

VISUAL 400

VIDEO DISPLAY TERMINAL REFERENCE MANUAL



Visual Technology Incorporated

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WARNING

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual may cause interference to radio communications. As temporarily permitted by regulation it has not been tested for compliance with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules which are designed to provide reasonable protection against such interference. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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SAFETY WARNING

Hazardous voltages 115, 220 VAC and 15 KV DC are present when the terminal is on, and may remain after power is removed. Use caution when working on internal circuits, and do not work alone.

When handling the cathode ray tube caution is required as the internal phosphor is toxic. Safety goggles and gloves must be used whenever the CRT tube is handled. Should the tube break, skin or eyes exposed to the phosphor, rinse the affected area with cold water and consult a physician.

This terminal is supplied with a cord set that includes a safety ground. Do not use this terminal with an ungrounded outlet, missing ground pin, or use any adaptor which will defeat the safety ground.

Insure that power is turned off before connecting or disconnecting the keyboard cable.

PREFACE

This manual describes the features and operation of the VISUAL 400 display terminal. Programming and application information together with first level service information is also included. For second level maintenance information, please consult the VISUAL 100/400 Maintenance Manual.

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1. INTRODUCTION

The new VISUAL 400 is a highly sophisticated smart editing video terminal utilizing the Z-80 microprocessor. The VISUAL 400 adheres to the American National Standards Institute (ANSI) X3.64 standard for display terminals, thus making the VISUAL 400 an ideal terminal for designing a lasting and flexible system architecture.

The VISUAL 400 supports both conversational and buffered transmission modes with independent transmit and receive rates up to 19,200 b.p.s. The buffered mode permits the user to locally store information and also allows extensive editing. And editing is not merely limited to the insertion and deletion of lines and characters. The user may define whether data on the screen moves up or down for inserted/deleted lines, and right or left for inserted/deleted characters. Further, the user may limit the extent of editing functions to the current field, line, area, or page, via software selectable modes.

Multiple area definition including numeric only, alpha only, right justify, protect, must fill and total fill ensures accurate, speedy data entry.

When it comes to transmission, the VISUAL 400 allows all or any part of the screen to be transmitted including modified fields only. Message framing is completely user programmable as are the twelve function keys.

Your operator will appreciate the advanced human engineering features of the VISUAL 400 like smooth scrolling of data on the screen, block or underline cursor selection, detached keyboard with n-key rollover and selectable autorepeat. Also a tiltable screen with etched non-glare faceplate available in green or white phosphor. We've eliminated all external switches, except for power ON/OFF, through extensive use of non-volatile memory allowing terminal parameters to be configured from the keyboard as desired and the configuration saved for re-use.

1.1 COMMONLY USED TERMS

Control Sequence Introducer

Two codes (ESC [) which introduce all multi-code control sequences.

Parameter, Numeric and Selective

Character combinations from Column 3 of the ASCII Code Chart that are used in control sequences. Numeric parameters are abbreviated Pn and usually specify how many times a particular function is to be performed. Selective parameters are abbreviated Ps and usually specify how a particular function is to be performed. The maximum decimal value of either Pn or Ps is 255.

Area Attribute Code – (AAC)

A code stored in a non-displayable "phantom" position that defines the beginning or end qualified display areas. AAC's are set using the Define Area Qualification or Set Tab commands. A maximum of 32 AAC's may be set for any one line. AAC's are recognized in Block mode only and only when Protect mode is set but may be set while in Character mode.

Area

A group of contiguous characters starting with an AAC and ending with the character immediately preceding the next AAC, or the end of the screen. An area may extend over many lines or may be a single character with an AAC controlling the data to be entered into the character position. Areas exist in Block mode only and only when Protect mode is set.

Field

A group of contiguous characters starting at a tab stop and end at the next tab stop. A field may contain one or many areas, but never less than one area. Fields exist in Block mode only.

2. SPECIFICATIONS/CHARACTERISTICS

The VISUAL 400 display terminal consists of three basic subassemblies: Keyboard, Video Monitor, and Printer Circuit Board including communication interface. The following paragraphs summarize the basic features of each subassembly. Section 2.4 lists the general specifications of the VISUAL 400.

2.1 KEYBOARD

The VISUAL 400 employs a field proven solid-state keyboard using capacitively coupled keys for high reliability and long life. The keys are arranged in a familiar "typewriter" layout as pictured in Figure 4-1.

The keyboard is fully detachable from the terminal for operator comfort and optimal space utilization. The cable leading from the keyboard is terminated with a 15-pin connector which plugs into the receptacle labeled keyboard on the rear panel.

All keys except those noted in Section 3.2.2.6 may also be defined to be "typomatic", (auto repeat) or non-typomatic. The typomatic feature allows the codes for the depressed key to be generated at a rate of 30 characters per second.

Section 4 details all keys on the keyboard and the code(s) they generate.

2.2 VIDEO MONITOR AND COMPOSITE VIDEO

The Video Monitor used in the VISUAL 400 is a high quality 12" cathode ray tube (CRT). The CRT uses a P4 white phosphor and a non-interlaced raster scanning method to produce crisp, easy to read characters of high resolution. The CRT includes a non-glare faceplate to assure easy readability even in the brightest environments. Characters are formed using 7 x 7 dot matrix for upper case, and 7 x 9 for lower case. The VISUAL 400 also has a CRT saver feature which causes the screen to dim if the terminal is inactive for a period of 8 minutes. Hitting any key on the keyboard will cause the screen to return to normal intensity. This feature greatly prolongs CRT life.

The format for character display may be either 24 lines of 80 characters or 24 lines of 132 characters. Characters may also be formed in double heights and double widths on a line by line basis.

Composite video output is provided via a jack on the rear panel. This feature will drive another T.V. monitor of the following specifications:

1. Video Bandwidth 12 MHz
2. Horizontal Frequency 15.6 kHz
3. Voltage Output 1.5 Volts, Peak to Peak

2.3 P.C.B. AND COMMUNICATION INTERFACE

A single, vertically mounted printed circuit board (P.C.B.) contains all necessary program memory (ROM) and display memory (RAM). The P.C.B. utilizes a convection cooled, no-fan design for high reliability and silent operation.

The VISUAL 400 provides as standard, both an EIA RS232-C and a 20-milliampere current loop interface. Both interfaces conform to a bit-serial, asynchronous, start-stop format and may operate in either a half-duplex or full-duplex mode.

The EIA RS232-C interface provides all control and sequencing signals for interfacing to remote equipment through a modem or for direct connection to local equipment. This interface labeled EIA, is located on the rear panel and interfaces with the communications line via a 25 pin connector. Table 2-1 lists all the EIA signal definitions and connector pins for the RS232-C interface.

The 20-milliampere current loop interface may be passive or active and allows direct connection to most equipment. Table 2-1 lists the pin polarity designations for the 20-milliampere current loop interface.

**TABLE 2-1
EIA RS232-C SIGNAL DEFINITIONS AND CONNECTOR PINS,
AND 20 MA CURRENT LOOP PIN POLARITY**

| Pin | RS232-C Mnemonic | CCITT V24 Mnemonic | Definition |
|-----|------------------|--------------------|--|
| 1 | AA | 101 | Protective Ground |
| 2 | BA | 103 | Transmit Data to Modem |
| 3 | BB | 104 | Receive Data from Modem |
| 4 | CA | 105 | Request-to-Send |
| 5 | CB | 106 | Clear-to-Send |
| 6 | CC | 107 | Data Set Ready |
| 7 | AB | 102 | Signal Ground |
| 8 | CF | 109 | Carrier Detect |
| 11 | SCA | — | Secondary Channel Request-to-Send (202 modem) |
| 12 | SCF | 122 | Secondary Channel Carrier Detect |
| 17 | — | — | Current Loop Receive — |
| 18 | — | — | Current Loop Receive + |
| 19 | SCA | 120 | Secondary Channel Request-to-Send (RS232, V24 modem) |
| 20 | CD | 108.2 | Data Terminal Ready |
| 21 | — | — | Current Loop Transmit + |
| 23* | CH | 111 | Speed Select, always ON (High Speed) |
| 25 | — | — | Current Loop Transmit — |

*Pin 23 is used on some dual-speed modems to select speed. This VISUAL 400 always has this signal ON. If low speed operation of the dual-speed modem is desired, it is necessary to "float" pin 23 (extract pin 23 from the modem cable at one end).

The EIA RS232-C or 20-milliampere current loop interface is selected via a row of 8 miniature dip switches located at position U73 on the P.C.B. Table 2-2 summarizes the initial switch setting and the function of each miniature switch.

**TABLE 2-2
INITIAL SETTINGS AND FUNCTIONS FOR INTERNAL SWITCHES**

| Switch Number | Initial Setting | OFF | ON | Comments |
|---------------|-----------------|--|---|----------------------------------|
| 1 | OFF | Disable Optional Character Generator ROM | Enable Optional Character Generator ROM | No Optional ROM in Standard Unit |
| 2 | OFF | EIA Interface | Current Loop Interface | |
| 3 | OFF | EIA Interface or Current Loop Active | Current Loop Interface Passive | Receive |
| 4 | OFF | Passive Current Loop Interface (Exterior Current Source) | Active Current Loop Interface (V400 Current Source) | Receive |
| 5 | OFF | EIA Interface or Current Loop Active | Current Loop Interface Passive | X-mit |
| 6 | OFF | Passive Current Loop Interface | Active Current Loop Interface | X-mit |
| 7 | OFF | Pin #19 on EIA Interface Disconnected | Pin #19 Switches Appropriately | For EIA Secondary Channel |
| 8 | ON | Pin #11 on EIA Interface Disconnected | Pin #11 Switches Appropriately | For Bell 202 Secondary Channel |

Examples of Typical Settings

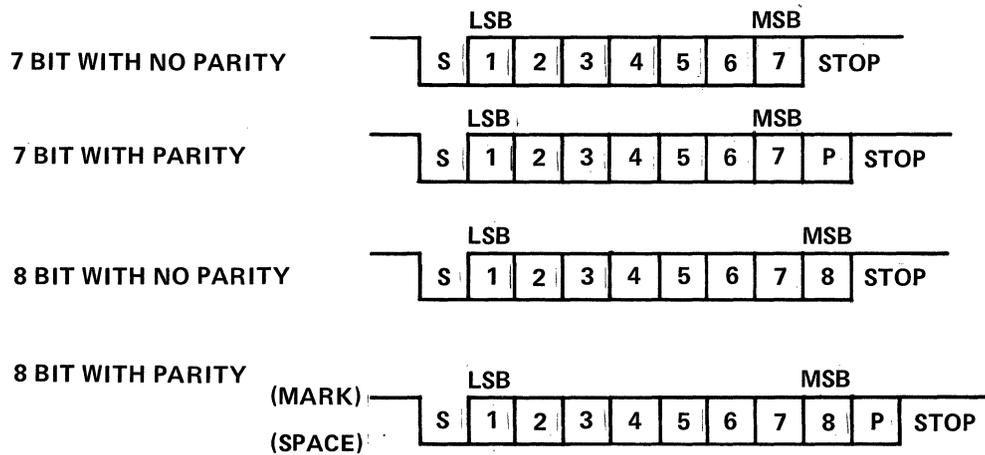
1. Passive Current Loop Interface; Switches 2, 3, 5 ON
2. Active Current Loop Interface; Switches 2, 4, 6 ON
3. EIA RS232/CCITT V24, Switch 7 ON (all other switches OFF)
4. Bell 202 Interface, Switch 8 ON (all other switches OFF)

Other communication interface features include:

- Local copy capability for applications requiring the “echoing” of transmitted data (see Section 3.2.2.21)
- 16 data rates ranging from 50 to 19,200 baud
- Independent transmit/receive rates
- Odd, even, or no parity, generated on transmit and checked on receive
- 7 or 8 bit ASCII Code. (See Figure 2-1 for various byte configurations)
- Half-Duplex or Full-Duplex
- Secondary Channel
- Programmable Line Turnaround Code

BYTE DESCRIPTION

BYTE CONFIGURATION



- S** = START BIT, ALWAYS = 0
- LSB** = LEAST SIGNIFICANT DATA BIT
- MSB** = MOST SIGNIFICANT DATA BIT
(ALWAYS SPACE, WITH 8 BIT CODE)
- STOP** = STOP BIT(S), 2 AT 110 BAUD OR LESS,
1 AT HIGHER THAN 110 BAUD
- P** = PARITY BIT, ODD OR EVEN

Figure 2-1. Byte Configurations

2.4 GENERAL SPECIFICATIONS

TERMINAL TYPE: ANSI X3.64 Standard, TTY Compatible Z-80 Microprocessor based.

