logic associated with the Printer interface. Refer to table 2-1 for the DIP switch settings which establish the BUSY signal polarity appropriate for the printer in use.

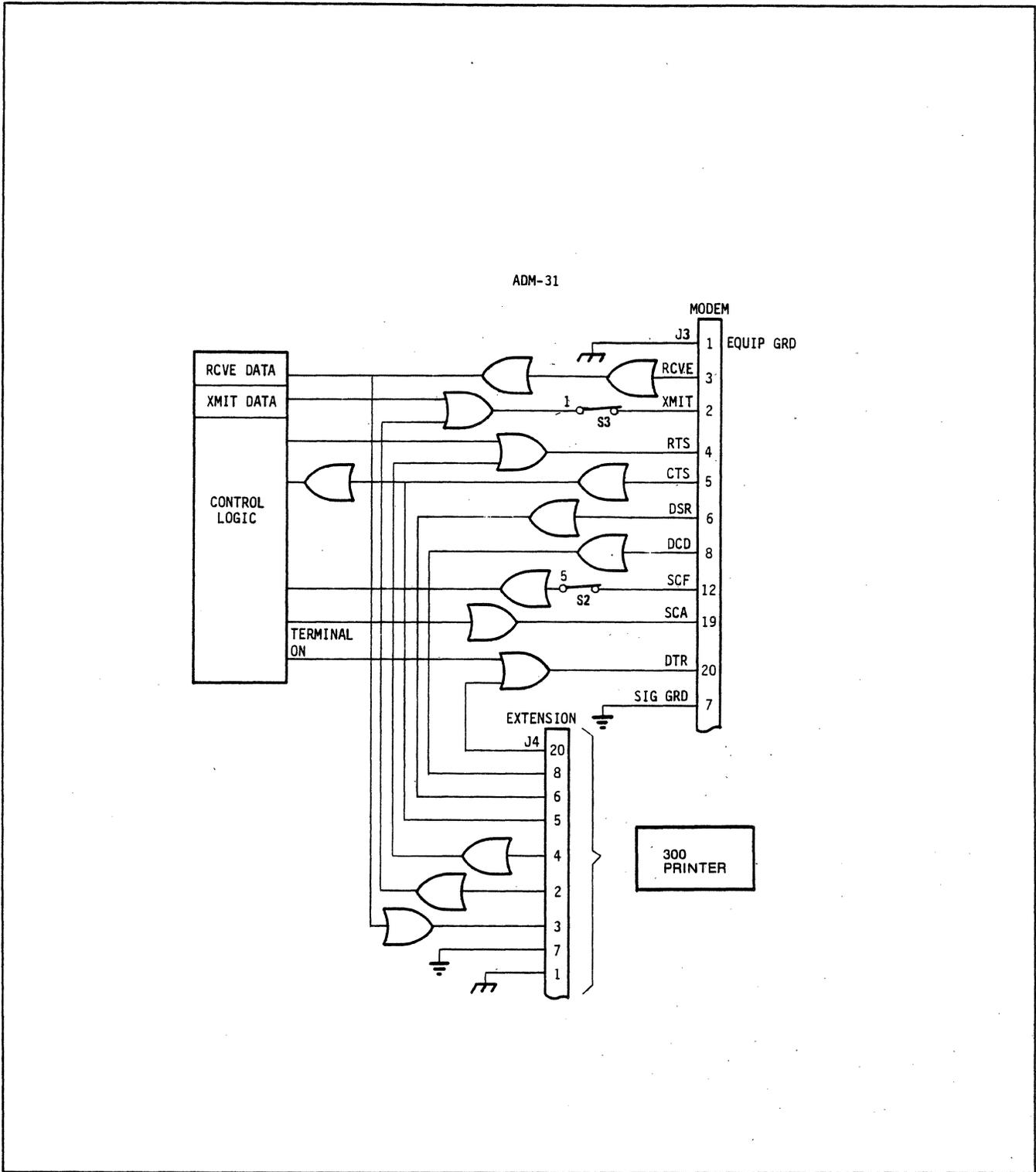


Figure 2-4. Typical Standard RS-232 and Extension Interface Logic

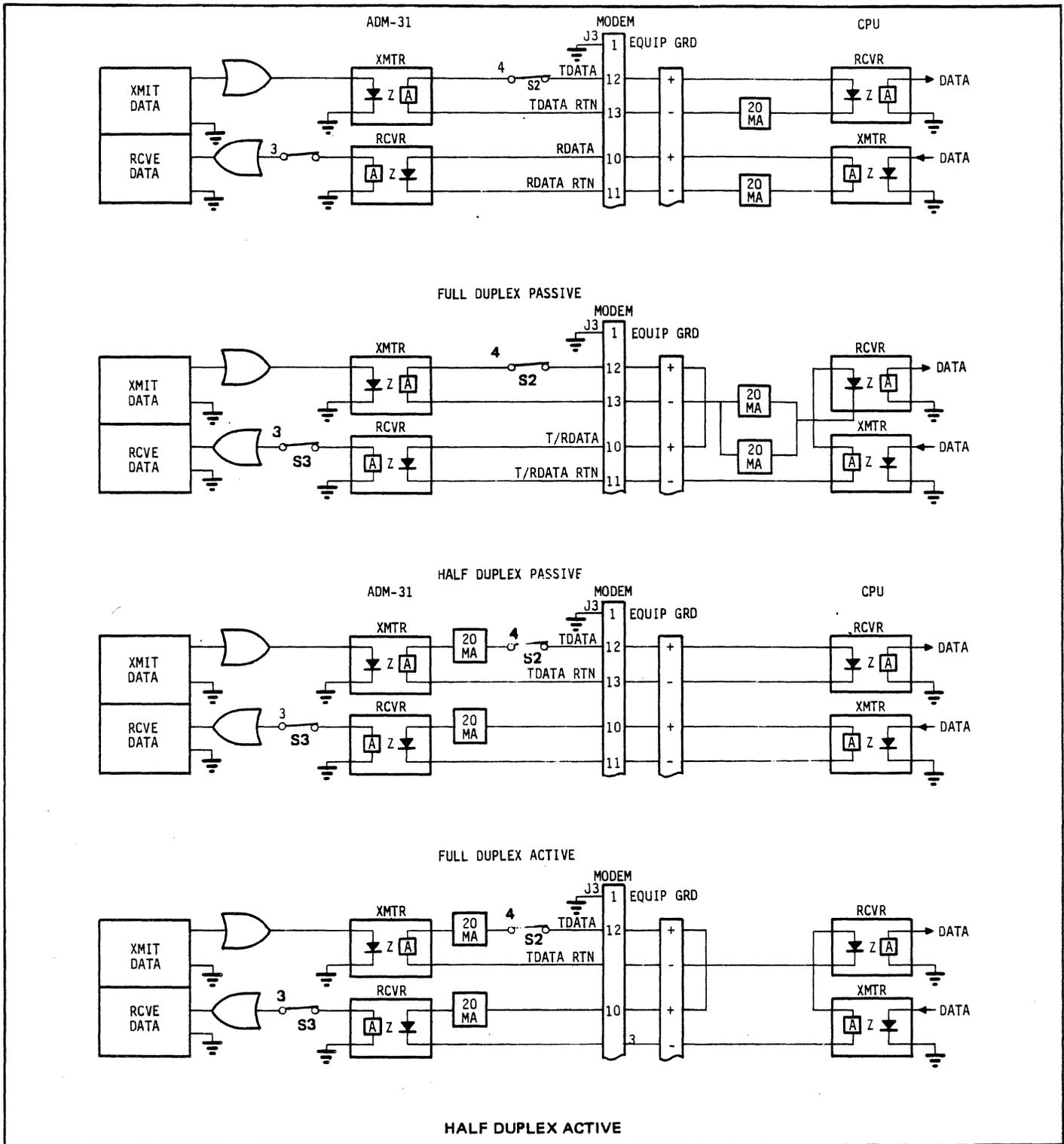


Figure 2-5. Typical Current Loop Interface Logic



## 2.6 INSTALLING THE ADM-31

To install the ADM-31, proceed as follows:

1. Connect the data interface cable to the terminal using the appropriate interface information (paragraph 2.5).
2. Check the ON/OFF switch (figure 2-8) to ensure that it is set to OFF.
3. Plug the terminal into a grounded AC outlet of the proper voltage.
4. Set the MODEM and PRINTER (if required) BAUD RATE switches (see figure 2-8) to the desired baud rate.

### Note

The BAUD RATE switches are factory set as follows:

Switch	Position	Baud Rate
MODEM	14	9600
PRINTER	7	1200

5. Set the configuration control DIP switches (refer to table 2-1) to the appropriate positions for controlling the ADM-31 characteristics.
6. Proceed to turn on the terminal.

## 2.7 POWER TURN-ON

Refer to figure 2-8 and proceed as follows:

1. On terminals equipped with the Polling Option, press CLEAR key.
2. Set the ON/OFF switch to ON.

### CAUTION

To avoid damage to the CRT screen when the terminal is to remain on but unchanged for extended period of time, reduce the screen brightness using the BRIGHTNESS control.

3. Wait approximately 20 seconds for the unit to warm up. The cursor should appear at the HOME position, and the rest of the screen should be clear.
4. If the cursor does not appear, momentarily press the HOME key. If the cursor still does not appear, operate the CONTRAST and BRIGHTNESS controls to check for misadjustment. If the cursor appears, adjust the controls for desired cursor brightness with the background barely visible.

### CAUTION

When recycling power using the ON/OFF switch, wait 10 seconds between the OFF and ON operations to ensure complete reset of the terminal's electronics.

5. If the cursor still does not appear, troubleshoot the CRT monitor, then the terminal electronics, if necessary.

## 2.8 OPERATIONAL CHECK

Operational check of the ADM-31 consists of performing certain operations which will provide reasonable assurance that the terminal will respond properly to basic keyboard operations. Depending upon operator familiarity with the terminal and its capabilities, other more sophisticated checks may be performed which are beyond the scope of this manual.

### Note

In Conversation Mode, if the Full-Duplex Mode is selected, typing at the keyboard will not display characters (Program Mode not set) unless echo-back from the host computer is provided. If Half-Duplex Mode is selected, data will be displayed as it is typed. Unless otherwise stated, the procedures which follow assume that

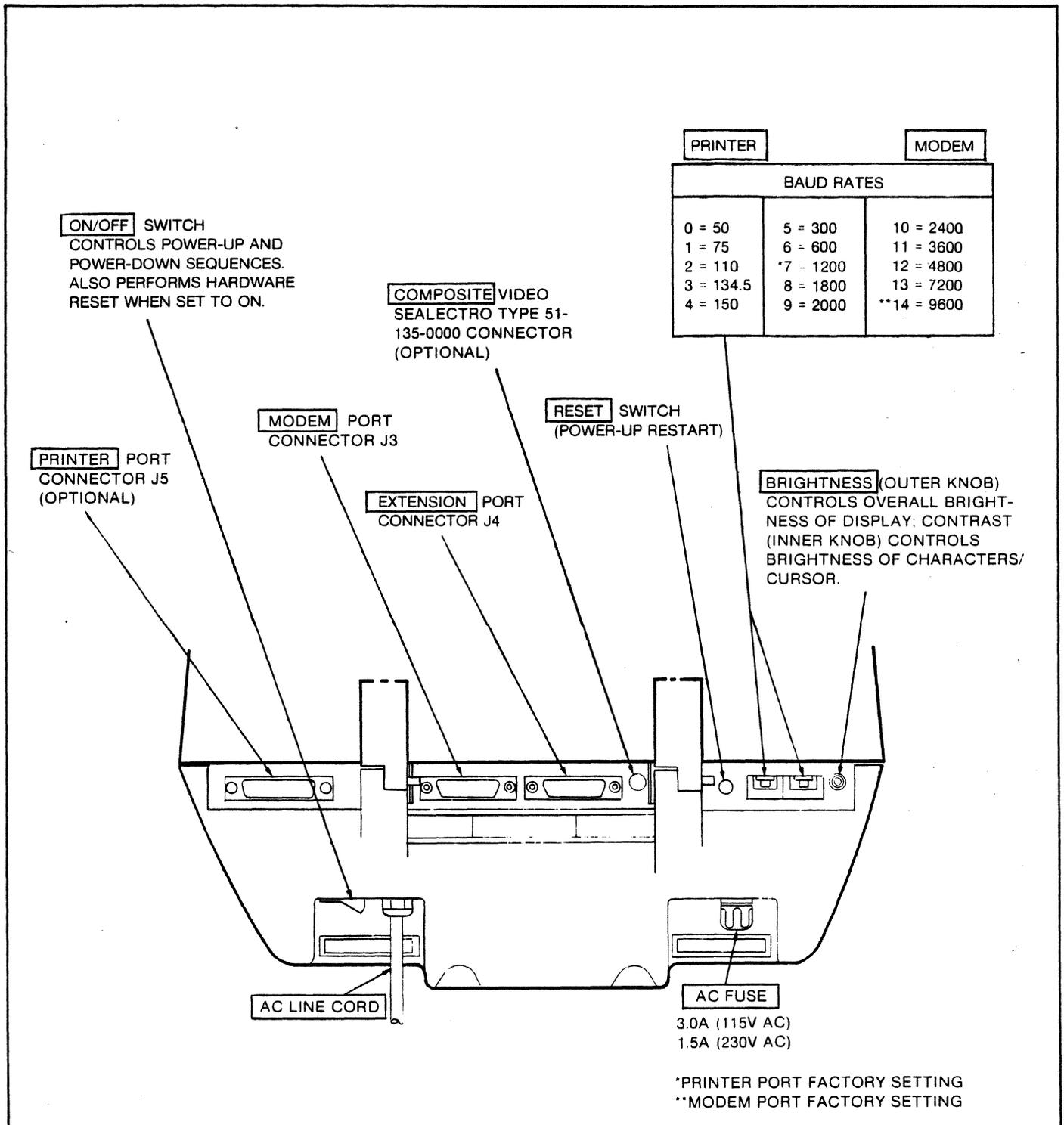


Figure 2-8. ADM-31 Rear Panel Controls

*Conversation Mode is set and the generated codes are properly echoed if Full-Duplex Mode is selected.*

### 2.8.1 Check of Displayable Character Keys

1. Press **CAP LOCK** key and observe that key light goes out.
2. Type in sequence the following 2nd row keys and observe that the appropriate character or symbol is displayed.  
1 2 3 4 5 6 7 8 9 0 - ^ \ ' 7 8 9 -
3. Press **CAP LOCK** key and observe that key light goes on.
4. Type in sequence the following 2nd row keys and observe that the appropriate character or symbol is displayed:  
1 2 3 4 5 6 7 8 9 0 - ^ \ ' 7 8 9 -
5. Press and hold the **SHIFT** key while typing the following 2nd row keys; observe that the appropriate character or symbol is displayed:  
! # \$ % & ' ( ) \_ = ~ | 7 8 9 -
6. Type and hold any alphanumeric key (assume **J**); observe that character (**J**) is repeated on screen as long as key is held.

### 2.8.2 Check of Special Function Keys

1. Hold down **SHIFT** and type the **CLEAR** key. Observe that CRT screen is cleared and cursor goes to **HOME** position.
2. Type approximately half a line of copy on the screen.
3. Type **RETURN** key and observe that cursor returns to the beginning of the line in which it rests.
4. Repeat step 2 above.