COMMUNICATION

Code: 128 Character ASCII
Type: Serial Asynchronous
Speed: Independent Xmit/receive rates; 50, 75, 110
134.5, 150, 200, 300, 600, 1200, 1800, 2000
2400, 3600, 4800, 9600, 19,200
Method: Character by Character (conversational) or Block
Mode: Full-duplex with or without local echo, or Half-duplex
Parity: Odd, even, none
Interface: EIA RS232-C and 20/50 M.A. current loop
Stop Bits: 2 at 110 BPS or below, 1 at 134.5 BPS and above

SCREEN PRESENTATION

Display Unit: 12" non-glare CRT. Composite video output
Format: 24 lines by 80 columns, or 24 lines by 132 columns
Cursor: Blinking block or blinking underline, selectable
Character Formation: 7 x 7 dot matrix with 2 dot lower-case extenders
Character Presentation: Single/double heights and widths, selectable on line basis
Refresh Rate: 50/60 Hz
Character Sets: 128 ASCII, German, Swedish/Finnish, Norwegian/Danish, French, U.K., Spanish, Portuguese; plus 32 character graphics all standard
Video Attributes: Underline, reverse-video, blink, bold in any combination
Multiple Area Definition: Numeric only, alpha only, alph-numeric, right justify, must fill, total fill, protect, protect and guard

DATA ENTRY: Scroll mode, selectable scroll area, smooth scroll.

AUDIBLE INDICATORS: On receipt of BEL code, keyclick for xmitted codes and error indicator, selectable bell at column 72/124.

EXTERNAL OPERATOR CONTROLS:

Power ON/OFF

LED INDICATORS: Line/Local, Keyboard Locked, Character/Block Mode, Insert Mode, Protect Mode, Programmable LED

KEYBOARD: Detachable solid-state, capacitive scan technology, selectable auto repeat.

DIAGNOSTICS: Self test

POWER: 117 x AC \pm 15% @ 1A, 250 VAC \pm 15% @ .5A

PHYSICAL: H x W x D; 13" x 17" x 21", weight: Keyboard 6 lbs, Terminal 37 lbs.

OPERATING RANGE: 10 to 40 degrees Celsius, -20 to 60 (storage)
Humidity 5% to 95% non-condensing

OPTIONS: Serial Buffered Printer Interface
Green Phosphor Screen
2 or 4 Extra Pages of Memory

STANDARDS: Listed U.L. 478 File E73056

3. START-UP PROCEDURES

3.1 INSTALLATION

When installing the VISUAL 400 for the first time, or when moving the terminal to a new location or new communications trunk, the following steps should be followed.

1. Unpack the terminal and place it in the desired work area.
2. Tilt the terminal portion up and read the voltage value from the serial number tag. If the voltage is correct, proceed to step 4.
3. If the voltage is incorrect, change the transformer wiring as described in Section 8.8.
4. If the interface is EIA, proceed with step 7.
5. If the interface is current loop, remove the rear panel (Section 8.2) and set the internal switches as defined in Table 2-2.
6. Install the rear panel.
7. Plug in the Keyboard cable, Interface cable, and Printer cable into the corresponding connector.
8. Power on the terminal.
9. If intensity is too low, cursor not visible, press SET-UP key once, then press and hold the  key until the screen presentation is visible.
10. Proceed with SET-UP procedure as described in Section 3.2.

3.2 SET-UP MODES

3.2.1 General

The VISUAL 400 does not use exterior switches or jumpers to determine which built-in terminal features will be on or off. Instead, a nonvolatile RAM memory is used to remember which features and modes are enabled and disabled. Terminal features and modes are selected and stored in a special mode called SET-UP mode. When SET-UP mode is entered, the status of terminal features is displayed on the screen. You can then change the terminal features to any desired configuration. Once the desired configuration is selected, the terminal will function per the new configuration on either temporary basis (by exiting SET-UP mode) or fixed basis (by performing the SAVE operation).

SET-UP mode is divided into three parts; SET-UP A, SET-UP B and SET-UP C*. SET-UP A shows whether an 80 or 132 column screen format is selected and also displays the location of each columnar tab stop. Each SET-UP A feature is described in detail in Section 3.2.2. SET-UP B and SET-UP C summarize the status of other terminal features and are also described in detail in Section 3.2.2. Table 3-1 summarizes the various features that are determined in SET-UP A, B, and C.

*If the buffered printer option is present, SET-UP mode is divided into 4 parts, see Section 7.

3.2.1.1 How to Enter SET-UP Mode

SET-UP A is entered by depressing the SET-UP key on the keyboard. SET-UP B may only be entered from SET-UP A and SET-UP C may only be entered from SET-UP B and are entered by depressing the  key on the keyboard.

Subsequent depressions of the  key will alternately switch between SET-UP A, SET-UP B and SET-UP C.

3.2.1.2 How to Determine the Status of SET-UP Features

When SET-UP A is entered, the screen will display a presentation as shown in Figure 3-1. This presentation shows the location of each tab stop, as indicated by a "T" and also shows whether an 80 column or 132 column format is enabled.

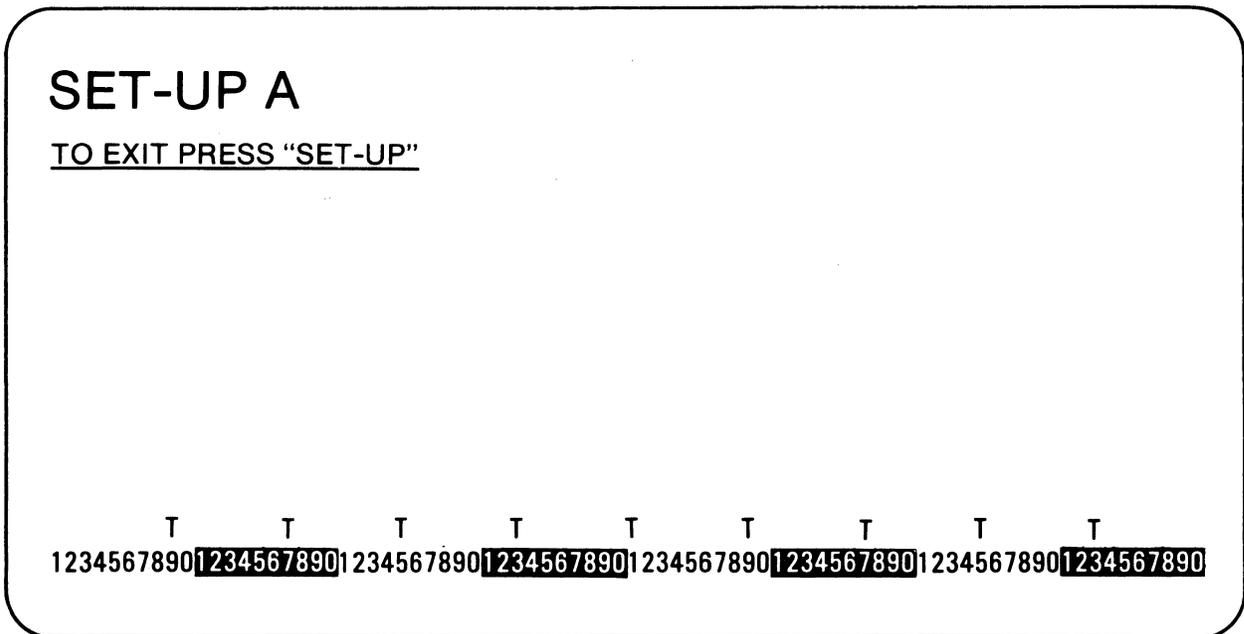


Figure 3-1. SET-UP A Presentation

When SET-UP B is entered, the screen will display a presentation as shown in Figure 3-2A. This presentation shows which features are enabled per the summary in Figure 3-3.

If the Paging Option is installed, the SET-UP B presentation will be altered slightly as indicated in Figure 3.2B.