5. Type **LINE FEED** key and observe that cursor is moved to the same column position in the next lower line.
6. Type **NEW LINE** key and observe that cursor is moved to the first character position of the next lower line.
7. Type **PAGE/NEW/LINE** key while holding **SHIFT** key; observe that cursor moves to HOME position of page 2. Repeat the operation to return to page 1.
8. Repeat step 2 above.
9. Type **HOME** key and observe that cursor returns to HOME position on the page.
10. Type in sequence the     keys and observe that the cursor moves upline, downline, left, and right as long as each key is typed.
11. Press and hold **CTRL** key while typing **G**; the terminal bell should sound.
12. Type **ESC U**, then **CTRL G**; observe that the symbol  $B_L$  is displayed and no bell sounds.
13. Type **ESC X** then **CTRL G**; the terminal bell should sound and no symbol should be displayed.
14. Press and hold **SHIFT** while typing **FUNCTION**, then enter **= + G**; observe that cursor moves to approximate center of the screen.
15. Type **ESC #**; observe that the terminal keyboard is disabled.
16. Press **RESET** switch at rear of the terminal and observe that cursor is at **HOME** position and keyboard control has returned.

## 2.9 POWER TURN-OFF

Refer to figure 2-8 and proceed as follows:

1. If the terminal contains any information which must be retained, be sure to transmit this information immediately to the host computer. This is necessary, as the display memory is cleared when power is removed from the terminal. As an alternate measure, print the information prior to turning off the terminal.
2. Turn off the ADM-31 by setting ON/OFF switch to OFF.

## 2.10 CARE OF THE ADM-31

This portion of the manual provides the required operator instructions pertaining to routine maintenance for the ADM-31 Data Terminal Display. Preventive Maintenance procedures are limited primarily to cleaning and inspection steps.

### 2.10.1 Cleaning

At periodic intervals, clean the exterior housing and lightly dust the unit using a soft brush or damp lint-free cloth. However, paper towels may be substituted if desired. Remove smudges from the CRT exterior screen and the housing with conventional spray cleaners or alcohol. Do not use petroleum base cleaners, such as lighter fluid, as this could be harmful to the painted surface. Be careful not to scratch the CRT screen, and do not use freon cleaners.

### 2.10.2 Inspection

Periodically, inspect switches and keyboard assembly for freedom of movement. Determine that the intensity of character trace on the CRT screen has not diminished. Any required mechanical and electrical adjustment shall only be performed by an authorized Lear Siegler service representative.

## SECTION III FUNCTIONAL DESCRIPTION

### 3.1 INTRODUCTION

This section describes the functional characteristics of the ADM-31 which contribute to the full operational use of the terminal.

### 3.2 OPERATIONAL DESCRIPTION

The ADM-31 is a microprocessor-based device which provides a means of communicating with a remote computer, and which allows the user full control of the content and format of data entered by means of the keyboard. Figure 3-1 illustrates the flow of data through the functional areas of the ADM-31.

The standard ADM-31 consists of a power supply, keyboard, control section (CPU), video logic and control, CRT display, configuration control switches, and external interface logic. The interface logic permits the standard and extension RS232-C interfaces and the serial printer interface.

#### 3.2.1 Switching Power Supply

The ADM-31 power supply is a 52-watt switching power supply mounted under the main printed circuit board assembly. Four regulated dc voltages are provided +15 volts, +5 volts, and  $\pm 12$  volts. The power supply can accept line voltage inputs of 115 Vac or 230 Vac (with 230-volt power supply option).

#### 3.2.2 Keyboard

Data to be processed by the terminal is either from the keyboard or is sent from the remote computer. Keyboard entry is made using one of the 90 keys on the keyboard. Each keystroke is encoded into a parallel ASCII character which appears on seven data lines connected to the CPU. Accompanying the 7-bit character is a keystroke which alerts the program that a character is to be input from the keyboard.

#### 3.2.3 Control Section (CPU)

The Control Section (CPU) contains the microprocessor and various integrated circuits which control all the operations of the ADM-31. These operations include: timing and control, data handling and storage, interpreting and responding to control commands from the keyboard and the computer, video control, I/O interfacing, and status control.

Data entering the terminal is placed on the Data Bus and sent to the CPU section, which contains the microprocessor and various other integrated circuits and switches. The CPU, executing a stored read only memory (ROM) program, decodes the input data and reformats it into data and control instructions for the video logic and control section.

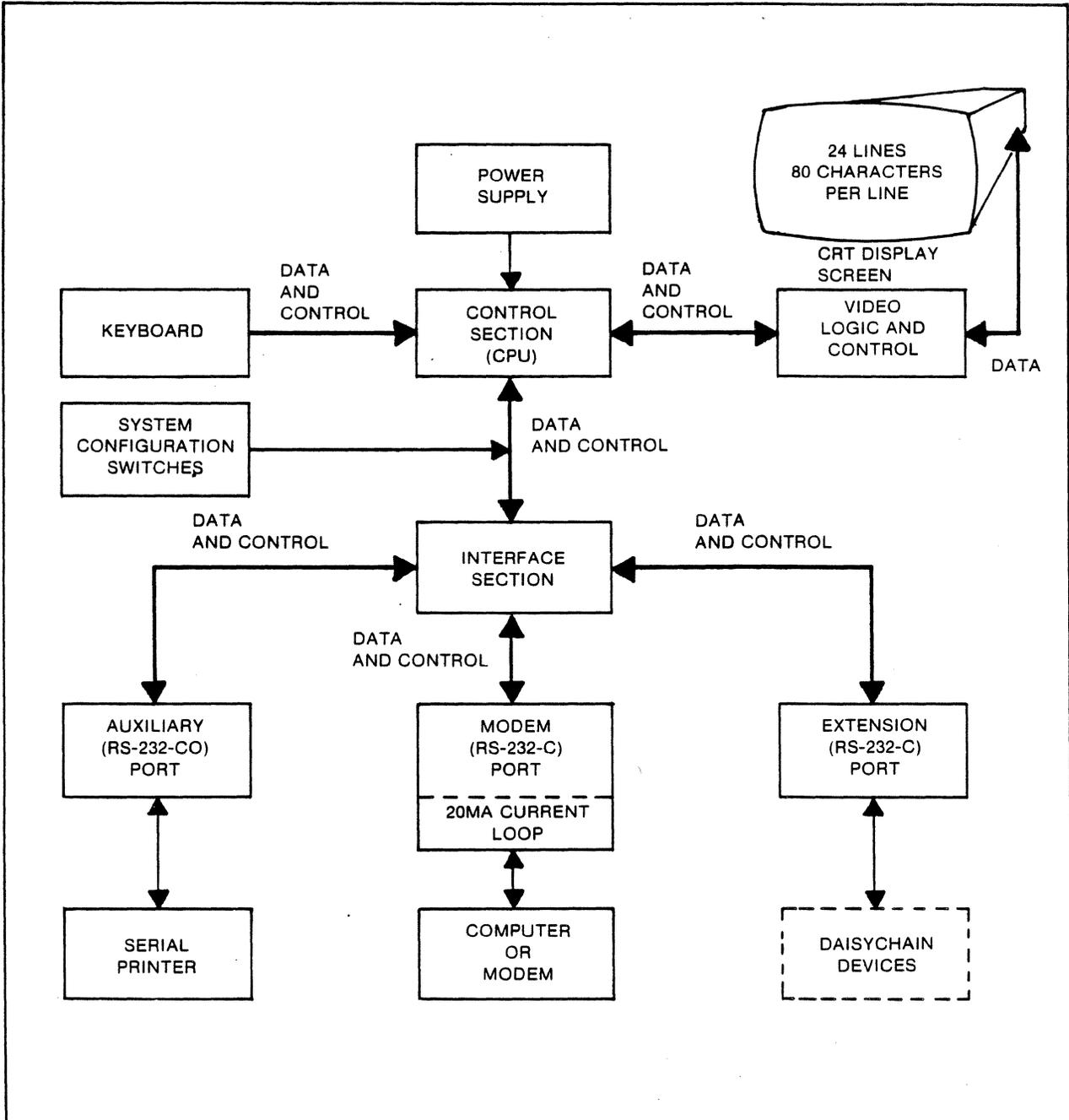


Figure 3-1. ADM-31 Data Flow Block Diagram

### 3.2.4 Video Logic and Control

The Video Logic and Control section contains the display logic needed to drive the CRT, 4k of random access memory (RAM), and character generation circuits, as well as the video logic and 12-inch monitor. The monitor screen can display 24 lines of data containing as many as 80 characters per line. Data from the CPU is written into the video RAM; control instructions from the CPU cause the contents of the RAM to be periodically displayed on the CRT screen.

### 3.2.5 Interface Section

Data and control information from a remote computer is routed through the MODEM port to the interface section, and then to the CPU. The CPU causes data to be displayed on the CRT in the same manner as the keyboard data. The interface contains the logic circuitry appropriate for interfacing with RS232-C point-to-point signals or 20-ma current loop signals, and modem logic. Optional circuits for an RS232-C serial printer and direct connect interfaces are also provided. The interface section also contains the baud rate clock and baud rate switches which permit the ADM-31 to receive or transmit data at selected baud rates from 50 to 9600 baud.

The ADM-31 transmits data by retrieving data from the video RAM and placing it on the Data Bus for routing to the CPU. The CPU reformats the data and routes data and control information to the interface section over the Data Bus. Interface logic is used to prepare the data and control information for transmission to the appropriate device connected.

### 3.2.6 System Configuration Switches

Several banks of system configuration switches are provided to control various

attributes and characteristics of the ADM-31. The switches are mounted on the logic board. The characteristics thus controlled include: mode of transmission/reception, parity, word structure, refresh rate, cursor/display attributes, and the polling address (optional).

### 3.3 STANDARD CHARACTER FORMAT

The standard ADM-31 character set contains 128 ASCII characters, 32 of which are control characters. (See figure 3-2.) The entire character set may be displayed on the CRT screen by placing the terminal in Program Mode or by preceding control characters with an ESC code.

### 3.4 ADM-31 WORD STRUCTURE

The ADM-31 can transmit and receive data characters in any one of the asynchronous character formats shown in figure 3-3. The appropriate word format for the user's application is selected by means of the indicated DIP switches.

### 3.5 DATA TRANSMISSION CHARACTERISTICS

Data which has been written in memory and displayed on the CRT may be transmitted to the host computer either character by character as during Conversation Mode operation, or in message blocks, as during Block Mode operation. Transmission is asynchronous, in one of the word formats established in accordance with figure 3-3, and at a transmission rate determined by the application. Using the MODEM BAUD Rate switch at the rear of the terminal (see figure 2-8), it is possible to select a data transmission rate of 50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, or 9600 baud. The standard ADM-31 MODEM port is set for 9600 baud at the factory.

OPERATORS QUICK REFERENCE CHART  
OF DISPLAYABLE CHARACTER SET CODES

			CONTROL CHARACTERS		DISPLAYABLE CHARACTERS					
HEX BYTE	1ST		0	1	2	3	4	5	6	7
	BITS 4 <sub>3</sub> 2 <sub>1</sub>	BITS 7 <sub>6</sub> 5	0 <sub>0</sub> 0	0 <sub>0</sub> 1	0 <sub>1</sub> 0	0 <sub>1</sub> 1	1 <sub>0</sub> 0	1 <sub>0</sub> 1	1 <sub>1</sub> 0	1 <sub>1</sub> 1
2ND										
0	0000		NUL	DLE		0	@	P	`	p
1	0001		SOH	DC1	!	1	A	Q	a	q
2	0010		STX	DC2	"	2	B	R	b	r
3	0011		ETX	DC3	#	3	C	S	c	s
4	0100		EOT	DC4	\$	4	D	T	d	t
5	0101		ENQ	NAK	%	5	E	U	e	u
6	0110		ACK	SYN	&	6	F	V	f	v
7	0111		BEEP	ETB	'	7	G	W	g	w
8	1000		BS ( ← )	CAN	(	8	H	X	h	x
9	1001		(SKIP) HT	EM	)	9	I	Y	i	y
A	1010		LF ( ↓ )	SUB	*	:	J	Z	j	z
B	1011		VT ( ↑ )	ESC	+	;	K	[	k	{
C	1100		FF ( → )	FS	'	<	L	\	l	!
D	1101		CR	GS	-	=	M	]	m	}
E	1110		SO	(HOME) RS	.	>	N	^	n	~
F	1111		SI	(NEW LINE) US	/	?	O	—	o	DEL

CONTROL CODES

USE **CTRL** KEY  
WITH DISPLAYABLE  
CHARACTER KEYS TO  
PRODUCE CONTROL  
CODES

Figure 3-2. Displayable Character Set and Control Codes

WORD FORMAT	DIP SWITCH CONFIGURATIONS			WORD STRUCTURE										
	SW5	SW4	SW3	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT	BIT
				0	1	2	3	4	5	6	7	8	9	10
Eleven-Bit Word with Even Parity and 2 STOP Bits	ON	ON	ON	Start	ACTIVE BITS = 1 OR 0							even parity	stop	stop
Eleven-Bit Word with Odd Parity and 2 STOP Bits	ON	ON	OFF	Start	ACTIVE BITS = 1 OR 0							odd parity	stop	stop
Ten-Bit Word with Even Parity and 1 STOP Bit	ON	OFF	ON	Start	ACTIVE BITS = 1 OR 0							even parity	stop	X
Ten-Bit Word with Odd Parity and 2 STOP Bits	ON	OFF	OFF	Start	ACTIVE BITS = 1 OR 0							odd parity	stop	X
Eleven-Bit Word with No Parity and 2 STOP Bits	OFF	ON	ON	Start	ACTIVE BITS = 1 OR 0							always 0	stop	stop
Ten-Bit Word with No Parity and 1 STOP Bit	OFF	ON	OFF	Start	ACTIVE BITS = 1 OR 0							always 0	stop	X
Eleven-Bit Word with Even Parity and 1 STOP Bit	OFF	OFF	ON	Start	ACTIVE BITS = 1 OR 0							always 0	even parity	stop
Eleven-Bit Word with Odd Parity and 1 STOP BIT	OFF	OFF	OFF	Start	ACTIVE BITS = 1 OR 0							always 0	odd parity	stop

Figure 3-3. Word Format Codes with DIP Switch Configurations

### 3.5.1 Conversation Mode Characteristics

Conversation Mode communication between the ADM-31 and the host computer is character-by-character only. Transmission may be in one direction at a time, as in Half-Duplex operation; or in both directions simultaneously, as in Full-Duplex operation. At power-up, the standard ADM-31 is initialized in Conversation Mode, Half-Duplex. Refer to table 2-1 for the possible modifications using configuration control.

The ADM-31 may receive data at any time over the RCVE line (BB). Data for transmission is controlled by Request to Send (RTS) over line CA, Clear to Send (CTS) over line CB, and Carrier Detect (DCD) over line CF.

Request to Send (RTS) is set (high) to inform the host that the ADM-31 wishes to transmit. Clear to Send (CTS) from the host is set or modem should be (high) to initiate ADM-31 transmission. In Full-Duplex Mode, RTS is set high and remains high. In Half-Duplex Mode, RTS is reset to low whenever Return (CR), End of Transmission (EOT) or End of Text (ETX) is sensed by ADM-31 logic.

### 3.5.2 Block Mode Characteristics

In Block Mode, information is transmitted and received as complete messages or blocks of data (compared with character-by-character transmission in Conversation Mode). Complete messages, up to two full pages in length may be displayed and stored in display memory. These messages may be edited or otherwise modified from the keyboard before being transmitted to the host and/or to an optional auxiliary device such as a printer.

### 3.6 PRINT MODE TRANSMISSION CHARACTERISTICS

Print Mode Transmission requires an optional Serial Printer Interface installation as described in Section II of this manual. The interface can be used with most RS232-C compatible serial printers, which includes buffered as well as character-by-character printers. With this interface, configuration control DIP switches (refer to table 2-1) are provided to establish: word format, BUSY ON/OFF and polarity characteristics. In addition, the PRINTER BAUD RATE switch at the rear of the terminal (see figure 2-8), makes it possible to select a transmission rate of 50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, or 9600 baud. The factory setting for the PRINTER port baud rate is 1200.