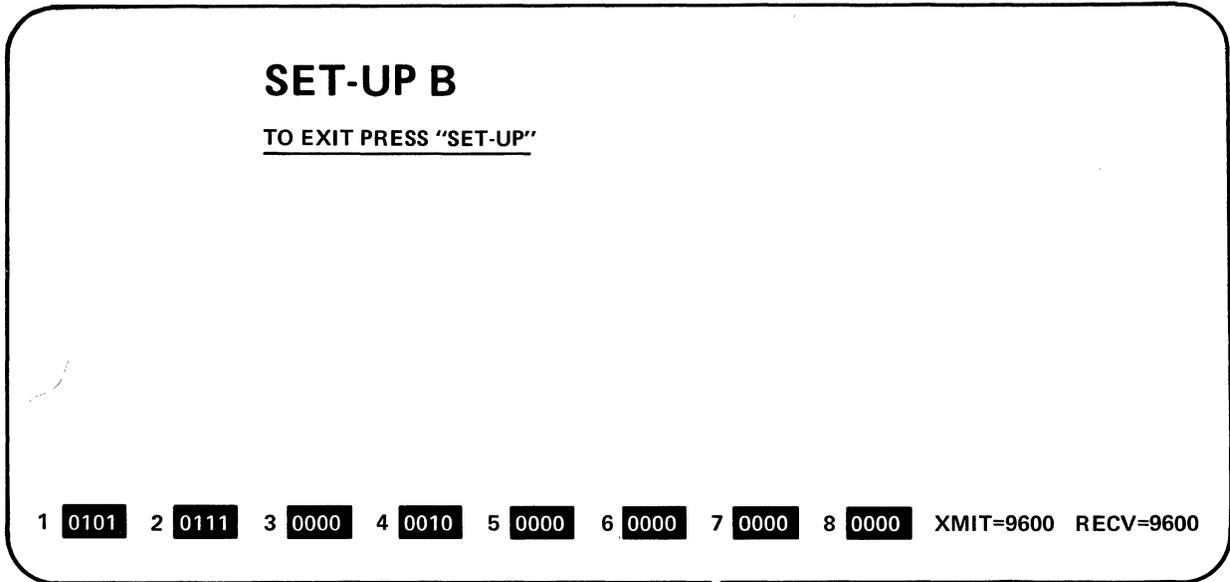


Figure 3-2A SET-UP B Presentation

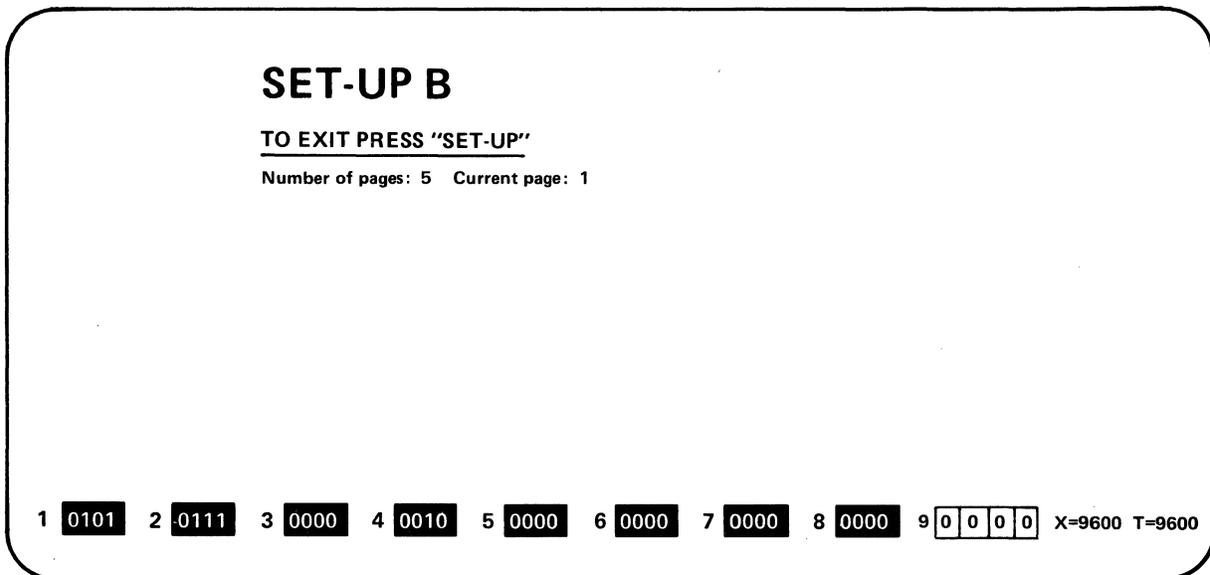


Figure 3-2B SET-UP B Presentation, Paging Option

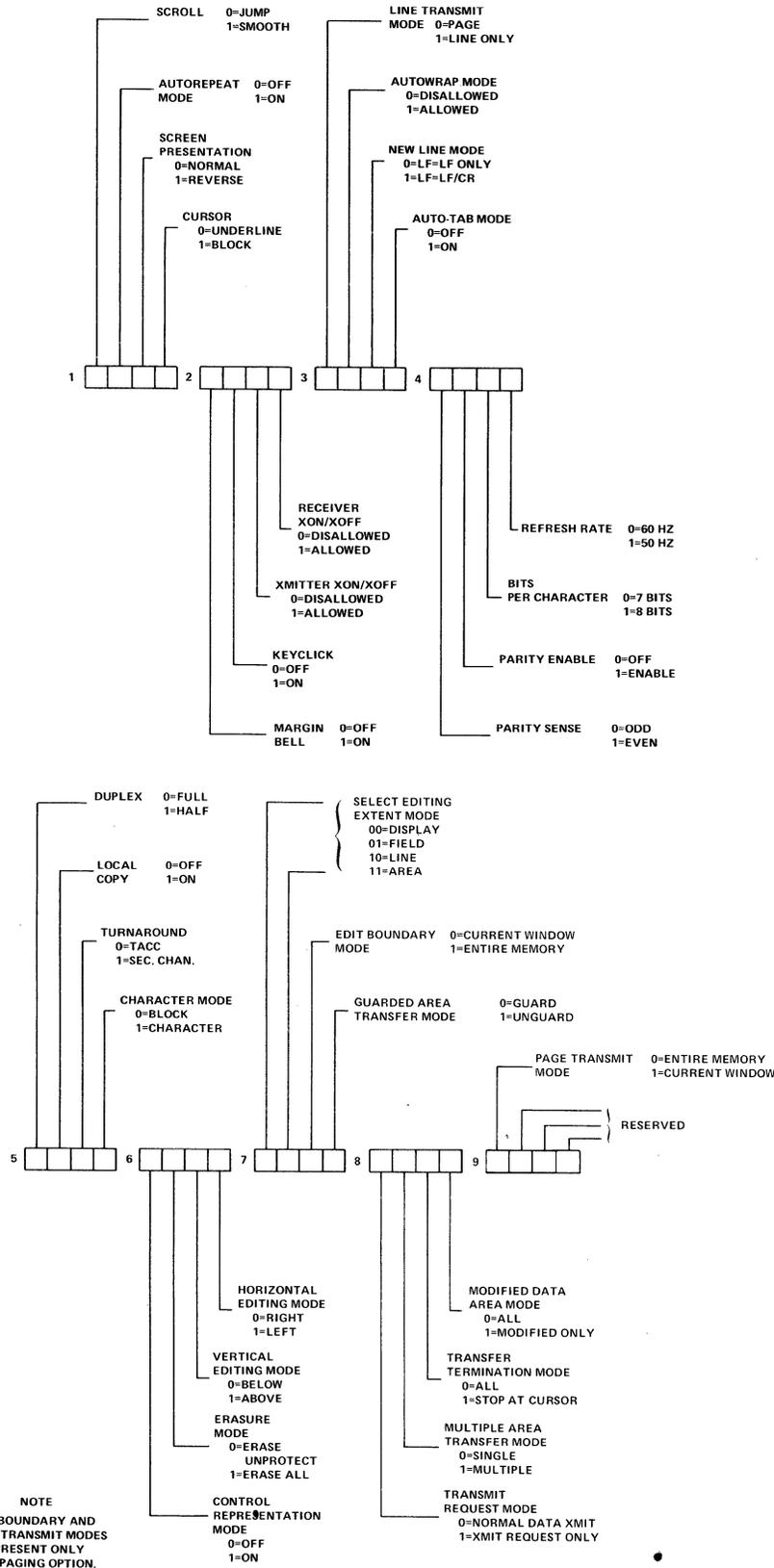


Figure 3-3. SET-UP B Summary

When SET-UP C is entered, the screen will display a presentation as shown in Figure 3-4. This presentation is summarized in Figure 3-5.

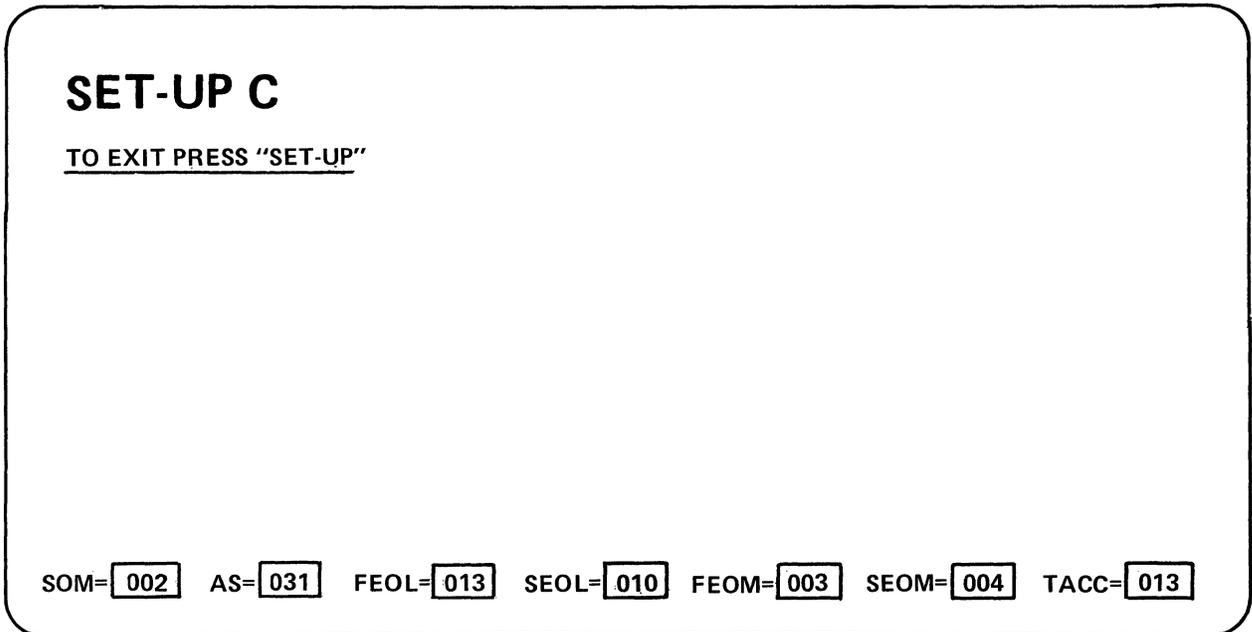


Figure 3-4. SET-UP C Presentation

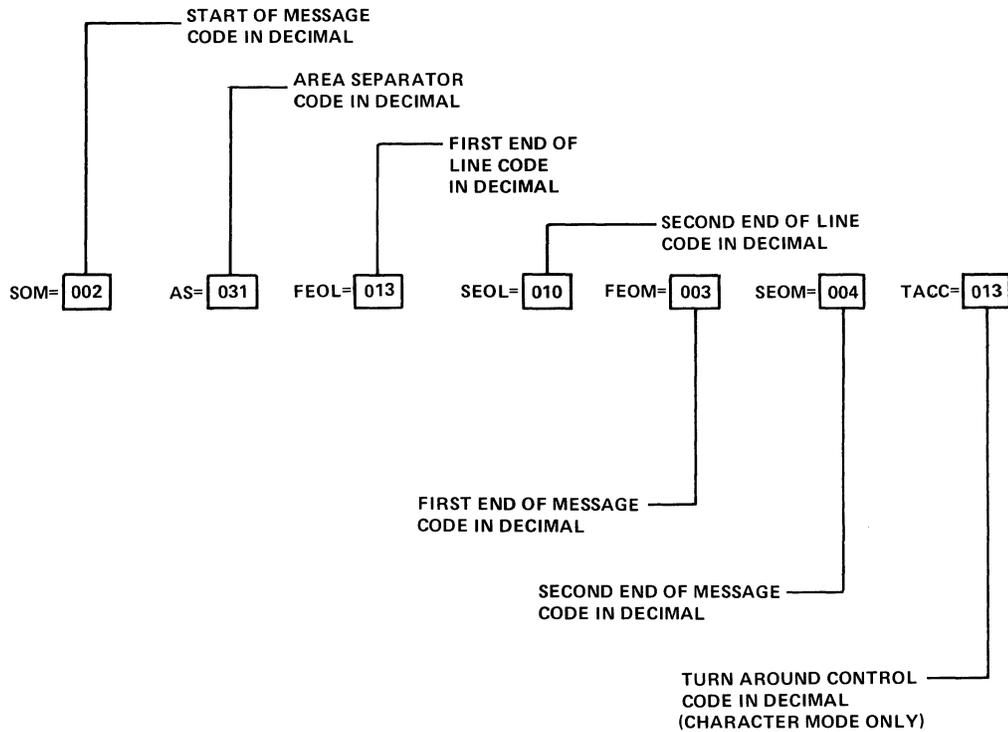


Figure 3-5. SET-UP C Summary

3.2.1.3 How to Change SET-UP Features

As noted earlier in this section, SET-UP features may be stored in non-volatile memory. The SET-UP features stored when the VISUAL 400 is shipped from the factory are shown in Figures 3-1, 3-2 and 3-4.

To change any or all of the SET-UP features from the keyboard, the following procedure should be followed:

1. Enter SET-UP mode by depressing the SET-UP key.
2. Select either SET-UP A, SET-UP B or SET-UP C by depressing the  key on the keyboard. SET-UP A must be selected to change SET-UP A features, SET-UP B to change SET-UP B features and SET-UP C to change SET-UP C features. Table 3-1 lists the features that are changeable in SET-UP A, SET-UP B and SET-UP C.
3. Position the cursor (via the   spacebar, tab or return key) over the feature or tab stop to be changed. (Some features may be changed by depressing a single dedicated key and thus do not require this step.)
4. Depress the  key to change the feature under the cursor. SET-UP B features have two possible states, enabled or disabled, and each depression of the  key will alternately enable and disable the SET-UP B feature under which the cursor resides. SET-UP C features have 128 possible states (one for each ASCII code) and each depression of the  key will step through the 128 possible states until the desired one is reached.

By following the steps listed in Section 3.2.1.3., SET-UP features may be changed to suit the preference of a particular operator, and to achieve terminal compatibility with the host computer.

After changing any or all of the SET-UP features, and exiting SET-UP mode, the VISUAL 400 will function per the new configuration. Please note that the new configuration of SET-UP features is selected on a temporary basis only. The SET-UP features initially displayed are still stored in the non-volatile RAM memory and are remembered by the terminal. The VISUAL 400 will recall and function per this fixed configuration when: the terminal is reset, the terminal is powered-down then powered-up, or a RECALL operation is performed. (See Section 3.2.1.4 for a discussion of the RECALL operation, see Section 3.2.1.6 for a discussion of the RESET operation.)