Generally, Print Mode data is transmitted continuously as long as the printer and the ADM-31 are READY. The logical conditions required for proper terminal/printer control (see figure 2-7 and table 2-1) are as follows:

1. CTS is enabled by setting DIP switch S2-SW1 or S2-SW2 (location 13A) to ON (refer to table 2-1). In Polling applications, the PRINTER interface is enabled by setting PRINTER DIP switch S4-SW8 (location 13L) to ON.
2. When the terminal is ready to transmit data, the Request to Send (RTS) line is set (high).
3. If the printer is READY, it signals not BUSY over the READY line, which alerts the terminal. Depending upon which printer is selected, not BUSY may be active when high or low on pin 19 or 20 of connector J5. DIP switches SW1, SW2, SW3, and SW6 in

switch bank S2 at location 13A (refer to table 2-1) are provided for this purpose.

4. If the Print command is executed by the host, the ADM-31 transmits a CR code to the host upon completion of the transmission to the printer.

### 3.6.1 Formatted Print Mode

Formatted Print Mode (Page Format Mode) transmits data to the printer so that it will be printed exactly as displayed on the CRT screen. A set of operation codes permits ALL displayed data to be sent with no distinction made between protected and unprotected data; or permits only unprotected data, as formatted, to be transmitted to the printer, with protected data sent as spaces. Trailing spaces or nulls are not transmitted and attribute operation codes are transmitted as spaces. When either PRINT command is executed (refer to Print Transmission Control Operations in Section IV), the following events take place:

1. The GS control code is written at the cursor position as a STOP code.
2. The cursor moves to the HOME position. If Auto Page is set, the cursor moves to the HOME position (or to the first unprotected position) on Page 1, and transmission begins.
3. The code sequence CR LF NULL is sent to the printer, followed by the data as formatted on the screen.
4. NULL characters and trailing spaces on a line are not sent. When the last character on each line is sent, the terminal sends CR LF NULL before moving to the next line.

### Note

A STOP (GS) code within the text will cause the printing to stop at that point.

5. Upon reaching the STOP code, the operation is terminated, a final CR LF NULL is sent, and the STOP code (GS) is overwritten with a space.

### 3.6.2 Unformatted Print Mode

Unformatted Print Mode transmits in a continuous stream, without inserting control characters or internal ADM-31 delays, the data displayed on the CRT. This mode allows greater flexibility in formatting the printed copy, especially with printers having other than 80-character lines. No distinction is made between protected and unprotected data as displayed. When this PRINT command is executed (refer to Print Transmission Control Operations in Section IV), the following events take place:

1. The cursor must be set at the beginning of the data to be transmitted, before transmission is initiated.
2. Line control characters (CR, LF, etc.) are not inserted at the end of each ADM-31 line; transmission continues without delay from line to line, until the GS STOP code is reached. The STOP code is overwritten with a space.
3. NULL characters on the screen are sent to the printer, and all trailing spaces are transmitted.
4. Control codes for print formatting may be embedded in the text using local coding sequences, but only when Program Mode is set. Such control codes include: CR, LF, FF, VT, BEL, ESC, BS, FS, GS, RS, and US.

### 3.6.3 Copy Print Mode

In Copy Print Mode, data from the host is sent to the printer via the ADM-31 print buffer without any terminal intervention (except buffering). Operating under software control, the print buffer is formed by taking over the display memory usually assigned to Page 2. Data is read out of the buffer in Unformatted Print format at a transmission rate determined by the setting of the PRINTER BAUD RATE switch at the rear of the terminal, which is factory set at 1200 baud (see figure 2-8).

A set of control codes permits data from the host to be read into the buffer and retransmitted to the printer: a) without being displayed; or b) after being displayed and/or acted upon by the ADM-31.

When either PRINT command is executed (refer to Print Transmission Control Operations in Section IV), the following events take place:

1. Copy Print Mode cannot be executed if Page 2 is in use (data displayed) or Auto Page is set. The New Page operation is inhibited.
2. Print data is read out of the print buffer at the selected printer baud rate, in accordance with the printer BUSY/READY protocol discussed above.
3. The control code DC4 from the host terminates transmission of data from the host; however, printing from the buffer continues until the buffer is empty.

## SECTION IV OPERATION

### 4.1 INTRODUCTION

This section provides the information necessary for the operator to utilize the ADM-31 to its fullest capabilities. Emphasis is given to the control codes required to initiate and control the various terminal operations, whether they originate at the host or the ADM-31 keyboard. It is assumed that the operator is thoroughly familiar with keyboard operations, which are not discussed herein, except as required to execute a given terminal operation. Refer to the Operators Quick Reference Guide DP111 for detailed keyboard information.

### 4.2 CONTROL CODES AND OPERATING MODES

#### 4.2.1 Standard Control Codes

The operational characteristics of the ADM-31 are controlled by a group of control codes which may originate at the host computer or at the terminal keyboard. Control codes are not displayable unless preceded by an ESC character or Program Mode is set. In either case, the ADM-31 will display but not act upon the recognized control code. Of the 32 standard control codes available for use, the standard (non-polling) ADM-31 recognizes and responds to the control codes listed in table 4-1.

#### 4.2.2 Escape Sequences

An escape sequence is formed by executing the ESC code (or rarely used alternate **CTRL [ ]**) or **SHIFT FUNCTION**, followed by one or more otherwise displayable ASCII characters. Each escape sequence controls a specific terminal operation. Some operations are one time only or for a specific number of times; others remain operative for as long as power to the terminal is not interrupted or until terminated by another control code.

Escape sequences are used primarily to control ADM-31 operations, but may also be extended to control a printer or other auxiliary device connected to the ADM-31.

Figure 4-1 shows the escape sequences recognized by the ADM-31, whether from the host or from the keyboard. Each escape sequence is immediately acted upon by the terminal, unless preceded by an additional ESC character, or Program Mode is set. In either case the escape sequence code will be displayed but not acted upon. Escape sequences initiated from the keyboard may be accomplished in one of several ways, as indicated in table 4-1. During specific modes of terminal operation, one method is preferred over another method, as follows:

- **Conversation Mode.** Preferred method: **SHIFT FUNCTION ASCII**.

ESCAPE SEQUENCES									
HEX BYTE	1ST →	2	3	4	5	6	7		
2ND ↓									
0		0	@	PRINT w/o PROT	P	PRINT PAGE	\	p	UNFORM PRINT (POLLING)
1	!	1	A	BUFF PRNTM*	Q	INSERT CHAR	a	q	SET INS MODE
2	" KBD ENA **	2	B	SET BLOCK	R	DELETE LINE	b	r	CLEAR INS MODE
3	# KBD DISA **	3	C	SET CONV	S	SEND MSG	c	s	
4	\$	4	D	SEND FG LINE	T	ERASE LINE (PERS)	d	t	
5	%	5	E	SEND PAGE	U	SET PGM MODE	e	u	CLEAR PGM MODE
6	& SET PROTM	6	F	SEND ALL LINE	V		f	v	SET AUTO PG
7	' CLEAR PROTM	7	G	SEND ALL PAGE	W	DELETE CHAR	g	w	CLEAR AUTO PG
8	( CLEAR WPROT	8	H		X	CLEAR PGM MODE	h	x	
9	) SET WPROT	9	I	BACK TAB	Y	ERASE PAGE (PERS)	i	y	TAB (SKIP) ERASE PG TO NULL
A	* CLEAR ALL NULL	:	J	CLEAR ALL NULL	Z	PAGE BACK	j	z	
B	+ CLR FG SP/PERS	;	K	CLR FG SP/PERS	[	PAGE FWD	k	{	
C	, CLR TO PROT SP	<	L		\	UNFORM PRNT	l		
D	- LOAD PRC*	=	M	LOAD RC*	]		m	}	
E	. CHANGE PERS*	>	N		^		n	~	
F	/ READ PRC **	?	O	READ RC**	-		o	o	DISPLAY PERS* DEL

\*Multiple Characters Required  
\*\*Remote (from host) only

Figure 4-1. Chart of ADM-31 Escape Sequences

Table 4-1. Control Codes Recognized by Standard ADM-31

CONTROL CODE		HEX CODE	OPERATION
FROM HOST	FROM KEYBOARD		
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">CTRL C</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">CTRL D</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">CTRL M</div>	03 04	ETX (End of Text), EOT (End of Transmission), or CR (Carriage Return) are used as line turn-around characters during half-duplex operation.
BEL	<div style="border: 1px solid black; padding: 2px; display: inline-block;">CTRL G</div>	07	BEEP - Generates audible alarm.
BS	<div style="border: 1px solid black; padding: 2px; display: inline-block;">CTRL H</div> or <div style="border: 1px solid black; padding: 2px; display: inline-block;">←</div>	08	Back Space - Moves cursor to the next unprotected position to the left on the line or on the next previous line, moving from right to left.
HT	<div style="border: 1px solid black; padding: 2px; display: inline-block;">CTRL I</div> or <div style="border: 1px solid black; padding: 2px; display: inline-block;">BACK TAB TAB</div>	09	Horizontal Tab - Skips cursor to next tab set position, when Protect Mode is set. If no such position, cursor moves to HOME (or next unprotected position) on page, or other page if Auto Page is set.
LF	<div style="border: 1px solid black; padding: 2px; display: inline-block;">CTRL J</div> or <div style="border: 1px solid black; padding: 2px; display: inline-block;">↓</div>	0A	Line Feed - Moves cursor to same column position in next lower line, or to next unprotected position in new line or next line, if necessary.
VT	<div style="border: 1px solid black; padding: 2px; display: inline-block;">CTRL K</div> or <div style="border: 1px solid black; padding: 2px; display: inline-block;">↑</div>	0B	Up Line - Moves cursor to same column position in next previous line, or to next unprotected position (moving from left to right) in new line or next line, if necessary.
FF	<div style="border: 1px solid black; padding: 2px; display: inline-block;">CTRL L</div> or <div style="border: 1px solid black; padding: 2px; display: inline-block;">→</div>	0C	Forespace - Moves cursor to the next unprotected position to the right on the line, or to the first unprotected location on the next lower line, moving from left to right.
CR	<div style="border: 1px solid black; padding: 2px; display: inline-block;">CTRL M</div> or <div style="border: 1px solid black; padding: 2px; display: inline-block;">RETURN</div>	0D	Return - Moves cursor to first unprotected position in line containing the cursor.

Table 4-1. Control Codes Recognized by Standard ADM-31 (continued)

CONTROL CODE		HEX CODE	OPERATION
FROM HOST	FROM KEYBOARD		
ESC	<div style="border: 1px solid black; display: inline-block; padding: 2px;">ESC</div> or <div style="border: 1px solid black; display: inline-block; padding: 2px;">CTRL</div> <div style="border: 1px solid black; display: inline-block; padding: 2px;">[</div> <div style="border: 1px solid black; display: inline-block; padding: 2px;">SHIFT</div> <div style="border: 1px solid black; display: inline-block; padding: 2px;">FUNCTION</div>	1B	Escape - Recognized by ADM-31 as code extension character which must be followed by otherwise displayable character(s) to invoke a specific terminal operation. Also used preceding a control code to cause control code to be displayed instead of acted upon.
RS	<div style="border: 1px solid black; display: inline-block; padding: 2px;">CTRL</div> <div style="border: 1px solid black; display: inline-block; padding: 2px;">^</div> or <div style="border: 1px solid black; display: inline-block; padding: 2px;">HOME</div>	1E	HOME - Moves cursor to first character position on page. If Auto Page is set, cursor moves to Home on page 1. If HOME is protected, cursor moves to first unprotected position on affected page.
US	<div style="border: 1px solid black; display: inline-block; padding: 2px;">CTRL</div> <div style="border: 1px solid black; display: inline-block; padding: 2px;">_</div> or <div style="border: 1px solid black; display: inline-block; padding: 2px;">PAGE NEW LINE</div>	1F	New Line - Causes a combined Return (CR) and Line Feed (LF) to be executed. Cursor moves to first unprotected position on next line.

Especially useful when operating in Full Duplex when host does not echo. The escape sequence is not transmitted; it is used only as a local operation code. Using the ESC key may cause the host to interpret the ESC character as an abort command.

- **Block Mode.** Preferred method: 

ESC

ASCII

. Alternate method: 

CTRL

[

ASCII

. Preceding the escape sequence with an additional ESC character will imbed the sequence in the text without causing the terminal to respond.

**Note**

Control codes imbedded in the text in this manner are transmitted when the block of data is sent.

**4.2.3 Special Function Codes**

A special function code may be generated for transmission, at the keyboard, by typing 

FUNCTION

 followed by an alphanumeric character, preferably one which is not committed for any other purpose. The following code is generated: SOH 

ASCII

 CR, where 

ASCII

 is the selected alphanumeric character. A typical use of this code sequence might be as a header for a special message.

**Note**

CR, as specified above may be modified by a personality change sequence, described later, to be a different ASCII character.

## 4.2.4 Keyboard Enable/Disable

The ADM-31 keyboard is always active unless disabled by an ESC # sequence. Once disabled, the keyboard may be enabled by an ESC " sequence from the host only, or by pressing the red RESET button at the rear of the terminal.

## 4.2.5 Scrolling

In the ADM-31, data is entered into display memory starting at HOME position on each page (except as modified by certain restrictions when protected fields are involved), and continuing through Position 80 in Line 24. When Position 80 is filled, the display is shifted upwards one line and data entry continues, starting with Position 1 in the new Line 24. The original top line is lost. Scrolling on each page continues indefinitely, unless Auto Page is set; if so, scrolling is inhibited. Also, scrolling is inhibited if Protect Mode is set.

## 4.2.6 Display of Program Version

The firmware program installed in the ADM-31 varies with its level of enhancement and with customer requirements. The program version installed can be displayed by executing ESC o 9. The display will be one of the following:

- a. 1211 For a standard ADM-31 with or without any option except the Polling Option.
- b. 0200 For an ADM-31 with Polling Option and with or without any other option.

## 4.3 FORMAT CONTROL OPERATIONS

Certain ADM-31 operations are concerned primarily with formatting or controlling the manner in which data is formatted, whether it is input from the host or from the keyboard.

## 4.3.1 Program Mode

Program Mode is typically used for transparent operation. In Program Mode control characters (CR, LF, FS, etc.) are written and displayed as they are received or keyed but are not acted upon. Program Mode is set by executing ESC U and terminated by executing ESC X or ESC u.

## 4.3.2 Protected Fields and Modes

Areas in the ADM-31 display may be designated as protected fields. These fields appear at reduced intensity and have the following characteristics:

- Protected fields cannot be overwritten as long as Protect Mode is set.
- Forms appearing on the display initiated by the computer are usually in protected characters.

### 4.3.2.1 Write Protect Mode

Write Protect Mode is set by executing ESC ) and terminated by executing ESC (.

### 4.3.2.2 Protect Mode

Protect Mode is set by executing ESC &, and terminated by executing ESC ".

### 4.3.2.3 Designated Protected Field

The operator has complete control over any character typed into display memory. Consequently, the operator may elect to protect or leave unprotected any character entered from the keyboard. To enter protected characters Write Protect Mode must be set by executing ESC ). Write Protect Mode is terminated by executing ESC (. Characters written while Write Protect Mode is set then may

be protected by executing ESC & to set Protect Mode. The ESC ) and ESC ( codes are used during a Send All operation as delimiters for protected fields in a line or page. Protect Mode is terminated by executing ESC.

#### 4.3.2.4 Selected Protected Field

The ( ` ) character may be used to establish a special protected field in which characters which have been written protected will be transmitted along with unprotected characters in a message. While operating in Write Protect Mode a ( ` ) character will establish the field and another ( ` ) character will terminate the field. Any characters bracketed by the ( ` ) character will thus be transmitted as though unprotected during a SEND LINE, SEND PAGE, or SEND MESSAGE routine. The bracketed field will not be erased on CLEAR to Foreground SHIFT/CLEAR.

The following is an example of this special operation:

1. Assume that the terminal is in Write Protect Mode.
2. The operator enters a combination of protected (P) characters, specially protected (p) characters, and unprotected (U) characters, as follows:  

```
PPP ` ppp ` UU ` ppp ` PPP UU
```
3. The terminal is then placed in Protect Mode to protect the entire field.
4. If SEND LINE, SEND PAGE, or SEND MESSAGE is commanded, the following will be transmitted. (An FS character is sent in the place of each ( ` ) character.)  

```
FS ppp UU ppp FS UU
```

The selected protected field is cleared along with and in the same manner as any other protected field.

### 4.3.3 Auto Page Mode

Auto Page Mode is set by executing ESC v, and terminated by executing ESC w. This mode establishes Page 1 and Page 2 of display memory as one continuous page with the current page designated as Page 1. When Auto Page is set, several modifications to terminal operations take place:

- **Cursor Position** - The cursor position on the replaced page is memorized, so that when the page is recalled the cursor returns to its last position prior to page change.
- **Scrolling** - Scrolling is inhibited. When data is entered in Position 80 of the former Page 2, data entry continues in the HOME position or the first unprotected position of the former Page 1.
- **Line Insert** - Line 24 of former Page 1 is moved to Line 1 of former Page 2; cursor moves to the first character position of the new blank line.
- **Line Delete** - Line 1 of former Page 2 is moved to Line 24 of former Page 1; cursor moves to the first character position of Line 1 of the former Page 2.
- SHIFT SEND PAGE - Keyboard operation only. Message on both pages can be sent by ensuring that the cursor is set beyond the final FS character on Page 2, before keying SHIFT SEND PAGE.

### 4.3.4 Limited Graphics Mode

When an optional Line Drawing Alternate Character Generator is installed in the ADM-31, the terminal is equipped to produce simple line drawings in Limited Graphics Mode. In this mode, the characters on seven terminal keys are modified to produce eleven graphic symbols (see figure 4-2). Transmission of the graphics constructed from these keys is

KEY	SYMBOL (UNSHIFTED)	SYMBOL (WITH SHIFT)	KEY	SYMBOL (UNSHIFTED)	SYMBOL (WITH SHIFT)
22 - 0	0	—	42 { [	┌	└
24 ~ ^	⊥	⊥	43 } ]	┐	┘
25 : /	⊕		75 < ,	,	⊥
			76 > .	.	⊥

Figure 4-2. Limited Graphics Mode Symbols

the same as Block Mode or Conversation Mode transmission of other characters. Limited Graphics Mode is enabled by ESC G 8.

#### 4.4 CURSOR CONTROL OPERATIONS

##### 4.4.1 Non-Addressed Cursor Positioning

The cursor may be moved to any unprotected position on the screen under the remote or local control of the operator; its position signifies the next character position in the display. When data is being entered, the cursor moves one position to the right or to the first unprotected position in the next line each time a character is written under its present position. The cursor cannot stop in a protected field. The operation codes and keyboard operations required to control

the non-addressed and absolute (addressed) cursor positions are listed and described in table 4-2.

##### 4.4.2 Absolute Cursor Addressing

Absolute cursor addressing consists of commanding the cursor to a specific display location or reading out the exact cursor location, using operation codes. Commanding the cursor to a specific location, or loading the cursor, may be executed by host or keyboard commands; reading the cursor may be executed only by the host, and the position codes are sent only to the host. The load/read commands are executed by means of multiple character escape sequences in which the exact page, row, and column location of the cursor is expressed in a set of ASCII characters, as shown below. See figure 4-3 for the ASCII characters assigned to each row and column location.

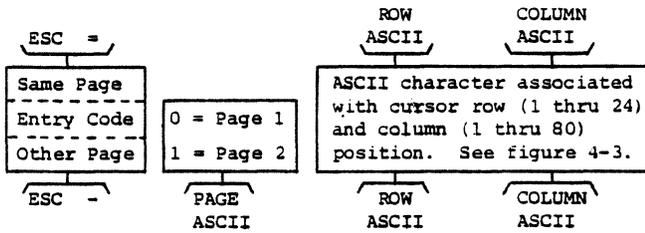


Table 4-2. Chart of Cursor Control Operations

OPERATION	HOW TO EXECUTE		DESCRIPTION
	FROM HOST	KEYBOARD	
Cursor HOME	RS	HOME or CTRL ^	Cursor moves to upper left corner position on page or if protected, to first unprotected position on page. If Auto Page is set, cursor moves to HOME on Page 1.
Down Line	LF	↓ or LINE FEED or CTRL J	Cursor moves one increment in the specified direction. If the new position is protected, cursor moves to first unprotected position in the specified line (for Backspace, the next previous position is selected). Character under cursor or characters passed over are not erased.
Upline	VT	↑ or CTRL K	
Backspace	BS	← or CTRL H	
Forespace	FF	→ or CTRL L	
Return	CR	RETURN or CTRL M	
New Line	US	PAGE NEW LINE or CTRL _	Cursor moves to the first unprotected position in the new line (combined CR and LF).
Horizontal Tab or Skip	HT or ESC i	BACK TAB TAB or ESC i or CTRL I	Operational only when Protect Mode is set. Tab moves cursor forward to the next unprotected position on the page. If there is no such position, cursor moves to HOME or the next unprotected position following HOME.
Backtab	ESC I	SHIFT BACKTAB / TAB or ESC I	Backtab moves cursor backwards to the last previous unprotected position after a protected field on the page. If there is no such position, cursor moves to the end of the page.
Load Cursor: Row, Column Page, Row, Column	ESC = ESC -	ROW ASCII COL ASCII PAGE ASCII	Refer to paragraph 4.4.2.1 for details.
Read Cursor: Row, Column Page, Row, Column	ESC ? ESC /	PAGE ASCII ROW ASCII COL ASCII CR	Refer to paragraph 4.4.2.2 for details.

#### 4.4.2.1 Load Cursor Operations

When the Load Cursor operation is initiated, the cursor moves to the commanded position, except that if Protect Mode is set, the cursor will not stop in a protected field; it will perform in the same manner as described for Horizontal Tab in table 4-2. The operation codes required to load the cursor are as follows:



Thus: operation code ESC - 1 2 M commands the cursor to Page 2, Row 19, Column 46.

#### 4.4.2.2 Read Cursor Operations

The Read Cursor operation consists of the read command from the host only and an immediate response from the terminal defining the cursor position, regardless of whether Conversation Mode or Block Mode is set. If the current page is different from the Read Cursor page, the Read Cursor page is called up and the memorized last position on the new page will be read. Thus, to read the cursor position to which the cursor was commanded in paragraph 4.4.2.1, the operation code sequence is as follows:

	<u>From Host</u>	<u>From ADM-31</u>
Same Page	ESC ?	2 M CR
Page 2	ESC /	1 2 M CR

### 4.5 DATA EDITING CONTROL OPERATIONS

The ADM-31 is equipped with extensive data editing capabilities, most of which may be executed from the host and from

the keyboard. Table 4-3 lists and describes all the data editing operations available on the terminal, along with the operation codes and/or keyboard operations required to execute them.

#### Note

If DIP switch S3-SW7 at location 11C is set to OFF, no NULL codes will be displayed.

### 4.6 DATA TRANSMISSION CONTROL OPERATIONS

Data transmission or send operations are associated most directly with ADM-31 Block Mode or optional Polling transmissions to the host computer. Table 4-4 lists and describes all the Data Transmission operations available, along with the operation codes and/or keyboard operations required to execute them. For additional Data Transmission information, refer to paragraph 3.5.

### 4.7 PRINT TRANSMISSION CONTROL OPERATIONS

Table 4-5 lists and describes all the Print Transmission operations available, along with the operation codes and/or keyboard operations required to execute them. For additional Print Transmission information, refer to paragraph 3.6.

### 4.8 PERSONALITY CONTROL OPERATIONS

The personality of the ADM-31 is the operational response of the terminal to specific operation codes. These codes may be "permanent" or "dynamic" (temporary). Dynamic operation codes may be executed from the host or the keyboard.

Table 4-3. Data Editing Control Operations

OPERATION	HOW TO EXECUTE		DESCRIPTION
	FROM HOST	KEYBOARD	
Clear Foreground	ESC + or ESC ;	SHIFT CLEAR or ESC + or ESC ;	Unprotected data is cleared from screen and from memory; positions are filled with space codes (or null codes, if operation is modified by a dynamic personality change operation). Cursor goes to HOME or first unprotected position on page. If Auto Page is set, both pages are cleared and cursor goes to HOME on Page 1.
Clear ALL to NULL	ESC * or ESC :	ESC * or ESC :	All displayed data, unprotected and protected, is cleared and replaced with null codes. Cursor goes to HOME. If Auto Page is set, both pages are cleared and cursor goes to HOME on Page 1.
Clear All to Protected Spaces	ESC ,	ESC ,	All displayed data is cleared and replaced with protected spaces. If Protect Mode is set at this time, the last space on the screen becomes unprotected, and cursor may rest there.
Set/Clear Insert Mode	Set: ESC q Clear: ESC r	ESC q or ESC r	In the line containing the cursor, a string of characters may be written under cursor, without first writing a space. All following characters move one space to the right for each insertion. Insertions are inhibited when inserted characters fill the line (previous characters following the cursor are lost), or protected field occupies last space in the line.
Character Insert	ESC Q	CHAR INSERT	Writes a space under the cursor; all following characters move one space to the right. If line is full, last character in the line is lost, unless character is protected. Operation terminates when line is filled with inserted spaces or a protected field is encountered.
Character Delete	ESC W	CHAR DELETE	Deletes character under cursor; all characters that follow in the field or line move one space to the left to fill deleted position. A space is written at the end of the field or line. Protected positions are not disturbed.
Line Insert	ESC E	LINE INSERT	Line containing the cursor and all lower lines shift downwards one line. Deleted line is replaced with unprotected spaces and cursor moves to first position in the new line. When screen is full, bottom line is lost, unless Auto Page is set; then line 24 of page 1 is moved to line 1 of page 2. If Write Protect Mode is set, Line Insert resets that mode. If Protect Mode is set, Line Insert cannot be performed.

Table 4-3. Data Editing Control Operations (continued)

OPERATION	HOW TO EXECUTE		DESCRIPTION
	FROM HOST	KEYBOARD	
Line Delete	ESC R	LINE DELETE	Line containing cursor is erased, simultaneously, all lower lines shift upwards one line. Cursor moves to the first position of the line that moves upwards, and the bottom line is filled with unprotected spaces. If Auto Page is set, line 1 of page 2 moves to line 24 of page 1. If Protect Mode is set, Line Delete cannot be performed.
Line Erase	ESC T	LINE ERASE	Starting with the cursor position, all characters in the line (or current field if Protect Mode is set) are erased and replaced with space or personality codes. Write Protect Mode is not reset.
Page Erase	ESC Y	PAGE ERASE	Starting with the cursor position and continuing to the end of the page, all unprotected characters are erased and replaced with unprotected space or personality codes. If Write Protect Mode is set, it is not reset. If Auto Page is set, the Page Erase command establishes the current page as Page 1 and erases all unprotected data on both pages following the cursor position.
Page Erase to Nulls	ESC y	ESC y	Starting with the cursor position and continuing to the end of the page, all data, unprotected and protected is cleared and replaced with unprotected null codes. If Write Protect Mode is set, it is not reset. If Auto Page is set, The Page Erase command establishes the current page as Page 1 and erases all data on both pages following the cursor position.
Page Back	ESC J	SHIFT PAGE NEW LINE	Page Back and Page Forward are essentially the same command. Each time the command is executed, the current page and cursor position are memorized and the "other" page is called up. Data entered on either page is retained when the other page is called up.
Page Forward	ESC K	SHIFT PAGE NEW LINE	

**Table 4-4. Data Transmission Control Operations**

OPERATION	HOW TO EXECUTE		DESCRIPTION
	FROM HOST	KEYBOARD	
Send Line Foreground	ESC 4	SEND LINE	Sends line of unprotected data, starting at beginning of line containing cursor and ending at the cursor position.
Send Line All	ESC 6	SHIFT SEND LINE	Sends line of unprotected and protected data, starting at the beginning of the line containing the cursor and ending at cursor position. Protected fields are bracketed by ESC ) and ESC (.
Send Page Foreground	ESC 5	SEND PAGE	Sends only unprotected data on page, starting with first unprotected character and continuing to cursor position. If Auto Page is set, unprotected data on both pages, up to cursor position is sent.
Send Page All	ESC 7	ESC 7	Sends all data on page, starting with HOME or first unprotected position following HOME, and continuing to cursor position. Protected fields are bracketed by ESC ) and ESC (. If Auto Page is set, unprotected data on both pages, up to cursor position, is sent.
Send Message	ESC S	ESC S SHIFT SEND PAGE	Sends all data in message containing no protected fields. ESC S causes FS code to be written at cursor position. Cursor returns to previous FS code or to (unprotected) HOME. Transmission starts at beginning of first line following the first FS or the first unprotected character following HOME. Transmission stops after final FS is transmitted and End Block character(s) is (are) written. Cursor moves to new line. If Auto Page is set, part or all of both pages may be sent by executing ESC S with cursor on Page 2.

**Table 4-5. Print Transmission Control Operations**

OPERATION	HOW TO EXECUTE		DESCRIPTION
	FROM HOST	KEYBOARD	
Print Page Formatted	ESC P	<b>PRINT</b>	Sends all data on page, up to cursor position to be transmitted in Page Format Mode (refer to paragraph 3.6.) If Auto Page is set, print data on both pages up to cursor position, is sent.
Print Page Unformatted	ESC L ESC p (Polling)	<b>SHIFT PRINT</b> or <b>ESC L</b> or <b>ESC p</b>	Sends all data on page, from cursor to GS code or end of page, in Unformatted Page Mode (refer to paragraph 3.6). If Auto Page is set, print data on both pages is sent. In a Polling program, space and null codes are transmitted, along with all trailing spaces. STOP code for polling is EM code.
Print Protected Data as Spaces	ESC @	<b>ESC @</b>	Protected data is sent as spaces. Nulls or trailing spaces are not transmitted and attribute codes are transmitted as spaces. If Auto Page is set, print data on both pages, up to cursor position, is sent.
Copy Print Without Display	Set: ESC A 1 Reset: DC4	<b>ESC A 1</b> <b>ESC A 0</b>	Data is read into printer buffer (Page 2) at terminal baud rate and read out at printer baud rate in Unformatted Print Mode (refer to paragraph 3.6). Meanwhile, normal ADM-31 operations continue on Page 1. Data is lost if buffer overflows.
Copy Print With Display	Set: ESC A 2 Reset: ESC A 0 or DC4	<b>ESC A 2</b> <b>ESC A 0</b>	Data is read into print buffer (Page 2) and displayed on Page 1 at terminal baud rate; read out at printer baud rate in Unformatted Print Mode (refer to paragraph 3.6). Data is lost if buffer overflows.

## 4.8.1 Display of Personality Attribute Codes

Figure 4-4 shows a coding chart for all the personality attributes (excluding video attributes) available and operational (or not operational) in the ADM-31. This chart may be called up to the screen by executing ESC o 0. The displayed codes are HEX codes which identify the ASCII character that represents a given attribute, or which expresses the hexadecimal value of the portion of program memory which controls the specified attribute(s). The HEX code 00 represents NULL or NO-OP.