If, after changing SET-UP features, it is desired to store the new SET-UP configuration, a SAVE operation must be performed. (See Section 3.2.1.5 for a discussion of the SAVE operation.)

**TABLE 3-1
SET-UP FEATURE CHANGE SUMMARY**

| SET-UP Feature | Change In | | | How to Change Feature | | |
|------------------------------|-----------|----------|----------|--|--|-----------|
| | SET-UP A | SET-UP B | SET-UP C | Dedicated Key | Position Cursor Then Depress  Key | From Host |
| Line/Local | ✓ | ✓ | ✓ |  | | |
| Column Mode (80/132) | ✓ | | |  | | ✓ |
| Tabs | ✓ | | |  and  | | ✓ |
| Screen Brightness | ✓ | ✓ | ✓ |  and  | | |
| Scrolling Mode (Jump/Smooth) | | ✓ | | | ✓ | ✓ |
| Autorepeat Mode | | ✓ | | | ✓ | ✓ |
| Screen Mode | | ✓ | | | ✓ | ✓ |
| Cursor Selection | | ✓ | | | ✓ | |
| Margin Bell | | ✓ | | | ✓ | |
| Keyclick | | ✓ | | | ✓ | |
| Transmitter XON/XOFF | | ✓ | | | ✓ | |
| Receiver XON/XOFF | | ✓ | | | ✓ | |
| Line Transmit Mode | | ✓ | | | ✓ | ✓ |
| Autowrap Mode | | ✓ | | | ✓ | ✓ |
| LF New Line Mode | | ✓ | | | ✓ | ✓ |
| Auto-Tab Mode | | ✓ | | | ✓ | ✓ |
| Parity Sense | | ✓ | | | ✓ | |
| Parity Enable | | ✓ | | | ✓ | |
| Bits Per Character | | ✓ | | | ✓ | |
| Refresh Rate | | ✓ | | | ✓ | |
| Duplex | | ✓ | | | ✓ | |
| Local Echo | | ✓ | | | ✓ | |
| Turnaround | | ✓ | | | ✓ | |
| Character/Block Mode | | ✓ | | | ✓ | ✓ |

**TABLE 3-1
SET-UP FEATURE CHANGE SUMMARY (Cont.)**

| SET-UP Feature | Change In | | | How to Change Feature | | |
|---|-----------|----------|----------|--|--|-----------|
| | SET-UP A | SET-UP B | SET-UP C | Dedicated Key | Position Cursor Then Depress  Key | From Host |
| Control Representation Mode | | ✓ | | | ✓ | ✓ |
| Erasure Mode | | ✓ | | | ✓ | ✓ |
| Vertical Editing Mode | | ✓ | | | ✓ | ✓ |
| Horizontal Editing Mode | | ✓ | | | ✓ | ✓ |
| Select Editing Mode | | ✓ | | | ✓ | ✓ |
| Edit Boundry Mode (Paging Option Only) | | ✓ | | | ✓ | ✓ |
| Guarded Area Transfer Mode | | ✓ | | | ✓ | ✓ |
| Transmit Request Mode | | ✓ | | | ✓ | ✓ |
| Multiple Area Transfer Mode | | ✓ | | | ✓ | ✓ |
| Transfer Termination Mode | | ✓ | | | ✓ | ✓ |
| Modified Area Transfer Mode | | ✓ | | | ✓ | ✓ |
| Page Transmit Mode (Paging Option Only) | | ✓ | | | ✓ | ✓ |
| Transmit Speed | | ✓ | |  | | |
| Receive Speed | | ✓ | |  | | |
| Answerback Message | | ✓ | |   | | |
| Keyboard Layout | | ✓ | |   | | |
| Start of Message Code | | | ✓ | | ✓ | ✓ |
| Area Separator Code | | | ✓ | | ✓ | ✓ |
| First End of Line Code | | | ✓ | | ✓ | ✓ |
| Second End of Line Code | | | ✓ | | ✓ | ✓ |
| First End of Message Code | | | ✓ | | ✓ | ✓ |
| Second End of Message Code | | | ✓ | | ✓ | ✓ |
| Turn Around Control Code | | | ✓ | | ✓ | ✓ |

3.2.1.4 Performing a RECALL Operation

The stored SET-UP features may vary from the SET-UP features currently selected. If it is desired to return to the stored features, the RECALL operation should be performed per the following:

1. Enter SET-UP mode
2. Depress the SHIFT and R keys simultaneously. The screen will be cleared. After a few seconds the terminal will return to SET-UP mode.

3.2.1.5 Performing a SAVE Operation

The SAVE operation is used to store all current SET-UP features, and is performed per the following:

1. Enter SET-UP mode
2. Depress the SHIFT and S keys simultaneously. After a few seconds the terminal will return to SET-UP A mode.

After performing the SAVE operation the current SET-UP features will be stored. To select SET-UP features temporarily, do not use the SAVE operation, simply exit SET-UP mode after changing the features.

3.2.1.6 Performing a RESET Operation

The RESET operation has the same effect as powering-down then powering-up the terminal and is used to run the self test and return the SET-UP features to their fixed states. This operation will also clear the screen of any data. The RESET operation is performed per the following:

1. Enter SET-UP mode
2. Depress the  key on the keyboard. The terminal will reset and return to all initialized parameters and fixed SET-UP features.

3.2.2 This section describes SET-UP features and the effect of each feature on the VISUAL 400.

3.2.2.1 Line/Local

On-line or local operation may be selected in either SET-UP A, SET-UP B, or SET-UP C mode by depressing the  key. On-line operation is indicated by the illumination of the ON-LINE LED. When On-line, the terminal may send and receive data from the host computer.

Local operation is indicated by the illumination of the LOCAL LED. When in Local, the terminal is electrically disconnected from the host computer. Any data entered at the keyboard is looped back through the terminal receiver and displayed on the screen.

3.2.2.2 Column Mode

The VISUAL 400 may display a screen format of either 24 lines of 80 characters, or 24 lines of 132 characters. When changing between the 80/132 column formats, the contents of the screen are destroyed.

Column mode may also be changed by the host, see Section 5.4.15.

NOTE

If double width characters are used, the number of characters per line is halved i.e., a 132 column format used in conjunction with double width characters provides for 66 double-width characters per line.

3.2.2.3 Tabs

In SET-UP A mode, the location of each tab stop is indicated by a "T". All tab stops may be cleared by depressing the  key or tab stops may be cleared individually. To set or clear a stop on an individual basis, the following procedure should be followed:

1. Position the cursor under the tab stop to be set or cleared.
2. Depress the  key to set/clear the tab stop at the cursor location. Subsequent depressions of the  key will alternately set/clear the tab stop at the cursor location.

Tab stops may also be set and cleared by the host computer, see Section 5.3.3.

NOTE

The tab stops indicated by a "T" apply to Character mode only.

3.2.2.4 Screen Brightness

Screen brightness may be adjusted up or down, in either SET-UP A, Set-Up B, or SET-UP C mode. Screen brightness is increased by depressing the  key, and decreased by depressing the  key.

3.2.2.5 Scrolling Mode

Scrolling of data on the screen may take place in one or two ways: smooth or jump scroll.

Jump scroll is the traditional scrolling method whereby lines of data move one line at a time to make room for new lines of data entered on the screen.

Smooth scroll is a scrolling method whereby lines of data move a scan line at a time to make room for new lines of data entered on the screen. Smooth scroll is a human engineering feature which allows scrolling lines of data to be more easily read by an operator.

Smooth/Jump scroll may also be changed from the host computer, see Section 5.4.16.

3.2.2.6 Autorepeat Mode

When enabled, Autorepeat mode allows each key to generate its code at a rate of 30 times per second, when the key is depressed for more than 0.75 seconds. All keys will be auto-repeating except for ESC, NO SCROLL, TAB, PRINT, HOME, XMIT, BREAK, RETURN and CTRL with any key, when autorepeat is enabled. When autorepeat is disabled, each key will generate its code once per key depression.

Autorepeat mode may also be selected by the host computer, see Section 5.4.20.

3.2.2.7 Screen Mode

When enabled, this mode causes characters to be formed by black dots on a white background. When reset, characters are formed by white dots on a black background.

Screen mode may also be selected by the host computer, see Section 5.4.17.

3.2.2.8 Cursor Selection

The cursor marks the point where the next character will be entered on the screen and may be defined to be either a blinking block or a blinking underline.

3.2.2.9 Margin Bell

When enabled, this feature allows a warning bell to be sounded when the cursor is eight characters from the end of the current line. When disabled no warning bell will be sounded.

3.2.2.10 Keyclick

When enabled, this feature provides for an audible keyclick tone to be generated by the VISUAL 400 every time a code-generating key is depressed. When disabled, no audible tone will be sounded to indicate the generation of a code by key depression.

3.2.2.11 Transmitter XON/XOFF

This feature allows the VISUAL 400 to automatically generate the XOFF (DC3) and XON (DC1) synchronization codes to make sure data transmitted from the host computer is not lost. When enabled, the XOFF code will be transmitted when the receive FIFO buffer is almost full or the NO SCROLL key is depressed.

The XON code will be automatically transmitted to resume host transmission when the receive FIFO buffer is almost empty or the NO SCROLL key is depressed again.

The host computer must respond to XON/XOFF protocol for this feature to be effective.

NOTE

XON/XOFF protocol is not available in half-duplex.

3.2.2.12 Receiver XON/XOFF

This feature determines whether or not the VISUAL 400 will respond to XON/XOFF protocol.

When enabled and the terminal is in Block mode, receipt of the XOFF code will cause the terminal to suspend any transmission in progress. Upon receipt of the XON code, the terminal will resume any transmission that was in progress before XOFF was received. Any suspended block transmission will be completed.

The XON/XOFF codes will never be recognized if preceded by ESC.

3.2.2.13 Line Transmit Mode

This feature determines the power-up state of Line Transmit mode and is described in Section 5.4.22.

3.2.2.14 Autowrap Mode

This feature determines the power-up state of Autowrap mode and is described in Section 5.4.19.

3.2.2.15 Linefeed New Line Mode

This feature determines the power-up state of LF New Line mode and is described in Section 5.4.11.

3.2.2.16 Auto Tab Mode

This feature determines the state of Auto Tab mode and is described in Section 5.4.13.

3.2.2.17 Parity Enable

The Parity enable feature provides a check for errors in host transmitted data. When this feature is enabled, the VISUAL 400 will check received data for correct parity (odd or even) and generate parity on transmitted data. If a character is received with incorrect parity, a



will be placed on the screen in place of the error character.

3.2.2.18 Parity Sense

The Parity Sense feature determines whether an odd or even parity checking scheme will be utilized. If the Parity Enable feature is disabled, the Parity Sense feature will be disregarded.

3.2.2.19 Bits Per Character

This feature determines whether each transmitted character will contain 7 or 8 data bits. When enabled, this feature will cause 8 bit characters to be transmitted with bit #8 (M.S.B.) always set to space (Ø). When disabled, each transmitted character will contain 7 data bits. See Figure 2-1 for possible byte configurations.

3.2.2.20 Refresh Rate

50 and 60 H_z refresh-rate capability is built into the basic unit and is determined by this feature. When this feature is OFF, 60 H_z is selected, when ON, 50 H_z is selected.

3.2.2.21 Duplex

This feature selects either half-duplex or full-duplex operation. In full-duplex, the Request to Send Lead is always "high" and data may be independently transmitted and received.

In half-duplex, communication is only in one direction at a time, transmitted data is internally echoed back to the screen. The Request to Send Lead is high when a key is typed on the keyboard or the selected Turn Around Control Code is received. See Section 6.3 for a complete discussion of half/full-duplex operation.

3.2.2.22 Local Echo

The Local Echo feature provides for an automatic "echoing" of transmitted data back to the screen. If an echoing of transmitted data is not desired, the terminal is set for half-duplex, or the host computer or modem provides an echo, this feature should be disabled.

3.2.2.23 Turn Around

This feature applies to Character mode half-duplex operation only and determines whether a Turn Around Control Code or secondary channel will be used for line turnaround.

If the Turn Around feature selects a Turn Around Control Code, the Turnaround Control Code may be any ASCII character and may be selected remotely or in SET-UP C mode.

3.2.2.24 Character/Block Mode

This feature determines whether the terminal operates in a Block transmission mode, or a Character transmission mode as described in Section 5.4.8.

3.2.2.25 Control Representation Mode

This feature determines the state of Control Representation mode as described in Section 5.4.3.

3.2.2.26 Erasure Mode

This feature determines the state of Erasure mode as described in Section 5.4.5.

3.2.2.27 Vertical Editing Mode

This feature determines the state of Vertical Editing mode as described in Section 5.4.6.

3.2.2.28 Horizontal Editing Mode

This feature determines the state of Horizontal Editing mode as described in Section 5.4.7.

3.2.2.29 Edit Boundary Mode

This feature is provided only with the Paging Option and determines the power-up state of Edit Boundary mode as described in Section 8.3.1.

3.2.2.30 Select Editing Extend Mode

This feature determines the state of Select Editing Extent mode as described in Section 5.5.

3.2.2.31 Guarded Area Transfer Mode

This feature determines the state of Guarded Area Transfer Mode as described in Section 5.4.1.

3.2.2.32 Transmit Request Mode

This feature determines the state of Transmit Request Mode as described in Section 5.4.21.

3.2.2.33 Multiple Area Transfer Mode

This feature determines the state of Multiple Area Transfer Mode as described in Section 5.4.9.

3.2.2.34 Transfer Termination Mode

This feature determines the state of Transfer Termination Mode as described in Section 5.4.10.

3.2.2.35 Modified Data Area Transfer Mode

This feature determines the state of Modified Area Transfer Mode as described in Section 5.4.14.

3.2.2.36 Page Transfer Mode

This feature is provided only with the Paging Option and determines the power-up state of Page Transfer mode as described in Section 8.3.2.

3.2.2.37 Xmit Speed

This feature is used to select one of the 16 available transmit baud rates. When in SET-UP B mode, each depression on the

| |
|--------|
| & 7 |
|--------|

 key will cause the terminal to step through and display the various transmit baud rates until the desired transmit speed is reached.

3.2.2.38 Receive Speed

This feature is used to select one of 16 available receive baud rates. When in SET-UP B mode, each depression of the

| |
|--------|
| · 8 |
|--------|

 key will cause the terminal to step through and display the various baud rates until the desired receive speed is reached.

3.2.2.39 Answerback Message

The Answerback Message is set in a manner different from other terminal features. The Answerback Message will be automatically sent to the host computer upon receipt of the ENQ code, (without affecting the screen), or whenever CTRL-BREAK is depressed. Answerback is set per the following procedure.

1. Enter SET-UP B mode.
2. Depress the SHIFT and A keys simultaneously. The terminal will display "A=" on the screen.

3. Enter the message delimitator character. This character will not be part of the Answerback Message and may be any character not used in the Answerback Message.
4. Enter the Answerback Message which may be a maximum of 20 characters long, and may contain any ASCII characters including control codes. If control codes are part of the message, they will be displayed as **◆** when entered.
5. Enter the message delimitator character to end the Answerback Message.

After completing the above steps, the Answerback Message is selected on a temporary basis. The Answerback Message may be stored on a fixed basis, like any other SET-UP feature, by performing the SAVE operation.

3.2.2.40 Select Keyboard Layout

The Select Keyboard Layout feature allows the user to select any one of 8 keyboard layouts. Each keyboard layout is illustrated in Appendix III. This feature is selected per the following.

1. Enter SET-UP B mode.
2. Depress the SHIFT and K keys simultaneously. The terminal will display "K=" on the screen.
3. Enter a numeric character between zero and seven to select the desired keyboard layout.

| | | |
|--------|---|-----------------|
| 1 or 0 | = | U.S./U.K. |
| 2 | = | French |
| 3 | = | German |
| 4 | = | Swedish/Finnish |
| 5 | = | Norwegian |
| 6 | = | Spanish |
| 7 | = | Portuguese |
| 8 | = | Danish |

After completing the above steps the keyboard layout will be selected on a temporary basis only, but may be stored on a fixed basis, like any other SET-UP feature, by performing the SAVE operation.

Please note that the Select Keyboard Layout SET-UP feature defines the keyboard layout only, and does not alter the presently enabled character set. The Select Character Set Command is used for defining the character set. For example, a user desiring a French version VISUAL 400 will select the French character set via the Select Character Set command *and* also define the Keyboard Layout to be French see Section 5.3.11.

WARNING

When selecting a keyboard layout the keyboard is *immediately* switched to the selected layout which means that many keys may generate codes that are different from the legends on the keycaps.

3.2.2.41 Start of Message Code (SOM)

This code may be defined to be any one of the 128 ASCII codes. Once defined, the Start of Message code will precede all Block transmissions from the VISUAL 400 including all function key transmissions, and status transmissions. Receipt of the start of Message Code will lock the keyboard.

The start of Message Code may be set in SET-UP C Mode or may be set remotely via the Set Communication Control Code command, see Section 5.3.13. When SET-UP C is entered, the presently selected SOM will be displayed in decimal notation. To

change the SOM, position the cursor under the SOM decimal value and depress the  key. Each depression of the  key will cause the SOM value to step through and display the 128 decimal values of the ASCII Code Chart. When the desired SOM value is reached, the terminal will function per the newly selected SOM by exiting SET-UP mode. The SOM may be stored by performing the SAVE operation.

3.2.2.42 Area Separator Code (AS)

This code applies to Block Mode only and may be defined to be any one of the 128 ASCII codes. Once defined, the Area Separator code will be inserted into Block transmission data streams to separate each transmitted area. Received Area Separator codes will be ignored by the terminal so the user should be careful to select an ASCII code that *is not* used to perform a terminal function.

The Area Separator code may be set in SET-UP C mode or may be set remotely via the SET Communication Control Code command see Section 5.3.13.

The AS is set from the keyboard in a manner similar to the SOM code, i.e., position the cursor under the decimal value of the AS then depress the  key until the desired decimal value is reached.

3.2.2.43 First End of Line Code (FEOL) and Second End of Line Code (SEOL)

These codes apply to Block mode only and each may be defined to be any of the 128 ASCII codes. Once defined, the FEOL and SEOL will be inserted into Block transmission data streams to signify the end of data on each transmitted line. Receipt of the FEOL will cause the Carriage Return function to be performed and is the *only* code which will do so. Receipt of the SEOL will cause the Line Feed function to be performed and is the *only* code which will do so.

For these reasons the user should be careful when selecting the FEOL/SEOL.

The FEOL and SEOL may be set in SET-UP C mode or may be set remotely via the Set Communication Control Code command, see Section 5.3.13.

The FEOL and SEOL are set from the keyboard in a manner similar to all SET-UP C features i.e., position the cursor under the decimal value of the FEOL or SEOL then depress the  key until the desired decimal value is reached.

3.2.2.44 First End of Message Code (FEOM) and Second End of Message Code (SEOM)

Each of these codes apply to Block Mode only and may be defined to be any one of the 128 ASCII codes. Once defined, the FEOM and SEOM will terminate all Block transmissions from the VISUAL 400 including all Block Mode function key transmissions and status transmissions. Receipt of either the FEOM and/or SEOM will clear the keyboard lock condition caused by receipt of the Start of Message code.

The FEOM and SEOM may be set in SET-UP C mode or may be set remotely via the Set Communication Control Code Command see Section 5.3.13.

The FEOM and SEOM are set from the keyboard in a manner similar to all SET-UP C features, i.e., position the cursor under the decimal value of the FEOM or SEOM then depress

the  key until the desired decimal value is reached.

3.2.2.45 Turn Around Control Code (TACC)

This code applies primarily to Character Mode half-duplex operation and may be defined to be any one of the 128 ASCII codes. The TACC is used to switch the VISUAL 400 from a receive state (Request to Send Lead on EIA interface is "low") to a transmit state (Request to Send is "high") or vice versa. When received by the terminal the TACC will cause the terminal to switch from the receive state to the transmit state. When transmitted by the terminal, the TACC will cause the terminal to switch from transmit state to receive state.

The TACC will also terminate all Character Mode function key transmissions, answerback transmissions, and status transmissions. Receipt of the TACC will also clear the keyboard lock condition caused by receipt of the Start of Message Code.

The TACC may be set in SET-UP C mode or may be set remotely via the Set Communication Control Code command, see Section 5.3.13.

The TACC is set from the keyboard in a manner similar to all SET-UP C features, i.e., position the cursor under the decimal value of the TACC then depress the  key until the desired decimal value is reached.

NOTE

The TACC will not cause the terminal to switch from a transmit to receive state or vice versa unless the Turnaround SET-UP feature is disabled.

4. KEYBOARD CONTROLS AND L.E.D.'S

This section describes the various keys and LED indicators on the VISUAL 400 keyboard and also describes the codes transmitted and effects of each key on the terminal. As noted in Section 3.2.2.37, the user may define any one of eight possible keyboard layouts.

When operating in Block mode, most key depressions will cause a local action only, i.e., no codes will be transmitted with each key depressed. For example, depressing alpha keys will cause the alpha characters to be entered into memory and displayed on the screen, no transmission will occur.

When operating in Character mode, most key depressions will cause characters to be transmitted as each key is depressed. A local action will occur only if the transmitted code(s) are "echoed" back to the terminal. (Echoing may be accomplished by the modem, host, or by the terminal.) For example, depressing alpha keys will cause the code for each key depressed to be immediately transmitted. The transmitted alpha characters will not appear on the screen unless echoed.

The VISUAL 400 US/UK keyboard is illustrated in Figure 4-1.

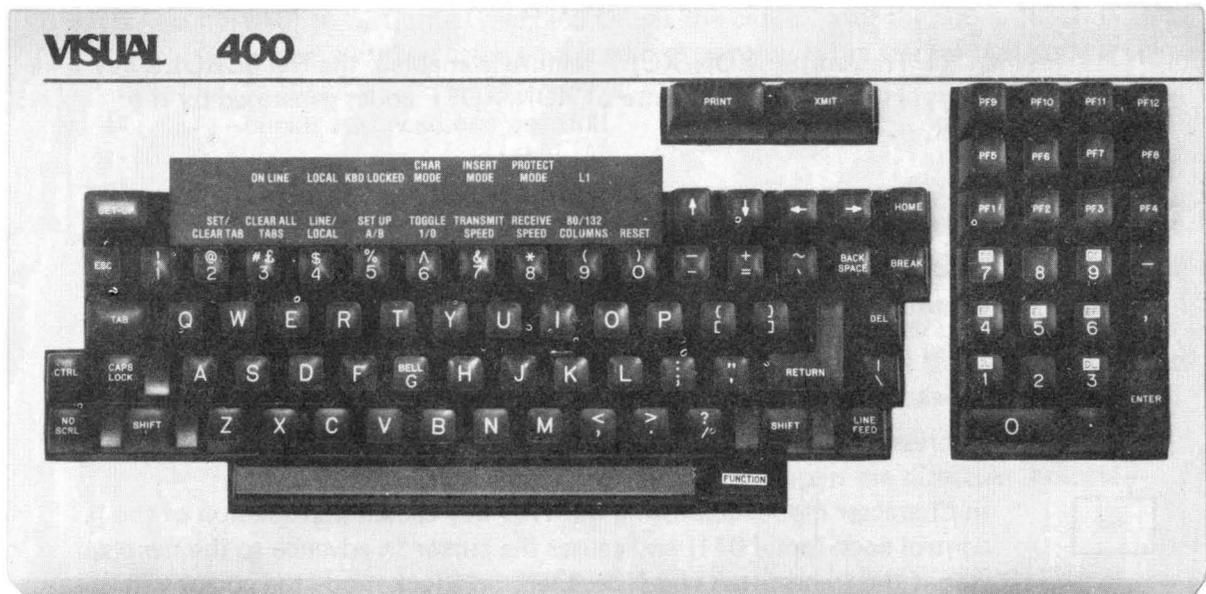


Figure 4-1. VISUAL 400 US/UK Keyboard Layout



This key is used to alternately enter and exit SET-UP Mode and will cause no codes to be transmitted under any circumstance.