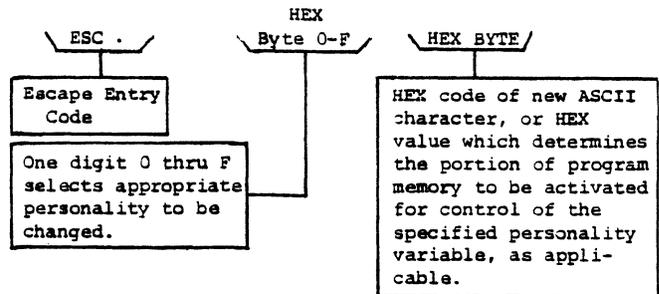
## 4.8.2 DIP Switch Personality Control

DIP configuration control switches located on the logic board assembly are provided to establish the "permanent" or default condition of certain terminal operational characteristics. Each time the terminal is powered up the personality thus controlled defaults to the condition defined by the switch position. The switches may be re-positioned by the operator to establish a new default condition. Refer to table 2-1 for the installation settings of these switches and the operations they control.

## 4.8.3 Dynamic Personality Change Codes

Dynamic (temporary) personality modifications may be made by means of personality change operation codes. Certain codes modify a single terminal operation; others may modify an operation each time it is called for. Dynamic modifications are reset during power-up of the ADM-31.

The operation codes are escape sequences having the following structure:



### 4.8.3.1 Modification of Escape Lead-In Character

Example: ESC . 0 5D would *add* the character ] to the standard ADM-31 escape lead-in character ([). Thus, the ADM-31 would respond to either escape character; however, during Send All transmissions, ] would be transmitted instead of ESC.

### 4.8.3.2 Modification of End of Block Character(s)

Example: ESC . 1 1D would establish Group Separator character GS as the first End of Block delimiter character.

ESC . 2 1F would establish New Line character US as the second End of Block character. Both GS and US would be transmitted as End of Block delimiters.

### 4.8.3.3 Modification of New Line Character(s)

Example: ESC . 3 1D would cause Group Separator character GS to replace the standard New Line character US. ESC . 4 1F would establish New Line character US as the second New Line character. Both GS and US would be imbedded in the text when New Line is called for.

PERSONALITY BYTE	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
ROW 1 (Not Applicable)	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
ROW 2 Indicates default value of Personality Attribute Code	1D	0D	00	00	00	00	01	00	20	0A	0A	00	00	00	00	00
ROW 3 Indicates present value of Personality Code, with dynamic modification.	1B	0D	00	00	00	00	01	00	20	0A	0A	00	00	00	00	00
PERSONALITY DEFINITION																
Escape Lead-In Character																
End of Block Character																
2nd End of Block Character																
End of Line Character																
2nd End of Line Character																
Field Delimiter Character																
Function Lead-In Character																
Parity Error Replacement Character																
Erase/Clear Replacement Character																
RTS ON Delay																
RTS OFF Delay																
Polling, Addressing Control																
Transmission Number Limit																
Reserved																

Figure 4-4. Display of Personality Attribute Codes

**4.8.3.4 Modification of Field Separator Character**

Example: ESC . 5 19 would change the standard FS Field Separator character to EM. Field separators are usually employed when Protect Mode is set to delimit protected fields.

**4.8.3.5 Modification of Function Lead-In Character**

Example: ESC . 6 00 would change the standard SOH Function Lead-In character to NUL.

**4.8.3.6 Modification of Parity Error Replacement Character**

Example: ESC . 7 15 would establish NAK as the character which would be written on the screen when the ADM-31 senses a parity error. Standard ADM-31 parity error replacement character is NUL; thus, ensuring that whatever is received is displayed.

**4.8.3.7 Modification of CLEAR/ERASE Replacement Character**

Example: ESC . 8 2D would establish the hyphen (-) as the character to be displayed when a Clear Screen or Erase command is executed. The standard ADM-31 replacement character is a space.

**4.8.3.8 RTS ON Delay Control**

Example: ESC . 9 3A establishes a time delay of 116 milliseconds from when Request to Send (RTS) goes high, and the actual beginning of transmission (CTS) during Block Mode transmission. The double HEX byte 3A expresses the numerical value (58) of 1/2 the delay time in milliseconds.

**4.8.3.9 RTS OFF Delay Control**

Example: ESC . A 08 establishes the time delay of 9 milliseconds from the end of transmission before RTS is turned OFF (RTS goes low), during Block Mode transmission. As shown in the chart

RECOMMENDED RTS OFF DELAY TIMES					
RTS DELAY (MILLISECONDS)	BAUD RATE	HEX CODE	RTS DELAY (MILLISECONDS)	BAUD RATE	HEX CODE
343	50	AC	9	1800	05
229	75	73	7	2000	05
*175	110	50	5	2400	04
127	135.5	40	3	3600	04
115	150	3A	3	4800	03
57	300	1D	3	7200	03
29	600	0F	1	9600	03
** 9	1200	08			

\*Standard default setting - non-polling

\*\*Standard default setting - polling

of recommended RTS OFF delay times, below, this setting corresponds to 1200 baud, the standard default baud rate for Polling terminals. The default time delay in standard non-polling terminals is 175 milliseconds (HEX CODE 50) which corresponds to a 110 baud rate.

#### 4.8.3.10 Polling and Addressing Control

##### Note

*For detailed information on Polling and Addressing, refer to Section V of this manual.*

ESC . B HEX CODE controls the optional Polling and Addressing variables. As previously established, ESC . is the escape sequence entry code; B is the personality byte to be changed; and the HEX CODE specifies the specific polling variables that have been selected for use. Any number of variables may be in operation at the same time; however, all the desired variables MUST be selected at the same time by means of the HEX CODE. Figure 4-5 shows the specific variable controlled by each HEX (and equivalent binary) bit, along with its default setting.

To control this operation determine, from figure 4-5 the HEX value required to set ALL the desired bits to logic 1. All bits must be set at the same time. Thus, to establish an operation where: a) remote FAST SELECT is conditional; b) any keyboard key may be used to switch from Polling to Local Mode; and c) headers are required in the ADM-31 response, execute ESC . B 07.

#### 4.8.3.11 Transmission Number Limit Control

Example: ESC . C 04 specifies that when bit 0 of personality byte B (paragraph 4.8.3.10) is set, a total of four different transmission numbers will be counted before the transmission count is recycled (repeat transmissions are not counted. The transmission count is imbedded in the header (refer to Section V). ESC . C 00 specifies that no transmission numbers are sent.

### 4.9 VIDEO ATTRIBUTE CONTROL OPERATIONS

Video attributes highlight selected fields in the displays; however, the selected modification will apply only to the end of the line containing the attribute. The default condition of the blanking and underlining attributes are established by setting DIP switch S3-SW6 at location 11C as follows:

ON to enable Blanking attribute

OFF to enable Underlining attribute

Table 4-6 lists the operation codes required to modify the terminal's video attributes and describes the video characteristic affected. Each modification field is initiated by ESC G ASCII, where the ASCII is a single ASCII character that defines the attribute to be changed. ESC G 0 terminates the modification field and restores standard video.

##### Note

*When the optional Line Drawing character generator is installed, the Standard Character Generator is also available for use.*

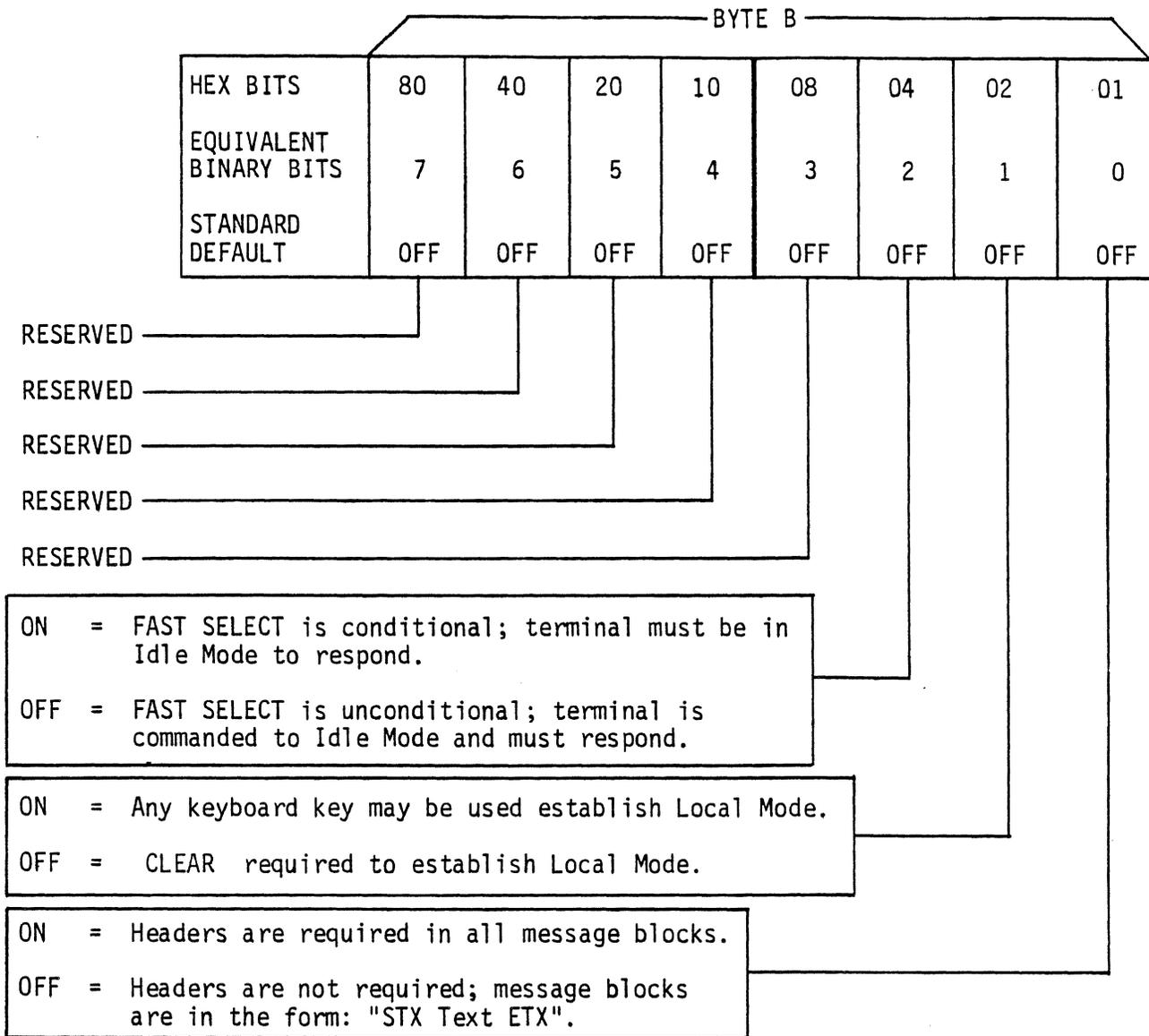


Figure 4-5. Polling and Addressing Personality Control Byte B

Table 4-6. Dynamic Video Attribute Operation Codes

Execute: **ESC** **G** **CHARACTER**

FUNCTION	STD. CHAR. GEN.	ALT. CHAR. GEN.
Reset to Standard Video	<b>ESC</b> <b>G</b> <b>0</b>	<b>ESC</b> <b>G</b> <b>0</b>
Limited Graphics Mode		<b>ESC</b> <b>G</b> <b>8</b>
*[Blanking or Underlining] of Designated Area	<b>ESC</b> <b>G</b> <b>1</b>	<b>ESC</b> <b>G</b> <b>9</b>
Blinking of Designated Area	<b>ESC</b> <b>G</b> <b>2</b>	<b>ESC</b> <b>G</b> <b>A</b>
Blinking and *[Blanking or Underlining] of Designated Area	<b>ESC</b> <b>G</b> <b>3</b>	<b>ESC</b> <b>G</b> <b>B</b>
Reversing of Designated Area	<b>ESC</b> <b>G</b> <b>4</b>	<b>ESC</b> <b>G</b> <b>C</b>
Reversing and *[Blanking or Underlining] of Designated Area	<b>ESC</b> <b>G</b> <b>5</b>	<b>ESC</b> <b>G</b> <b>D</b>
Reversing and Blinking of Designated Area	<b>ESC</b> <b>G</b> <b>6</b>	<b>ESC</b> <b>G</b> <b>E</b>
Reversing, Blinking and *[Underlining or Blanking] of Designated Area	<b>ESC</b> <b>G</b> <b>7</b>	<b>ESC</b> <b>G</b> <b>F</b>

\*[Alternate conditions established by DIP configuration switches]

## SECTION V POLLING AND ADDRESSING

### 5.1 STANDARD (ADM-31) POLLING

When the Polling Option is installed in the ADM-31, the terminal may then act as a polling terminal in a multi-point communications network. When active in a Polling environment, the ADM-31 is prevented from initiating transmission of traffic (data) except under the control of the network control center. All message transmission is between the network control center and the selected terminal or terminals; these messages, as well as control of the entire communications network, are controlled entirely by a polling/addressing dialogue initiated by the control center. Within the dialogue, the control center periodically asks or "polls" each device to see if any messages are waiting; if so, the device is commanded to transmit its message in a prescribed format. The control center may also send messages to a specified terminal or terminals at any time.

#### 5.1.1 Setting ADM-31 Address

The ADM-31 Polling Address is a two-character code (A1A2) which is part of the Polling sequence. Both address characters must be Graphic Displayable ASCII characters; however, both characters are identical. The terminal will recognize and respond to only the specified address. The address is preset by means of a DIP switch bank S6 at logic board location 14L. (See figure 2-2.) Each switch in the bank repre-

sents one bit in the 7-bit address: SW1 OFF sets bit 0 (LSB) = 1; SW2 ON sets bit 1 = 0; etc. SW8 ON enables the Polling Option. The preset switch settings establish the Polling Address for the ADM-31.

#### 5.1.2 Setting Up Terminal for Polling

The information to be transmitted when the terminal is polled must be entered on the ADM-31 display and enabled prior to being polled. Proceed as follows:

1. Type  to enable data entry from the keyboard.

#### Note

*This requirement may be modified by a dynamic personality change operation described in paragraph 4.8.*

2. Enter the data just as it is to be transmitted. All editing and embedding of control characters must be done at this time.
3. Select the appropriate ADM-31 send response to an expected POLL inquiry, as follows:
  - Type SEND LINE . When polled, the ADM-31 will send all unprotected (foreground) characters from the beginning of the line through the cursor position. To send protected, as well as

unprotected characters, type **SHIFT SEND LINE**. This operation is the same as the forced SEND v (unshifted) or SEND x (shifted) from the computer.

- Type **SEND PAGE**. When polled the ADM-31 will send all unprotected (foreground) characters from the beginning of the page through the cursor position. To send protected, as well as unprotected characters, type **ESC 7**. This operation is the same as the forced SEND w (unshifted) or SEND y (shifted) from the computer.

The terminal is now ready to transmit. It waits to be polled.

### 5.1.3 Removing Terminal from Standard Polling Status

#### 5.1.3.1 Enabling Keyboard

To enable the ADM-31 keyboard for data entry from the keyboard, type **CLEAR**. If the terminal does not return to keyboard operation, press **RESET**. The computer can override local keyboard operation by executing FAST SELECT or BROADCAST SELECT.

#### 5.1.3.2 Resetting Standard Polling Mode

To set Standard (Compose) Mode from the keyboard, type **CLEAR**. The ADM-31 will still respond as a polling terminal, in accordance with the setting-up instructions for the terminal. To disable Polling Mode, set POLLING ADDRESS DIP switch S6-SW8 at location 13L to OFF and **RESET** the ADM-31.