In Character mode, depressing the ESC key causes the terminal to transmit the ESC control code (octal 033). In Block mode the ESC code causes the terminal to interpret the next received character as opposed to displaying it. The ESC code is used to initiate all control sequences.



The CTRL key does not produce a code by itself. It is depressed in conjunction with other keys to produce the control codes as described in Section 5.2.



The SHIFT key does not produce a code by itself. When depressed in conjunction with alph-numeric keys, it causes generation of the corresponding upper case alpha code or the code whose symbol appears on the upper part of the key. Two SHIFT keys are on the keyboard for operator convenience.



The CAPS LOCK key does not produce a code when depressed. This key enables the generation of only upper case alpha characters. The numeric and special keys are not affected by the CAPS LOCK key.



The NO SCROLL key alternately transmits the XOFF (DC3) and XON (DC1) control codes, if the Transmitter XON/XOFF feature is enabled. These codes are used to stop/start transmissions from the host computer, provided the host recognizes these codes. If the Transmitter XON/XOFF feature is disabled, the NO SCROLL key will transmit no codes.

NOTE

When the Transmitter XON/XOFF feature is enabled, the NO SCROLL key will be synchronized with the use of XON/XOFF codes generated by the terminal.

Example:

Host's transmission causes terminal's FIFO buffer to become almost full causing terminal to automatically transmit XOFF.

If the operator now depresses the NO SCROLL key, no XOFF code is sent.

Buffer empties, no XON sent.

Operator depresses NO SCROLL, XON sent.



In Character mode, depressing the TAB key causes transmission of the HT control code (octal 011) and causes the cursor to advance to the next tab stop if the transmitted code is echoed. In Block mode the cursor will advance to the next tab stop.



In Character mode, depressing the BACKSPACE key causes transmission of the BS control code (octal 010) and causes the cursor to move one position to the left if the transmitted code is echoed. In Block mode, the cursor moves one position to the left.



In Character mode, depressing the RETURN key causes transmission of the CR control code (octal 015), and causes the cursor to move to the first column of the present line if the transmitted code is echoed. If the New Line feature is enabled, the RETURN key will transmit the CR and LF

control codes, and will cause the cursor to move to the first column of the next line if the transmitted codes are echoed. In Block mode the cursor will move to the first column of the present line or the first column of the next line.



In Character mode, depressing the LINEFEED key causes transmission of the LF control code (octal 012) and causes the cursor to move down one line if the transmitted codes are echoed. In Block mode the cursor moves down one line.



Depressing the BREAK key causes a 250 millisecond spacing condition on the data-line. Depressing SHIFT-BREAK causes a 3.5 second spacing condition on the data-line and causes the Data Terminal Ready lead to go low for 3.5 seconds. Depressing CTRL-BREAK causes transmission of the Answer-back Message.



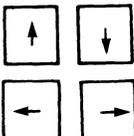
Depressing the DELETE key causes the DEL code (octal 177) to be generated.

SPACE
BAR

In Character mode, depressing the SPACE BAR causes the SP code (octal 040) to be transmitted, and causes the character at the cursor location to be erased and the cursor advanced one position if the transmitted code is echoed. In Block mode the character at the cursor location will be erased and the cursor advanced one position.



In Character mode, depressing the Home Key causes ESC [H (octal 033 133 110) to be transmitted and causes the cursor to move to the home position. In Block mode the cursor moves to the home position.



In Character mode, depressing a cursor positioning key causes transmission of its corresponding ESC sequence and causes the cursor to move one position in the direction indicated on the key if the transmitted sequence is echoed. The codes transmitted by these keys are summarized in Table 4-1.

In Block mode the cursor moves one position in the direction indicated on the key.

TABLE 4-1
CODES GENERATED BY CURSOR POSITIONING KEYS

| Key Depressed | Sequence Generated |
|---------------|--------------------|
| | ESC [A |
| | ESC [B |
| | ESC [C |
| | ESC [D |



Depressing the FUNCTION key in conjunction with certain keys on the numeric keypad allows for editing functions to be performed from the keyboard. In Character mode, the code sequence associated with each editing function will be transmitted and the editing function will be performed on the screen only if the transmitted code sequence is echoed.

In Block mode the editing function will be local only and no transmission will occur. Table 4-2 lists the codes transmitted and the editing functions performed for each depression of the FUNCTION key with keys on the numeric keypad.

**TABLE 4-2
FUNCTION KEY SUMMARY**

| Keys Depressed | Sequence Code Transmitted in Character Mode | Action Caused in Block Mode or in Character Mode if Sequence Echoed |
|----------------|---|---|
| FUNCTION with | ESC [L | Insert Line |
| FUNCTION with | ESC [M | Delete Line |
| FUNCTION with | ESC [N | Erase Field from Cursor |
| FUNCTION with | ESC [K | Erase Line from Cursor |
| FUNCTION with | ESC [J | Erase Page from Cursor |
| FUNCTION with | ESC [4h or ESC [4 l | Enable/Disable Insert Replace Mode as Indicated by Insert Mode LED |
| FUNCTION with | ESC [P | Delete Character |
| FUNCTION with | None | Enable/Disable Copy Mode If Buffered Printer Option Installed |



Causes the same action as the RETURN key.



This key is functional only if the Buffered Printer Option is installed and causes the contents of the screen to be sent out on the AUX PORT. If the XMITTER XON/XOFF feature is enabled, the XOFF code (DC3) will be sent to the host prior to the PRINT function and the XON code (DC1) will be sent to the host upon completion of the PRINT function.

If depressed with the FUNCTION key this key will alternately enable/disable Copy mode.



This key applies to Block mode only and causes a block transmission to begin when depressed. The portion of the screen to be transmitted depends upon the various transmission modes then enabled.



The twelve function keys, labeled PF1-PF12, are user programmable as described in Section 5.3.6. If not programmed otherwise, each function key will transmit its default message as indicated in Table 4-3. Please note that each function key transmission will be "framed" by the Start of Message code and Turn Around Control code when in Character mode. When in Block mode, each function key transmission will be framed by the Start of Message code and First and Second End of Message codes.

**TABLE 4-3
DEFAULT VALUES OF FUNCTION KEYS**

| Key | Default Value |
|------|---------------|
| PF1 | ESC _ A ESC \ |
| PF2 | ESC _ B ESC \ |
| PF3 | ESC _ C ESC \ |
| PF4 | ESC _ D ESC \ |
| PF5 | ESC _ E ESC \ |
| PF6 | ESC _ F ESC \ |
| PF7 | ESC _ G ESC \ |
| PF8 | ESC _ H ESC \ |
| PF9 | ESC _ I ESC \ |
| PF10 | ESC _ J ESC \ |
| PF11 | ESC _ K ESC \ |
| PF12 | ESC _ L ESC \ |

Keys Special Mode: When SET-UP mode is entered, some keys on the main keyboard are used to change SET-UP features. Refer to Table 3-1 for a summary of each key and its function in SET-UP mode.

LED Indicators: The VISUAL 400 keyboard has seven L.E.D. indicators, one that is programmable, and 6 that have predetermined meanings.

Table 4-4 lists each L.E.D. and its meaning:

**TABLE 4-4
LED SUMMARY**

| LED | Meaning When ON | Meaning When OFF |
|--------------|---|--|
| ON LINE | Terminal is electrically connected to host | Terminal is electrically disconnected to host |
| LOCAL | Terminal is electrically disconnected from host | Terminal is electrically connected to host |
| KBD LOCKED | Keyboard is locked and cannot be used to enter data | Keyboard is unlocked |
| CHAR MODE | Character mode is set, transmission is character by character | Character mode is reset, transmission is by block. |
| INSERT MODE | Insert Replace mode is set | Insert Replace mode is reset. |
| PROTECT MODE | Protect mode is set, all Area Attribute codes are honored | Protect mode is reset, Area Attribute codes are not honored. |
| L1 | Programmable | Programmable |

5. TERMINAL PROGRAMMING

5.1 GENERAL

As previously noted, the VISUAL 400 operates according to the American National Standard Institute (ANSI) X3.64 standard for display terminals. This section details the control codes, modes, and control sequence functions used to control the VISUAL 400.

A reference card summarizing all remote commands is located near the rear of the manual, and Appendix I also summarizes remote commands.

5.2 CONTROL CODES

This section describes how the VISUAL 400 responds to received control codes. Control codes are defined as codes from columns one and two of the ASCII code chart and the DEL code (octal 177). Not all control codes have an effect on the VISUAL 400. The control codes that do have an effect on the VISUAL 400 are listed in Table 5-1.

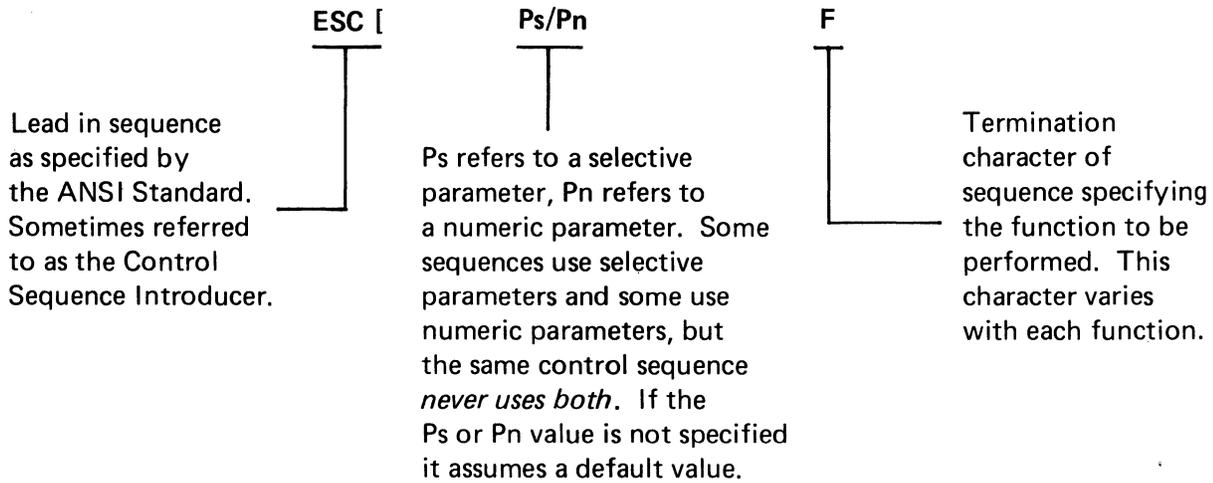
**TABLE 5-1
CONTROL CODE SUMMARY**

| Control Code | Octal Equivalent | Action |
|----------------------------|------------------|--|
| NUL (Control SP/Control @) | 000 | Ignored by terminal |
| ENQ (Control E) | 005 | Initiates Answerback Transmission |
| BEL (Control G) | 007 | Rings Bell |
| BS (Control H) | 010 | Backspaces Cursor |
| HT (Control I) | 011 | Advances cursor to next tab stop |
| LF (Control J) | 012 | Cursor moves down one line, or down one line to the left hand margin |
| FF (Control L) | 014 | Erases entire page according to setting or Erasure mode and homes cursor |
| CR (Control M) | 015 | Moves cursor to first position of present line |
| SO (Control N) | 016 | Enable G1 character set (see Section 5.3.11) |
| SI (Control O) | 017 | Enable G0 character set (see Section 5.3.11) |
| DC1 (Control Q)* | 021 | XON code, signals terminal to start transmission |
| DC3 (Control S)* | 023 | XOFF code, signals terminal to stop transmission |
| CAN (Control X) | 030 | Used to immediately abort an ESC sequence |
| SUB (Control Z) | 032 | Same as CAN |
| ESC (Control [) | 033 | Initiates control sequences |
| DEL | 177 | Ignored by terminal |

*XON/XOFF will be recognized only if the Receiver XON/XOFF SET-UP feature is enabled. XON/XOFF will never be recognized if preceded by ESC.