### 5.1.4 Initiating Standard Polling Sequence

All polling operations are initiated by the network control center through a standard control sequence. This sequence consists of the following:

1. EOT Character (EOT)
2. Two Address Characters (A<sub>1</sub>A<sub>2</sub>). In order for the terminal to respond, these characters must match the two identical address characters established by DIP switches S6-SW1 thru S6-SW7 at location 13L.
3. A Function Code. This code is an ASCII character, used to identify the transmit operation to be performed by the terminal. It may be one of the following:

p POLL  
q SELECT  
r SEQUENTIAL SELECT  
s FAST SELECT  
t BROADCAST SELECT  
v SEND LINE FOREGROUND  
w SEND PAGE FOREGROUND  
x SEND LINE ALL  
y SEND PAGE ALL  
z SEND MSG FOREGROUND  
{ SEND MSG ALL

4. ENQ Character (ENQ). This character is present only when a POLL (p), SELECT (q), or SEND (v, w, y, z, { ) operation is called for.

### 5.1.5 POLL Responses (See Figure 5-1)

The POLL sequence is initiated by the control center to let the ADM-31 know that the computer is available to receive messages. When the ADM-31 is addressed by the sequence "EOT A1A2 p ENQ" the terminal responds as follows:

1. If there is no message waiting to be sent (traffic), the terminal sends an EOT character to the control center and then returns to the IDLE state.
2. If there is traffic, the terminal sends the message to the control center in accordance with: how the message is prepared, the type of send operation commanded, the instructions in the Function Code, and the personality of the terminal.
  - a. If the Polling message is to be taken from the display screen or a FUNCTION key send, the terminal response is as follows:
    - \*SOH Character (SOH).
    - \*Two Address Characters (A1A2). These characters are the preset terminal address.
    - \*Transmission Number (#). This number may be inhibited (by means of an ESC . C00 sequence) and thus not appear. If enabled, the maximum number of transmissions counted (re-transmissions are not counted) may be between 1 and 9, depending upon the personality selection.

- STX Character (STX). This character identifies the beginning of the message to be transmitted.
- Text. This is the message which is written on the screen or the character selected after typing FUNCTION . The message is sent in one of two formats, depending on whether or not Protect Mode is set at the terminal.

If the Function Code is a send code (v,w,x,y,z, or C) instead of "p" the terminal complies with the instruction as described under Send Responses, below.

- ETX Character (ETX). This character designates the end of the polled message.
- \*LRC Character (LRC). This character represents the modulo 2 sum of the text transmitted, plus the ETX character. It is used by the control center to determine whether or not the text was received correctly.

#### Note

*If headers are selected, the LRC character is determined by all data following the SOH character, including the ETX character.*

- c. If the polling message is merely the FUNCTION key character and head-

\*Headers are not part of the standard ADM-31 polling response. Header characters will be present only if selected by ADM-31 personality.



ers are not required, the terminal responds: "STX SOH (character) ETX LRC". Note that the (character) is the key depressed after the **FUNCTION** key.

- c. If the polling message is merely the **FUNCTION** key character and headers are required, the terminal responds: "\*{SOH A<sub>1</sub>A<sub>2</sub> (#)]STX SOH (character) ETX LRC".

3. After the ADM-31 has sent the LRC character, it positions the cursor at the original location and waits for the control center to acknowledge receipt of the message. The acknowledgement will consist of one of the following:

- ACK. The message was received correctly. The terminal will respond by transmitting "EOT" and disconnecting.
- NAK. The message was received with errors. The terminal will respond by retransmitting the message (transmission number is not incremented) and again waiting for control center acknowledgement. The control center will determine how many re-transmissions will be called for.
- EOT. Retransmission is required. The terminal responds by positioning the cursor at the original location and awaiting polling.

### 5.1.6 SELECT Responses (See Figure 5-2)

The SELECT sequence is used when the control center wishes to send a message

\*Headers are not part of the standard ADM-31 polling response. Header characters will be present only if selected by ADM-31 personality.

to a single addressed terminal. When the ADM-31 is addressed by sequence "EOT A<sub>1</sub>A<sub>2</sub> q ENQ", the terminal responds as follows:

1. If the terminal is BUSY, it sends character NAK, beeps to alert the operator that a message is waiting, then disconnects. BUSY is defined as any of the following states:
  - The terminal is waiting to be polled.
  - The operator is entering data.
  - The terminal is sending data to the printer.
2. If the terminal is not BUSY, it sends character ACK to the control center, and waits for the center to send "\*{SOH A<sub>1</sub> A<sub>2</sub> (#)]STX TEXT ETX LRC". If there is an EOT in the message, terminal will disconnect to IDLE state.
3. After the selected header is received the following events occur:
  - If there are no errors, the ADM-31 sends character ACK to the control center, then disconnects to the IDLE or personality state.
  - If there are errors, the ADM-31 sends character NAK to the control center and awaits retransmission of the message.
  - The control center may then retransmit the message, starting with the selected header. If the control center decides not to retransmit, it sends character EOT instead of the selected header; the ADM-31 disconnects to the IDLE state.

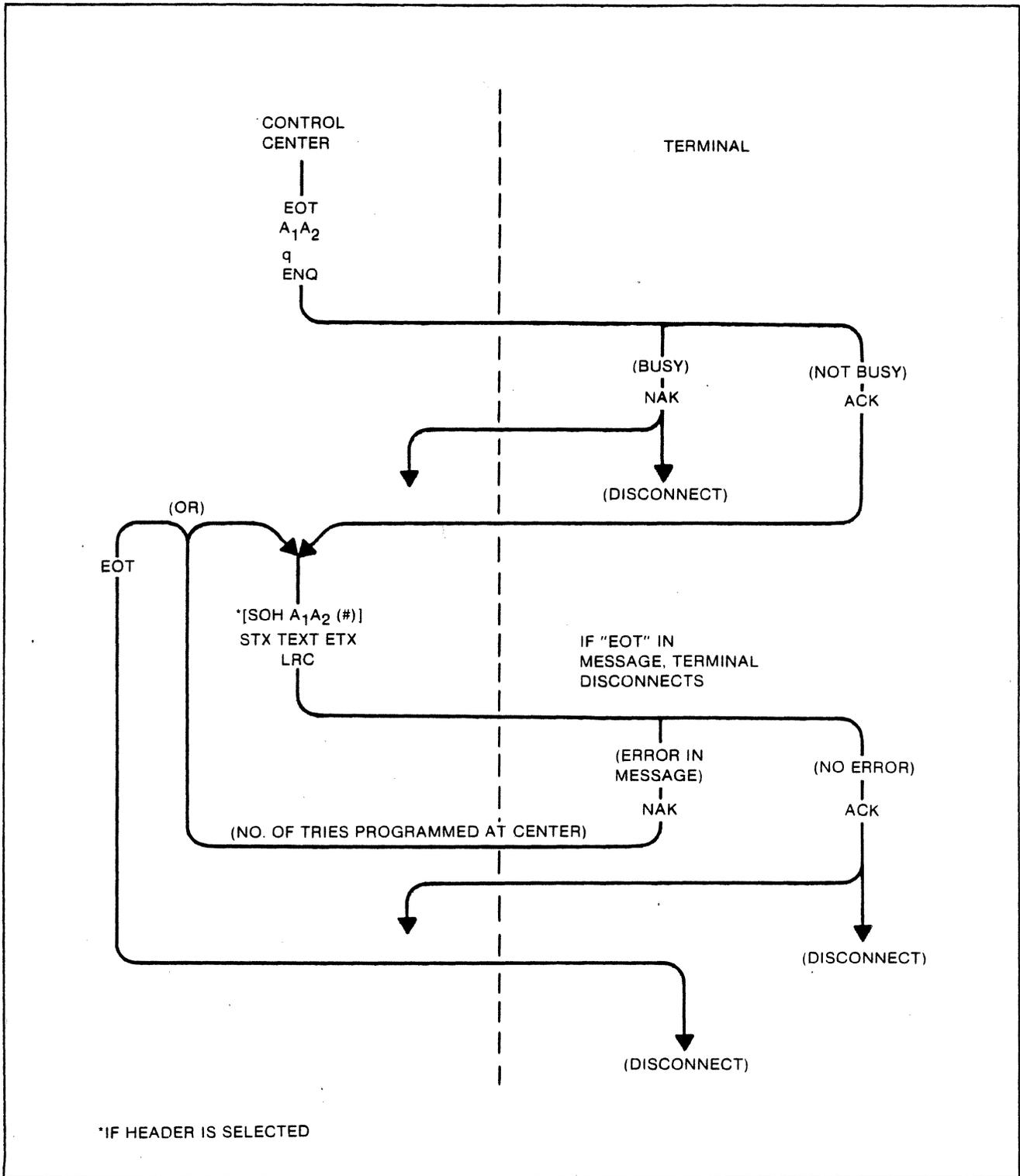


Figure 5-2. SELECT Function Dialogue, Flow Diagram

### 5.1.7 SEQUENTIAL SELECT Responses (See Figure 5-3)

The SEQUENTIAL SELECT operation is used to sequentially address a number of terminals with a single extended control message. The header sequence is "EOT A<sub>1</sub>A<sub>2</sub> r B<sub>1</sub>B<sub>2</sub> r...N<sub>1</sub>N<sub>2</sub> s". Note the the FAST SELECT (s) Function Code is sent to the last terminal addressed. This code is always followed by "[SOH N<sub>1</sub>N<sub>2</sub> (#)] STX TEXT ETX LRC". The following events take place:

1. All terminals except the last terminal (N<sub>1</sub>N<sub>2</sub>) test their BUSY status. If BUSY, each terminal will disconnect without responding.
2. Last terminal (N<sub>1</sub>N<sub>2</sub>) connects unconditionally and waits for an STX character. Any other terminal which is not BUSY connects and waits for an STX character.
3. Following receipt of "...ETX LRC" all addressed terminals except last terminal (N<sub>1</sub>N<sub>2</sub>) disconnect without responding. Terminal N<sub>1</sub>N<sub>2</sub> sends either character ACK or NAK to the control center, then disconnects to IDLE or personality state. The control center decides whether or not to retransmit if NAK is returned.

### 5.1.8 FAST SELECT Responses (See Figure 5-4)

The FAST SELECT function is used when the control center requires fast, unconditional (see note) selection of a specific terminal. Upon receiving the header sequence (EOT N<sub>1</sub>N<sub>2</sub> s), the terminal will unconditionally connect and wait for the message block. The terminal will not respond until after it has received the LRC character. The complete message block code is "[SOH N<sub>1</sub>N<sub>2</sub> (#)] STX TEXT ETX LRC". After receiving LRC, the terminal

sends either ACK or NAK to the control center, then disconnects to IDLE (or personality) state. The control center decides whether or not to retransmit if NAK is returned.

#### Note

*Acceptance of FAST SELECT may be made conditional by executing an escape sequence for changing personality.*

### 5.1.9 BROADCAST SELECT Responses (See Figure 5-5)

The BROADCAST SELECT function is used when the control center requires fast, unconditional selection of a number of terminals. All terminals on the line receive the same message under the header sequence. When each terminal receives the sequence "EOT N<sub>1</sub>N<sub>2</sub> t" followed by "[SOH N<sub>1</sub>N<sub>2</sub> (#)] STX TEXT ETX LRC" it will connect unconditionally, whether BUSY or not. Following receipt of the sequence, all terminals except the addressed terminal disconnect to the IDLE (or personality) state without responding. The addressed terminal will send either ACK or NAK to the control center, then disconnect to the IDLE (or personality) state. The control center decides whether or not to retransmit if NAK is returned.

### 5.1.10 SEND Responses (See Figure 5-6)

One of six characters specifies the information that the addressed terminal is to send. The function character (v, w, x, y, z, or C) is transmitted in place of the "q" in the standard header. The six possible SEND functions are as follows:

1. Send Line Foreground (v). The terminal will send all foreground unprotected data in the line in which the cursor rests from beginning of line to the cursor position. NULL characters are not transmitted.

\*Headers are not part of the standard ADM-31 polling response. Header characters will not appear unless selected by ADM-31 personality.

2. Send Page Foreground (w). The terminal will send all foreground data in the page, starting at the HOME location and ending at cursor position. NULL characters are not transmitted.
3. Send Line All (x). The terminal will send all data, protected and unprotected, in the line in which the cursor rests, stopping at cursor. All characters are transmitted, with the control code ESC ) preceding the first character of a protected field, and the control code ESC ( following the last character of a protected field.
4. Send Page All (y). The terminal will send all data, protected and unprotected, in the page, beginning at the HOME location, stopping at cursor. All characters are transmitted, with the control code ESC ) preceding the first character of a protected field, and the control code ESC ( following the last character of a protected field.
5. Send Message Foreground (z). The terminal will send only unprotected data. An FS character is written at the cursor location. The cursor is then returned to the last previous FS or (unprotected) HOME. Transmission begins with the next character following HOME or the beginning of the next line following the FS. Transmission stops at the last FS and the End Block character(s) is (are) written. The cursor moves to a new line. If Auto Page is set, and transmission started on Page 2, part or all of both pages could be transmitted. the final FS character is also transmitted.
6. Send Message All ( { ). The terminal operation is the same as for Send Message Foreground (z), except that all characters are transmitted, with ESC ( preceding the first character of a protected field and ESC ) following the last character of a protected field.

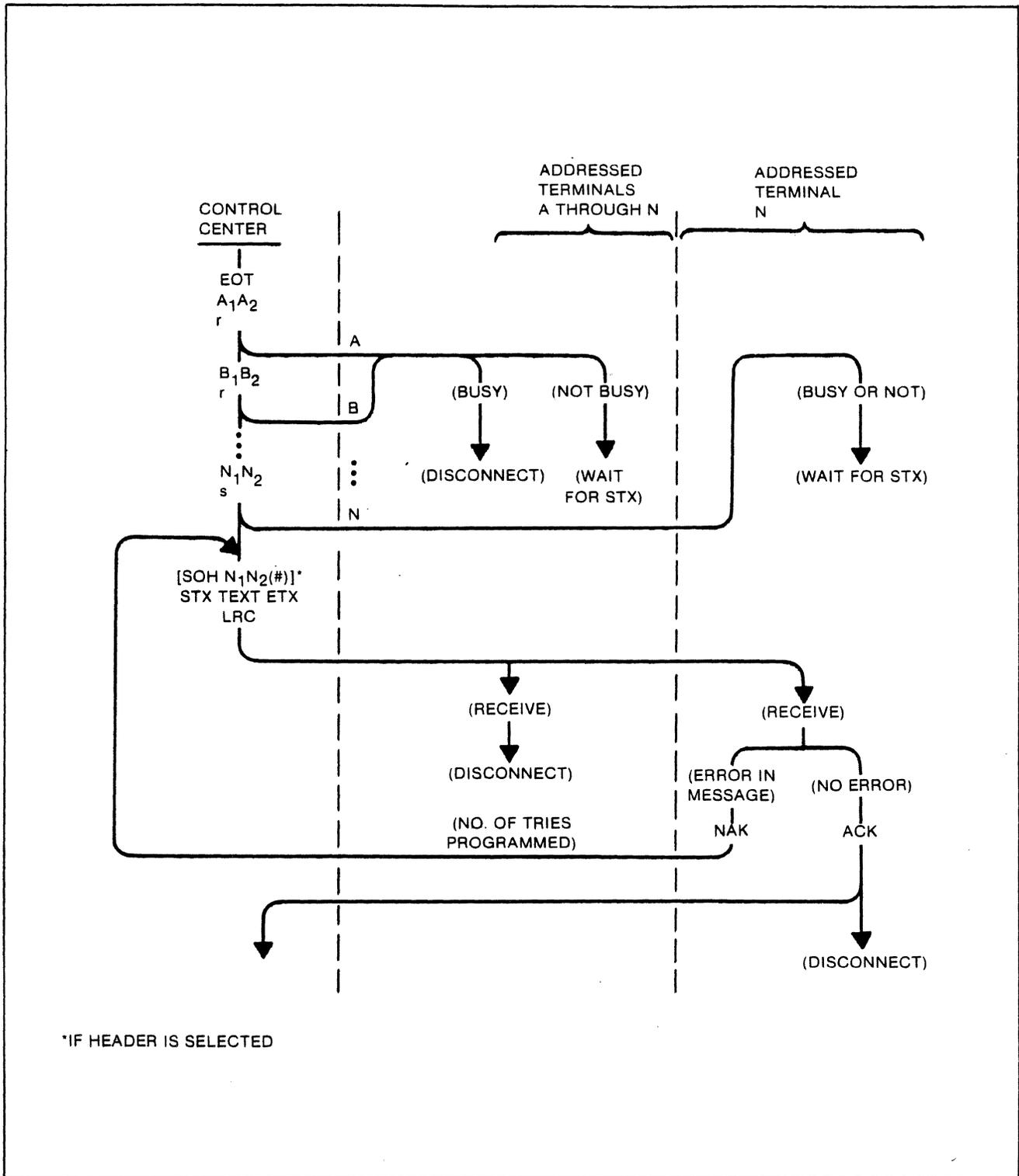


Figure 5-3. SEQUENTIAL SELECT Function Dialogue, Flow Diagram

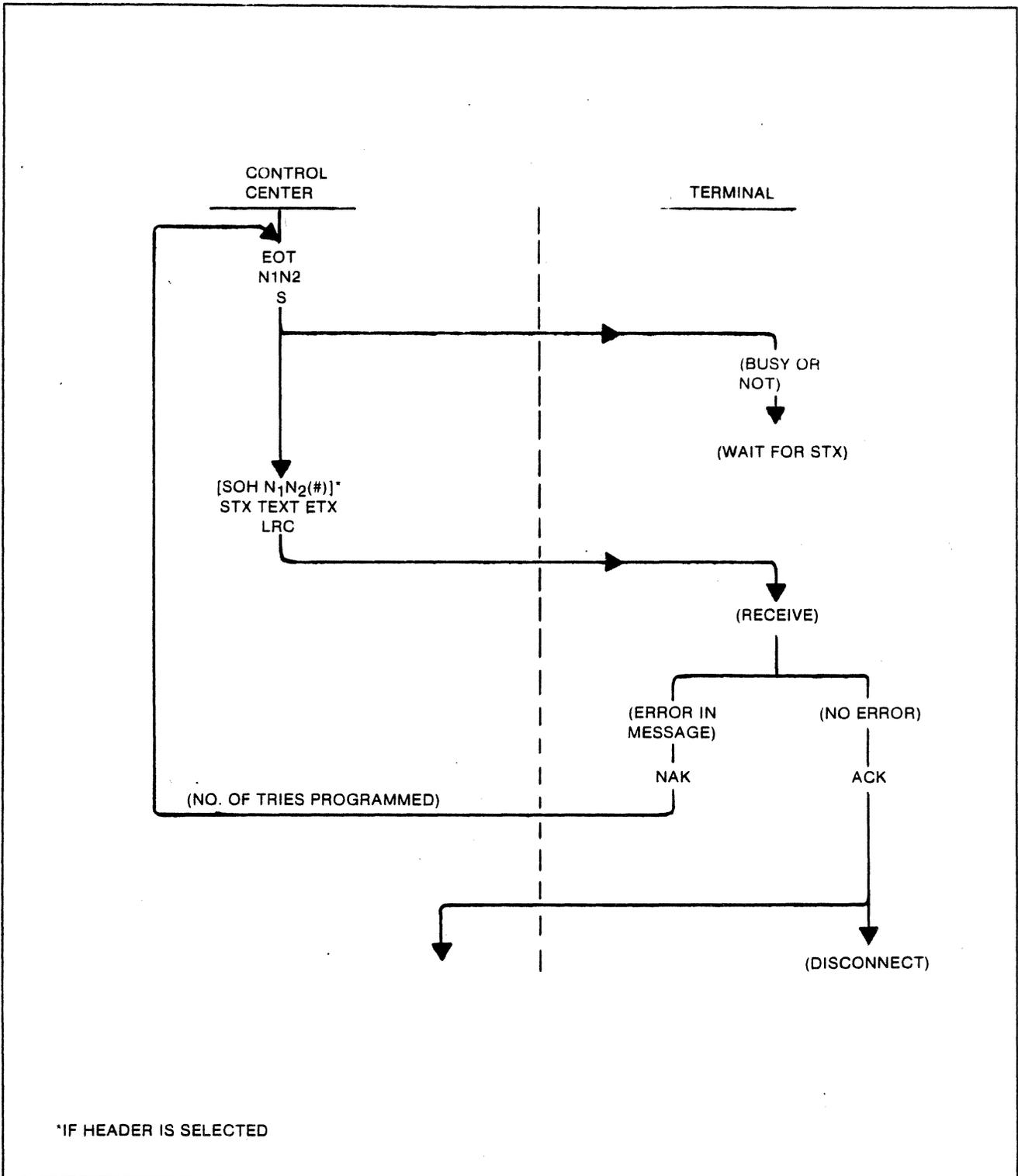


Figure 5-4. FAST SELECT Function Dialogue, Flow Diagram

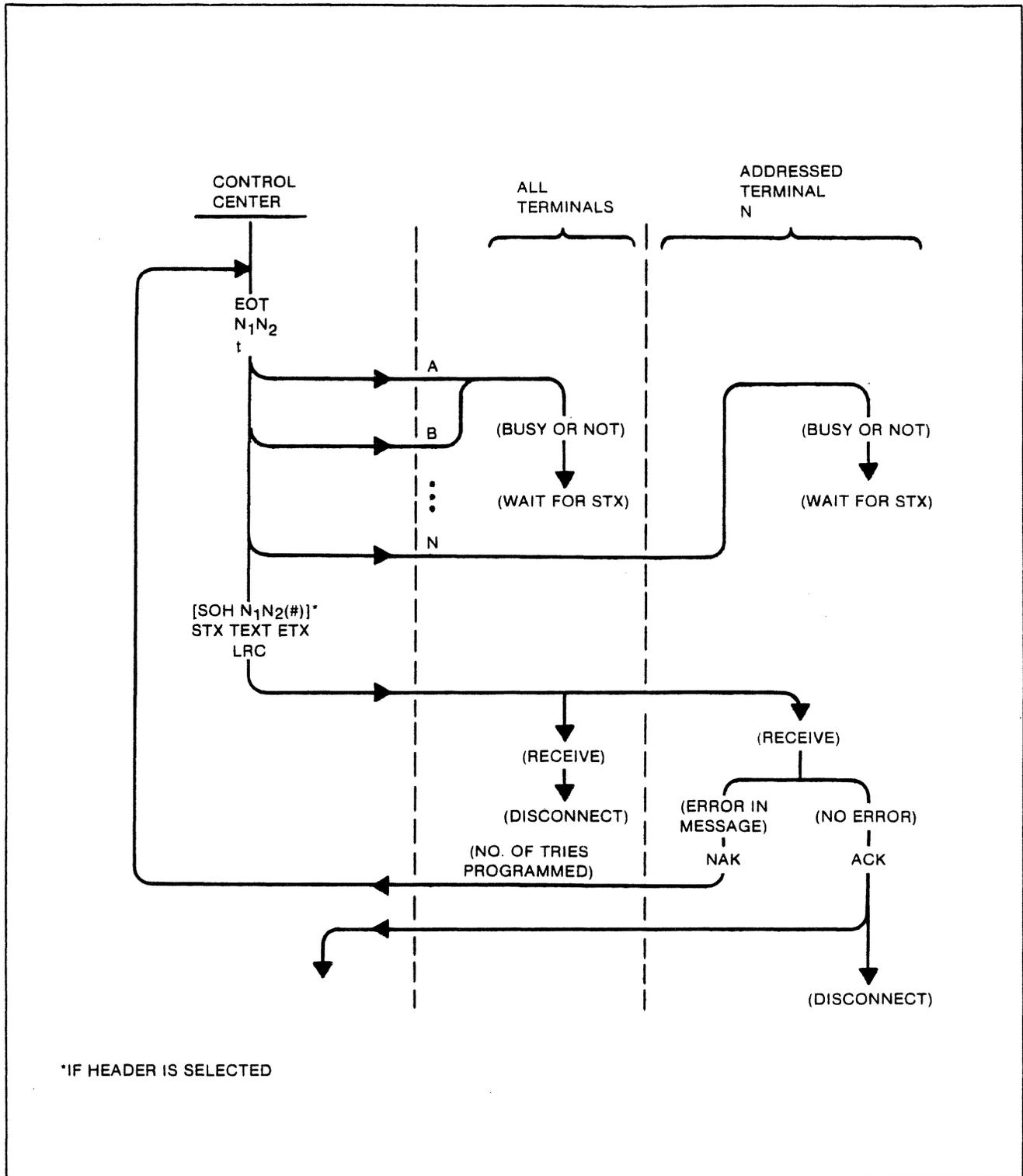


Figure 5-5. BROADCAST SELECT Function Dialogue, Flow Diagram

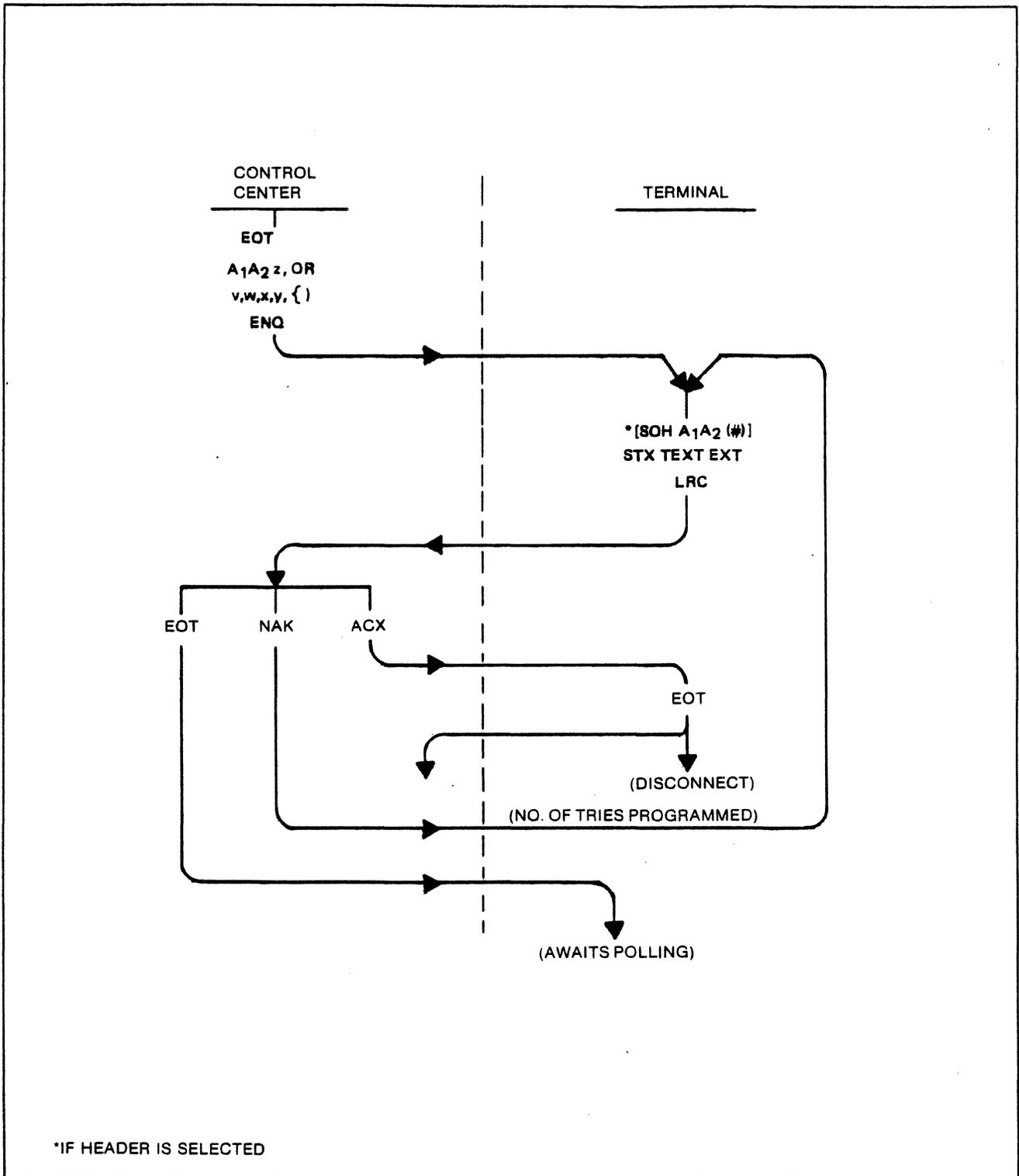


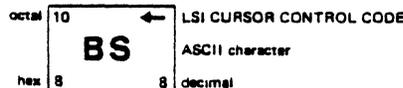
Figure 5-6. SEND Function Dialogue, Flow Diagram

# **OPERATORS QUICK REFERENCE CHARTS**

# ASCII CONTROL CODE CHART

B7 B6 BITS B5	0 0 0		0 1 0		1 0 0		1 1 0		1 1 1	
	CONTROL		NUMBERS SYMBOLS		UPPER CASE		LOWER CASE			
B4 B3 B2 B1	0	20	40	60	100	120	140	160	180	
0 0 0 0	NUL	DLE	SP	0	@	P	'	p		
0 0 0 1	SOH	DC1	!	1	A	Q	a	q		
0 0 1 0	STX	DC2	"	2	B	R	b	r		
0 0 1 1	ETX	DC3	#	3	C	S	c	s		
0 1 0 0	EOT	DC4	\$	4	D	T	d	t		
0 1 0 1	ENQ	NAK	%	5	E	U	e	u		
0 1 1 0	ACK	SYN	&	6	F	V	f	v		
0 1 1 1	BEL	ETB	'	7	G	W	g	w		
1 0 0 0	BS	CAN	(	8	H	X	h	x		
1 0 0 1	HT	EM	)	9	I	Y	i	y		
1 0 1 0	LF	SUB	*	:	J	Z	j	z		
1 0 1 1	VT	ESC	+	;	K	[	k	{		
1 1 0 0	FF	FS	,	<	L	\	l			
1 1 0 1	CR	GS	-	=	M	]	m	}		
1 1 1 0	SO	RS	.	>	N	^	n	~		
1 1 1 1	SI	US	/	?	O	_	o	~	RUBOUT (DEL)	