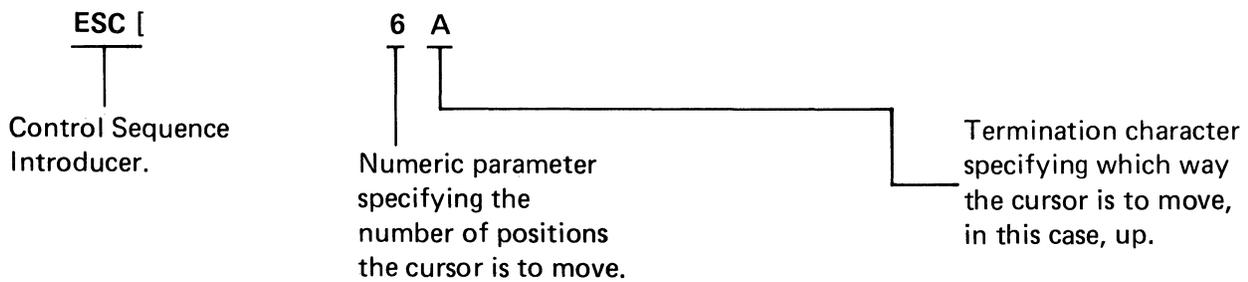
5.3 CONTROL SEQUENCE FUNCTIONS

This section describes the control sequences recognized by the VISUAL 400. Many of the control sequences described in this section conform to the basic format as specified by the ANSI X3.64 standard.

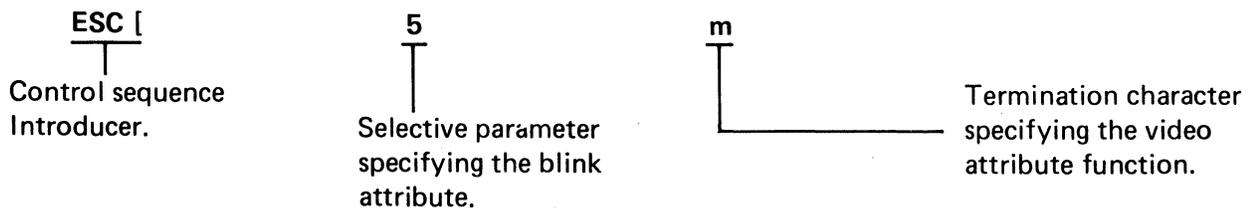


The following examples demonstrate the use of all three elements of the control sequence as specified by the ANSI X3.64 standard. Spaces are used for clarity only are not part of the sequence.

Example 1: Control Sequence Using Numeric Parameter, Move Cursor up 6 lines



Example 2: Control Sequence Using Selective Parameter, Turn on Blink Attribute



If multiple numeric or selective parameters are used in a single control sequence they must be separated with a semi-colon character.

5.3.1 Scrolling Region Command ESC [x ; y r

This command is applicable in Character mode only and is used to set the top and bottom lines of the screen scrolling region. The first numeric parameter, *x*, sets the top boundary and the second numeric parameter, *y*, sets the bottom boundary of the scrolling region. (Both numeric parameters are in decimal notation.) The default values are the entire screen, i.e., *x*=1 and *y*=24. The minimum size of the scrolling region is two lines.

Once the scrolling region is defined, incremental cursor positioning commands (Up, Down, Right, Left) can position the cursor anywhere within the scrolling region, but cannot position the cursor outside of the scrolling region. The Absolute Cursor Positioning commands remain unaffected by the screen scrolling region.

After the screen scrolling region is defined, a choice is provided, via Origin mode, for having line numbers on the screen dependent or independent of the defined scrolling region. For example, if line numbers are independent of the defined scrolling region, a received Absolute Cursor Positioning command with line and column parameters of 1, would position the cursor to the upper left-hand corner of the *screen*. If line and column numbers are dependent on the defined scrolling region, the aforementioned command would position the cursor to the upper left-hand corner of the *scrolling region*. Simply stated, the current state of Origin mode affects only the numbering of lines on the screen and thus only the Absolute Cursor Positioning and Cursor Vertical Absolute commands.

5.3.2 Cursor Movement Commands

The VISUAL 400 provides a wide variety of cursor positioning commands including incremental and absolute positioning and forward and back tabbing. This wide variety insures that the user can position the cursor in the most efficient manner for his particular application.

Incremental Cursor Positioning, ESC [Pn F

The cursor may be moved any number of increments up, down, right or left by using a single control sequence. The numeric parameter specifies in decimal the number of increments the cursor is to move, and the value of the termination character, *F*, specifies the direction of movement per Table 5-2.

The incremental cursor positioning commands will always cause the cursor to wrap screen boundaries and will never cause the screen to scroll.

**INCREMENTAL TABLE 5-2
CURSOR POSITIONING COMMANDS**

| Command Name | "F" Value | Sequence |
|-------------------------|-----------|------------|
| Cursor Up (Pn times) | A | ESC [Pn A |
| Cursor Down (Pn times) | B | ESC [Pn B |
| Cursor Right (Pn times) | C | ESC [Pn C |
| Cursor Left (Pn times) | D | ESC [Pn D |

Cursor Previous Line, Cursor Next Line ESC [Pn F, ESC [Pn E (Respectively)

These commands move the cursor to the beginning of the previous Pn lines, and the beginning of the next Pn lines respectively. The numeric parameter specifies in decimal the number of lines to move.

These commands will always cause the cursor to wrap screen boundaries and will never cause the screen to scroll.

Absolute Cursor Positioning, ESC [y;x H or ESC [y;x f

Either of the above commands may be used for positioning the cursor on an absolute basis. The above sequences will position the cursor to the line specified by y, and the column specified by x. Both the line and column parameters are in decimal notation and are numbered from 1-24 and 1-80 respectively. (When using 132 column format, columns are numbered 1-132.) The default value for x and y is one. If an attempt is made to position the cursor past screen boundaries the cursor will move to the screen boundary.

Cursor Horizontal Absolute, ESC [Pn G

This command moves the cursor right or left within a line to the column position specified in decimal by the numeric parameter. The default value for Pn is one. If the sequence is received with a Pn value too large (greater than 80 when using 80 columns, and greater than 132 when using 132 columns) the cursor will move to the rightmost column of the line.

Horizontal Position Relative, ESC [Pn a

This command moves the cursor right within a line the number of increments specified in decimal by the numeric parameter. The default value for Pn is one. If this sequence is received with a Pn value too large, the cursor will move to the rightmost column of the line.

Cursor Vertical Absolute, ESC [Pn d

This command moves the cursor up or down within a column to the line position specified in decimal by the numeric parameter. The default value for Pn is one. If this sequence is received with a Pn value too large (greater than 24) the cursor will move to the last line on the screen.

When this command is used in Character mode with a defined scrolling region less than one screen, the numbering of lines on the screen is dependent on Origin mode. See Section 5.4.18.

Cursor Vertical Relative, ESC | Pn e

This command moves the cursor down within a column the number of increments specified in decimal by the numeric parameter. The default value for Pn is one. If this sequence is received with a Pn value too large (i.e., would move the cursor off the screen) the cursor will move to the last line on the screen.

Index, ESC D

This sequence causes the cursor to move down one line. If the cursor is positioned on the bottom line of the screen or the bottom line of a defined scrolling region, the contents of the screen or scrolling region will scroll up one line if in Character mode. In Block mode a defined scrolling region and scrolling is never allowed. In this case the cursor will wrap from the bottom line to the top line.

Reverse Index, ESC M

This sequence causes the cursor to move up one line. If the cursor is positioned on the top line of the screen or the top line of a defined scrolling region, the contents of the screen or scrolling region will scroll down one line if in Character mode. In Block mode, a defined scrolling region and scrolling is never allowed. In this case the cursor will wrap from the top line to the bottom line.

5.3.3 Tabbing Commands

The VISUAL 400 supports forward and backward horizontal tabbing. In Character mode, tabbing is columnar much as it is on a standard typewriter. In Block mode, tabbing is by field, i.e., from beginning of field to beginning of field.

Tab stops are set remotely using the Cursor Tab Control or the Set Tab commands. Tab stops may also be set as part of the Define Area Qualification operation, see Section 5.3.17. Setting columnar tab stops (allowed in Character mode only) may also be accomplished by the operator in SET-UP A mode, see Section 3.2.2.3.

It is important to note that setting tab stops in Block mode defines the beginning of a field, and also sets an Area Attribute Code (AAC) at the cursor location thus defining the beginning of an area. The new area will have all the same properties of the AAC controlling the portion of the display where the new AAC (tab stop) is being set.

Tab stops are cleared remotely using the Cursor Tab Control or Tab Clear commands. Tab stops may also be cleared as part of the Define Area Qualification operation and the clear Attribute Code operation, see Section 5.3.17 and 5.3.18. Clearing columnar tab stops (allowed in Character mode only) may also be accomplished by the operator in SET-UP A mode, see Section 3.2.2.3.

Once tab stops have been defined, forward tabbing is initiated using the Cursor Horizontal Tab command and the HT control code. Backward tabbing is initiated by the Cursor Back Tab command.

Cursor Tab Control, ESC [Ps W

This command causes one or more tab stops to be set/cleared according to the Ps value.

| Ps Value | Action |
|-----------------|--|
| 0 (default) | Set tab at cursor |
| 2 | Clear tab at cursor |
| 4 | Clear all tabs in current line in Block mode. Clear all tabs in terminal in Character mode. |
| 5 | Clear all tabs in terminal if in Block mode. No action in Character mode. |

Tab Clear, ESC [Ps g

This command clears one or more tabs according to the Ps value.

| Ps Value | Action |
|-----------------|--|
| 0 (default) | Clear tab at cursor |
| 2 | Clear all tabs in current line in Block mode. Clear all tabs in terminal in Character mode. |
| 3 | Clear all tabs in terminal in Block mode. No action in Character mode. |

Set Tab, ESC H

This command sets a tab stop at the cursor location in Block mode, and sets a columnar tab in the current column in Character mode.

Cursor Horizontal Tab, ESC [Pn I

This command moves the cursor forward one or many tab stops as specified by the decimal value of Pn. Default value is one.

In Character mode, this command will cause the cursor to wrap from one line to the next and may also cause the screen to scroll as necessary if Autowrap mode is set.

If Autowrap mode is reset, the cursor will not move off the current line and thus scrolling will not occur.

If no tab stops exist, the cursor will move to the last column of the screen in Character mode.

In Block mode, this command will cause the cursor to wrap from one line to the next as necessary regardless of the setting of Autowrap mode. If no tab stops exist, the cursor will move to the home position.

Cursor Back Tab, ESC [Pn Z

This command moves the cursor backward one or many tab stops as specified by the decimal value of Pn. Default value is one.

In Character mode, this command will not cause the cursor to move off the current line. If the command is received that would move the cursor off the current line the cursor will move to the first column of the line. If no tab stops exist, the cursor will also move to the first column of the line.

In Block mode, the cursor will wrap from one line to the next as necessary. If no tab stops exist, the cursor will move to the home position.

5.3.4 Erasure Commands

Erasure may be accomplished on a character, line, field, area or page basis when in Block mode. The user may also define whether erasure commands erase only unprotected data or both protected and unprotected data. This choice is provided via Erasure mode, see Section 5.4.5.

When in Character mode, erasure may be accomplished on a character, line or page basis. Erasure mode does not affect erasure commands in Character mode.

None of the erasure commands listed in this section alter the location of the cursor.

Erase in Page, ESC [Ps J

This command erases some or all of the page according to the Ps value.

| Ps Value | Action |
|-----------------|------------------------------------|
| ∅ (default) | Erase from cursor to end of page |
| 1 | Erase from start of page to cursor |
| 2 | Erase entire page |

In Block mode, with Erasure mode set, the Erase Page commands will erase the selected portion of the page including protected data, Area Attribute Codes (AAC's) and tab stops. Any double size lines completely erased will return to single size.

In Block mode, with Erasure mode reset, the Erase Page Commands will erase only unprotected data within the selected portion of the page.

In Character mode, the Erase Page commands will erase the selected portion of the page including AAC's and tab stops. Any double size lines completely erased will return to single size.