## LEGEND



## OPERATORS QUICK REFERENCE CHART OF DISPLAYABLE CHARACTER SET CODES

HEX BYTE		1ST		CONTROL CHARACTERS		DISPLAYABLE CHARACTERS					
		BITS 4 <sub>3</sub> 2 <sub>1</sub>	BITS 7 <sub>6</sub> 5	0	1	2	3	4	5	6	7
2ND				0 <sub>0</sub> 0	0 <sub>0</sub> 1	0 <sub>1</sub> 0	0 <sub>1</sub> 1	1 <sub>0</sub> 0	1 <sub>0</sub> 1	1 <sub>1</sub> 0	1 <sub>1</sub> 1
0	0000			NUL	DLE		0	@	P	`	p
1	0001			SOH	DC1	!	1	A	Q	a	q
2	0010			STX	DC2	"	2	B	R	b	r
3	0011			ETX	DC3	#	3	C	S	c	s
4	0100			EOT	DC4	\$	4	D	T	d	t
5	0101			ENQ	NAK	%	5	E	U	e	u
6	0110			ACK	SYN	&	6	F	V	f	v
7	0111			BEEP	ETB	'	7	G	W	g	w
8	1000			BS (←)	CAN	(	8	H	X	h	x
9	1001			(SKIP) HT	EM	)	9	I	Y	i	y
A	1010			LF (↓)	SUB	*	:	J	Z	j	z
B	1011			VT (↑)	ESC	+	;	K	[	k	{
C	1100			FF (→)	FS	'	<	L	\	l	!
D	1101			CR	GS	-	=	M	]	m	}
E	1110			SO	(HOME) RS	.	>	N	^	n	~
F	1111			SI	(NEW LINE) US	/	?	O	—	o	DEL

CONTROL CODES

USE **CTRL** KEY  
WITH DISPLAYABLE  
CHARACTER KEYS TO  
PRODUCE CONTROL  
CODES

## OPERATORS QUICK REFERENCE CHART OF VIDEO ATTRIBUTE CONTROL SEQUENCES

Execute: ESC G CHARACTER

FUNCTION	STD. CHAR. GEN.	ALT. CHAR. GEN.
Reset to Standard Video	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">G</span> <span style="border: 1px solid black; padding: 2px;">0</span>	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">G</span> <span style="border: 1px solid black; padding: 2px;">O</span>
Limited Graphics Mode		<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">G</span> <span style="border: 1px solid black; padding: 2px;">8</span>
*[Blanking or Underlining] of Designated Area	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">G</span> <span style="border: 1px solid black; padding: 2px;">1</span>	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">G</span> <span style="border: 1px solid black; padding: 2px;">9</span>
Blinking of Designated Area	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">G</span> <span style="border: 1px solid black; padding: 2px;">2</span>	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">G</span> <span style="border: 1px solid black; padding: 2px;">A</span>
Blinking and *[Blanking or Underlining] of Designated Area	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">G</span> <span style="border: 1px solid black; padding: 2px;">3</span>	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">G</span> <span style="border: 1px solid black; padding: 2px;">B</span>
Reversing of Designated Area	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">G</span> <span style="border: 1px solid black; padding: 2px;">4</span>	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">G</span> <span style="border: 1px solid black; padding: 2px;">C</span>
Reversing and *[Blanking or Underlining] of Designated Area	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">G</span> <span style="border: 1px solid black; padding: 2px;">5</span>	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">G</span> <span style="border: 1px solid black; padding: 2px;">D</span>
Reversing and Blinking of Designated Area	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">G</span> <span style="border: 1px solid black; padding: 2px;">6</span>	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">G</span> <span style="border: 1px solid black; padding: 2px;">E</span>
Reversing, Blinking and *[Underlining or Blanking] of Designated Area	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">G</span> <span style="border: 1px solid black; padding: 2px;">7</span>	<span style="border: 1px solid black; padding: 2px;">ESC</span> <span style="border: 1px solid black; padding: 2px;">G</span> <span style="border: 1px solid black; padding: 2px;">F</span>

\*[Alternate conditions established by DIP configuration switches]

## OPERATORS QUICK REFERENCE CHART OF PERSONALITY CHANGE SEQUENCES

Execute: ESC . FUNCTION CODE HEX CODE

OPERATION	ENTRY AND FUNCTION CODES	HEX CODE	STD DEFAULT		
Escape Lead-in Character	ESC . 0	Enter HEX code associated with desired ASCII character. Example: If desired ASCII character is W, enter 5 7 .	ESC		
End Block Character	ESC . 1		CR		
2nd End Block Character	ESC . 2		NULL		
New Line Character	ESC . 3		NULL		
2nd New Line Character	ESC . 4		NULL		
Field Separator Character	ESC . 5		NULL		
Function Lead-in Character	ESC . 6		SOH		
Parity Character	ESC . 7		NULL		
Replacement Character	ESC . 8		SPACE		
RTS-START Delay Time	ESC . 9		Enter HEX code whose value is 1/2 the desired delay in milliseconds. Example: If desired delay is 22 milliseconds, enter 0 B .	00	
RTS-OFF Delay Time	ESC . A	Enter HEX code appropriate to the desired delay, in accordance with chart below.		50	
<b>RECOMMENDED RTS OFF DELAY TIMES</b>					
RTS-OFF DELAY (MILLISECONDS)	BAUD RATE	HEX CODE	RTS-OFF DELAY (MILLISECONDS)	BAUD RATE	HEX CODE
343	50	AC	9	1800	05
229	75	73	7	2000	05
175	110	50	5	2400	04
127	135.5	40	3	3600	04
115	150	3A	3	4800	03
57	300	1D	3	7200	03
29	600	0F	1	9600	03
9	1200	08			

## OPERATORS QUICK REFERENCE CHART OF PERSONALITY CHANGE SEQUENCES (cont'd)

OPERATION	ENTRY AND FUNCTION CODES	HEX CODE	STD DEFAULT
<p style="text-align: center;">Polling Option Variants</p> <p style="text-align: center;">NOTE</p> <p>To control this operation, determine the HEX value which sets (to "1") the HEX bit of each function to be operational (see accompanying chart). Thus, to set HEX bits 04, 02, and 01, execute:</p> <p style="text-align: center;">ESC . B 0 7</p>	ESC . B	<p style="text-align: center;">HEX CODED POSITIONS</p> <p style="text-align: center;">BYTE A      BYTE B</p> <p style="text-align: center;">80 40 20 10 08 04 02 01</p> <p style="text-align: center;">Bit Set = 1 = ON</p> <p>80 = Reserved 40 = Reserved 20 = Reserved 10 = Reserved 08 = Reserved 04 = ON = FAST SELECT is conditional       OFF = FAST SELECT is unconditional 02 = ON = Any key to set LOCAL       OFF = CLEAR to set LOCAL 01 = ON = Headers required       OFF = Headers not required</p>	<p>OFF</p> <p>OFF</p> <p>OFF</p> <p>OFF</p> <p>OFF</p> <p>OFF</p> <p>OFF</p>
<p style="text-align: center;">Polling Transmission Number</p>	ESC . C	<p style="text-align: center;">HEX CODE</p> <p>00 = Transmission number is inhibited;       count recycles each transmission.</p> <p>01 = Recycle each 2 transmissions thru 09 = Recycle each 10 transmissions</p>	00

## OPERATORS QUICK REFERENCE CHART OF ABSOLUTE CURSOR POSITIONS

OPERATION CODES	POSITION		OPERATION CODES	POSITION		OPERATION CODES	POSITION	
	ROW	COL		ROW	COL		ROW	COL
↑	SPACE	1 1	↑	;	28	↑	V	55
	!	2 2		<	29		W	56
	"	3 3		=	30		X	57
	#	4 4		>	31		Y	58
	\$	5 5		?	32		Z	59
	%	6 6		@	33		[	60
	&	7 7		A	34		\	61
Same Page Load: ESC =	,	8 8	Same Page Load: ESC =	B	35	Same Page Load: ESC =	]	62
Same Page Read: ESC ?	(	9 9	Same Page Read: ESC ?	C	36	Same Page Read: ESC ?	^	63
Other Page Load: ESC - 0/1	*	11 11	Other Page Load: ESC - 0/1	E	38	Other Page Load: ESC - 0/1	_	64
Other Page Read: ESC / 0/1	+	12 12	Other Page Read: ESC / 0/1	F	39	Other Page Read: ESC / 0/1	`	65
	,	13 13		G	40		a	66
	-	14 14		H	41		b	67
	.	15 15		I	42		c	68
	/	16 16		J	43		d	69
	0	17 17		K	44		e	70
	1	18 18		L	45		f	71
	2	19 19		M	46		g	72
	3	20 20		N	47		h	73
	4	21 21		O	48		i	74
	5	22 22		P	49		j	75
	6	23 23		Q	50		k	76
	7	24 24		R	51		l	77
	8	25		S	52		m	78
	9	26		T	53		n	79
	:	27		U	54		o	80
↓			↓			↓		

## OPERATORS QUICK REFERENCE CHART OF ESCAPE SEQUENCES

ESCAPE SEQUENCES							
HEX BYTE 2ND ↓	1ST →	2	3	4	5	6	7
0		0	@ PRINT w/o PROT	P PRINT PAGE	`	p UNIFORM PRINT (POLLING)	
1	!	1	A BUFF PRNTM*	Q INSERT CHAR	a	q SET INS MODE	
2	" KBD ENA **	2	B SET BLOCK	R DELETE LINE	b	r CLEAR INS MODE	
3	# KBD DISA **	3	C SET CONV	S SEND MSG	c	s	
4	\$	4 SEND FG LINE	D SET DUPLH or F	T ERASE LINE (PERS)	d	t	
5	%	5 SEND PAGE	E INSERT LINE	U SET PGM MODE	e	u CLEAR PGM MODE	
6	& SET PROTM	6 SEND ALL LINE	F	V	f	v SET AUTO PG	
7	' CLEAR PROTM	7 SEND ALL PAGE	G ATTRIB CONTROL*	W DELETE CHAR	g	w CLEAR AUTO PG	
8	( CLEAR WPROT	8	H	X CLEAR PGM MODE	h	x	
9	) SET WPROT	9	I BACK TAB	Y ERASE PAGE (PERS)	i TAB (SKIP)	y ERASE PG TO NULL	
A	* CLEAR ALL NULL	: CLEAR ALL NULL	J PAGE BACK	Z	j	z	
B	+ CLR FG SP/PERS	; CLR FG SP/PERS	K PAGE FWD	[	k	{	
C	, CLR TO PROT SP	<	L UNIFORM PRNT	\	l		
D	- LOAD PRC*	= LOAD RC*	M	]	m	}	
E	. CHANGE PERS*	>	N	^	n	~	
F	/ READ PRC**	? READ RC**	O	-	o DISPLAY PERS*	DEL	

\*Multiple Characters Required  
\*\*Remote (from host) only



INDEX

Absolute Cursor Addressing..... 4-7,4-8,4-9,A-6  
ACK..... 5-5  
Addressing Personality..... 4-19  
Alternate Character..... 1-3  
ASCII Control Code Chart..... A-1  
Attributes, Personality..... 4-15,4-16  
Attributes, Video..... 4-18,4-20  
Auto Page Mode..... 4-6

Backtab..... 4-3  
Baud Rate..... 1-4,2-3,2-12,3-3  
Block Mode..... 3-6  
Broadcast Select..... 5-7,5-11

Cap Lock..... 2-13  
Character Format..... 1-2,3-3,3-4  
Character Keys..... 2-13  
Cleaning..... 2-14  
CLEAR..... 2-13,4-11  
CLEAR/ERASE Replacement..... 4-17  
Configuration Control DIP Switch Settings..... 2-2  
Controls..... 2-12,2-13  
Control Codes..... 3-4,4-1,4-3,4-8,4-9,4-15,4-19,A-1,A-2,A-3  
Conversion Mode..... 3-6  
Copy Print Mode..... 3-8  
CPU..... 3-1  
CTRL..... 2-13,4-1,4-3  
Current Loop..... 2-5  
Cursor Addressing..... 4-8  
Cursor Control..... 4-7,4-9,4-10

Data Transmission:  
  Characteristics Control..... 3-3,4-10,4-13  
  Delay Time, RTS..... 4-17  
  Designated Protect Field..... 4-5  
  Direct Connect..... 1-3,2-7  
  Displayable Characters..... A-2  
  Dynamic Personality..... 4-15  
  Dynamic Video Attribute..... 4-20

INDEX (cont'd)

Editing..... 4-10,4-11  
End of Block Character..... 4-15  
ENQ.....5-2  
EOT.....5-2,5-5  
ESC..... 2-13,4-2,A-3,A-4,A-7  
Escape Lead-In Character..... 4-15  
Escape Sequences..... 4-1,4-2,4-11,4-15,4-17  
ETO..... 4-3  
ETX ..... 4-3,5-3  
  
Fast Select..... 5-7  
Field Separator Character.....4-17  
Format Control..... 4-5  
Formatted Print Mode..... 3-7  
Function Code..... 5-2  
Function Key..... 2-13,4-1  
Function Lead-In Character..... 4-17  
  
HEX Code..... 1-2,A-2,A-5,A-7  
HOME.....2-13  
  
Initiating Polling Sequence..... 5-2  
Installation..... 2-1,2-11  
Interface  
    Current Loop..... 2-5  
    Direct Connect..... 2-7  
    Printer..... 2-7  
    RS-232..... 2-5  
  
Keyboard..... 3-1  
Keyboard Enable/Disable..... 4-5  
Keys, Character..... 2-13  
  
Line Feed..... 2-13  
Line Voltage Selection..... 2-1  
Limited Graphics..... 4-6,4-7  
Load Cursor..... 4-10  
LRC Character..... 5-3

INDEX (cont'd)

Modifications:

CLEAR/ERASE.....	4-17
Dynamic Personality.....	4-15
End of Block.....	4-15
Escape Lead-In.....	4-15
Field Separator.....	4-17
Function Lead-In.....	4-17
New Line.....	4-15
Parity Error.....	4-17

NAK..... 5-5

New Line..... 2-13,4-15

Operational Check..... 2-11

Operational Description..... 3-1

CPU.....	3-1
Format Control.....	4-5
Interface.....	3-3
Keyboard.....	3-1
Power Supply.....	3-1
Video Logic.....	3-3

Options:

Alternate Character Generator Set.....	1-3
Direct Connect.....	1-3
Polling.....	1-1
Printer.....	1-1

Parity Error..... 4-17

Personality..... 4-16

Personality Attributes..... 4-15,4-16

Personality Charges..... A-4

Personality Control..... 4-10,4-15,4-19

Polling..... 1-1,4-19,5-1,5-2

Polling Control..... 4-19

Polling Option..... 1-1

Power ON..... 2-11

Power OFF..... 2-14

Power Supply..... 3-1

Print Mode Transmission:

Characteristics Control Operations.....	3-6,4-10
Print Transmission Control.....	4-10,4-14
Printer Interface.....	2-7
Printer Option.....	1-1
Program Display.....	4-5
Program Mode.....	4-5
Protected Fields.....	4-5,4-6
Protected Mode.....	4-5

INDEX (cont'd)

Read Cursor.....	4-10
Reset.....	2-13
Resetting Standard Polling.....	5-2
Return.....	2-13,4-3
RS-232 Interface.....	2-2
RTS OFF Delay Time.....	4-17
Safety Requirements.....	2-1
Scrolling.....	4-5
Selected Protected Field.....	4-6
Send Line (v).....	5-7
Send Line (x).....	5-8
Send Page (w).....	5-8
Send Page (y).....	5-8
Send Response.....	5-7,5-12
Sequential Select.....	5-7,5-9 5-10
Shift.....	2-13,4-1
Site Requirements.....	2-1
Specifications.....	1-4
STX Character.....	5-3
Switch Control.....	4-18
Switch Settings.....	2-2,2-3,2-4,2-6,2-7,4-18
Unformatted Print Mode.....	3-7
Video Attribute Control.....	4-18,4-20,A-3
Video Logic.....	3-3
Voltage Selection.....	2-1
Word Structure.....	3-3,3-5
Write Protect Mode.....	4-5



**LEAR SIEGLER, INC.**  
**DATA PRODUCTS DIVISION**

714 NORTH BROOKHURST STREET, ANAHEIM, CALIFORNIA 92803  
PHONE: (714) 774-1010 TELEX: 65-5444 TWX 910-591-1157