Erase in Line, ESC [Ps K

This command erases some or all of the current line according to the Ps value.

| Ps Value | Action |
|-----------------|------------------------------------|
| ∅ (default) | Erase from cursor to end of line |
| 1 | Erase from start of line to cursor |
| 2 | Erase entire line |

In Block mode, with Erasure mode set, the Erase Line commands will erase the selected portion of the line including protected data, AAC's, and tab stops. If the line is completely erased it will return to single size.

In Block mode with Erasure mode reset, the Erase Line commands will erase only unprotected data within the selected portion of the line.

In Character mode, the Erase Line commands will erase the selected portion of the line including AAC's and tab stops. If the line is completely erased it will return to single size.

Erase in Area, ESC [Ps O

This command erases some or all of the current area according to the Ps value.

| Ps Value | Action |
|-----------------|------------------------------------|
| Ø (default) | Erase from cursor to end of area |
| 1 | Erase from start of area to cursor |
| 2 | Erase entire area |

In Block mode, with Erasure mode reset, the Erase Area commands will be executed only if the current area is unprotected. With Erasure mode set, erasure will occur regardless of the area type. The Erase Area commands will not alter line sizes under any circumstances.

In Character mode, areas do not exist. In this case Erase Area commands will default to Erase Line commands.

Erase in Field, ESC [Ps N

This command erases some or all of the current field according to the Ps value.

| Ps Value | Action |
|-----------------|-------------------------------------|
| Ø (default) | Erase from cursor to end of field |
| 1 | Erase from start of field to cursor |
| 2 | Erase entire field |

In Block mode, with Erasure mode set, the Erase Field commands will erase all data in the current field. Under no circumstances will AAC's or line sizes be altered. With Erasure mode reset, only unprotected areas within the current field will be erased.

In Character mode, fields do not exist. In this case Erase Field commands will default to Erase Page commands.

Erase Character, ESC [Pn X

This command erases Pn characters starting at the cursor location. The maximum value of Pn is decimal 255. If Erasure mode is reset, only unprotected data will be erased. If a protected area is encountered, the data is unaffected but each position is counted in determining the total character positions to be erased as specified by Pn.

If Erasure mode is set, protected data will be erased. Under no circumstances will this command alter AAC's, tab stops, or line sizes.

5.3.5 Character Size and Screen Alignment Commands, ESC [Ps v

Characters may be formed on the screen (on a line by line basis) in three different sizes: single height-single width, single height-double width, double height-double width. When using double width characters the maximum number of characters per line is halved, i.e., 40 characters maximum when in 80 column format and 66 characters maximum when in 132 column format. When using double height-double width characters the maximum number of lines per screen is 12.

The screen may also be filled with upper-case E's via a single command. This command is used for screen alignment and focus.

Single Height-Single Width Line, ESC [O v or ESC [v or ESC [5 v

This command causes the line marked by the cursor to be single height-single width. All lines on the screen default to this condition upon power-up or reset.

Single Height-Double Width Line, ESC [6 v

This command causes the line marked by the cursor to be single height-double width. If the line was previously single height-single width all characters from the middle of the line to the end of the line are lost. The cursor remains under the same character position unless the character position is lost, in which case the cursor is moved to the right margin.

Double Height-Double Width Line, Top Half, ESC [3 v

Double Height-Double Width Line, Bottom Half, ESC [4 v

These two commands are used as a pair on adjacent lines to form double height-double width characters. The same character must be sent to the same column of both lines to form each character. If the line was previously single height-single width, all characters from the middle of the line to the end of the line are lost. The cursor remains under the same character position unless the character position is lost, in which case the cursor is moved to the right margin.

Screen Alignment Display, ESC [8 v

This command causes the screen to be filled with upper-case E's and is used for focus and alignment of the display.

5.3.6 Program Function Key Command, ESC [PK ; D₁ ; . . . D₇ p

This command is used to program a function key with data. PK defines which function key is to be programmed. The legal values for PK are zero through twelve. A PK value of 0 (zero) will reset all function keys to their default messages as specified in Table 4-3. A PK value of one will program function key PF1, a value of two will program PF2 etc., etc.

D_1 through D_7 are the decimal values of the ASCII characters desired in the function key message. Any ASCII code (decimal 0 through 127) may be "loaded" into a function key by entering its decimal equivalent. Appendix V shows the decimal equivalent of all ASCII codes. An ESCape sequence may be loaded into a function key by loading decimal values 128 through 255. The programmed sequence will be a two character sequence with the first character ESC, and the second character the programmed decimal value less 128 decimal. For example a decimal value of 193 would represent the ESCape sequence, ESC A ($193-128 = 65 = \text{ASCII A in decimal}$).

A maximum of seven characters may be programmed into a function key. ESCape sequences programmed as described above will count as a single character.

Once a function key message is programmed, it may be stored via the SAVE operation (SHIFT S in SET-UP Mode). The message will be transmitted each time the function key is depressed. Please note that all block transmissions from the VISUAL 400, including function key messages are "framed" as described in Section 6.2.

5.3.7 Program LED Command, ESC [Ps q

This command turns ON or OFF the programmable LED according to the Ps value. A Ps value of 1 turns LED L1 ON, and a Ps value of 0 (or none) turns LED L1 OFF.

5.3.8 Save/Restore Cursor Commands, ESC [Ps s

This command saves or restores the current cursor location, graphic rendition (video attributes), and character set according to the Ps value. A Ps value of 7 will cause the cursor location, graphic rendition, area qualification and character set to be saved. A Ps value of 8 will restore these previously saved parameters.

5.3.9 Report Commands and Responses

The following list describes host generated commands and possible terminal responses.

Please note that all terminal responses transmitted to the host will be "framed" as described in Section 6.2.

| Host Command | Sequence | Terminal Response(s) | Sequence |
|----------------------------------|----------------------------|---|------------------------|
| 1. What are you? | ESC [0 c or ESC [c | VISUAL 400 with printer option or Standard VISUAL 400 | ESC [2 c |
| 2. Is terminal OK? | ESC [5 n | Terminal is OK | ESC [0 c ESC [0 n |
| 3. What is Cursor location? | ESC [6 n | Cursor is positioned on line y, and column x. Both x and y are in decimal notation. The line number is dependent on Origin mode. | ESC [y; xR |
| 4. What are terminal parameters? | ESC [1x or ESC [0x | Terminal will report terminal parameters per selective parameters in Table 5-3. | ESC [s; p; n; x; rx |

**TABLE 5-3
SELECTIVE PARAMETERS ASSOCIATED WITH "REPORT TERMINAL
PARAMETERS" RESPONSE**

| Parameter | Possible Parameter Value(s) | Meaning |
|---|-----------------------------|--|
| s | 2 | This message is a report. (s assumes a value of 2 in response to ESC [0x. |
| | 3 | This message is a report. (s assumes a value of 3 in response to ESC [1x. |
| p (Parity) | 1 | No Parity |
| | 4 | Odd Parity |
| | 5 | Even Parity |
| n (No. of bits) | 1 | 8 bits per character |
| | 2 | 7 bits per character |
| x (transmit speed) and r (receive speed) | 0 | 50 baud |
| | 8 | 75 baud |
| | 16 | 110 baud |
| | 24 | 134.5 baud |
| | 32 | 150 baud |
| | 40 | 200 baud |
| | 48 | 300 baud |
| | 56 | 600 baud |
| | 64 | 1200 baud |
| | 72 | 1800 baud |
| | 80 | 2000 baud |
| | 88 | 2400 baud |
| | 96 | 3600 baud |
| | 104 | 4800 baud |
| 112 | 9600 baud | |
| 120 | 19,200 baud | |

5.3.10 Test Commands, ESC [Ps y

This command is used to start one or more of the various self tests on the VISUAL 400. The selective parameter (Ps) indicates which test(s) is to be performed. The parameter value is arrived at by taking the weight of each test and adding them together. A parameter value of 0 causes a reset.

| Test | Weight |
|------------------------------|------------------------------|
| Power-up check sum | 1 |
| Interface Test (Loop Back) | 2 (Turn around plug needed)* |
| EIA Test | 4 (Turn around plug needed)* |
| Repeat Tests until power-off | 8 |

*See Appendix IV for turn around plug.

5.3.11 Select Character Sets Command, ESC [P0; P1(D

This command is used to define the G0 and G1 character sets. Of the nine character sets provided, the user may define any particular set as the G0 set and any particular set as the G1 set by using the appropriate P0 and P1 selective parameters respectively. Once the G0 and G1 sets are defined they may be easily enabled via the SI and SO control codes respectively. (Resetting the terminal will enable the G0 set.) Once defined the G0 and G1 sets may be saved in non-volatile memory by performing the SAVE operation (SHIFT S in SET-UP mode). The initial state of the G0 and G1 character sets is U.S. and U.K. respectively.

| P0/P1 Value | Character Set |
|-------------|------------------|
| 0 or none | U.S. |
| 1 | U.K. |
| 2 | French |
| 3 | German |
| 4 | Swedish/Finnish |
| 5 | Norwegian/Danish |
| 6 | Spanish |
| 7 | Portuguese |
| 8 | Line Drawing |

ASCII code charts detailing each national character set are located in Appendix III. The Line Drawing character set is illustrated in Table 5-4. Please note that the Select Character Sets command defines the G0 and G1 character sets only, and does not alter the keyboard configuration. The Select Keyboard layout SET-UP feature is used for defining the keyboard layout. For example, a user desiring a French version VISUAL 400 may define the G0 character set to be French *and* also define the keyboard layout to be French.

5.3.12 Editing Commands

The VISUAL 400 provides control sequences for the flexible insertion and deletion of lines and characters. By using a single control sequence, one or many lines or characters may be inserted or deleted.

When inserting or deleting lines, a choice is provided for affecting lines at and below the current line or at and above the current line. This choice is provided via Vertical Editing mode see Section 5.4.6.

When inserting or deleting characters, a choice is provided for affecting characters at and to the right of the current cursor location, or at and to the left of the cursor location. This choice is provided via Horizontal Editing mode, see Section 5.4.7.

The user may also limit the portion of the screen affected by editing commands to the current line, field, area, or screen. This choice is provided via Select Editing Extent mode, see Section 5.5.

Insert Replace mode provides an alternate method of inserting characters and is described in Section 5.4.4.

TABLE 5-4
LINE DRAWING CHARACTER SET

| ASCII Code | Octal | Graphic | Desc. | ASCII Code | Octal | Graphic | Desc. |
|------------|-------|----------------|--------------------|------------|-------|---------|-----------------------|
| - | 137 | | Blank | o | 157 | — | Bar at Scan 1 |
| ` | 140 | ◆ | Diamond | p | 160 | — | Bar at Scan 3 |
| a | 141 | ⋯ | Checker Board | q | 161 | — | Bar at Scan 5 |
| b | 142 | H _T | Horiz. Tab | r | 162 | — | Bar at Scan 7 |
| c | 143 | F _F | Form Feed | s | 163 | — | Bar at Scan 9 |
| d | 144 | C _R | Carriage Return | t | 164 | ┌ | T Left |
| e | 145 | L _F | Line Feed | u | 165 | └ | T Right |
| f | 146 | ° | Degree | v | 166 | ⊥ | T Down |
| g | 147 | ± | Plus or Minus | w | 167 | ⊤ | T Up |
| h | 150 | N _L | New Line | x | 170 | | Vert. Bar |
| i | 151 | V _T | Vert. Tab | y | 171 | ≤ | Less than or equal |
| j | 152 | └ | Lower Right Corner | z | 172 | ≥ | Greater than or equal |
| k | 153 | ┐ | Upper Right Corner | { | 173 | π | Pi |
| l | 154 | ┌ | Upper Left Corner | ; | 174 | ≠ | Not equal to |
| m | 155 | └ | Lower Left Corner | } | 175 | £ | Pound Sign |
| n | 156 | + | Intersect lines | ~ | 176 | • | Center Dot |

The Line Drawing set is a modified U.S. character set in which the lower-case codes and upper-case code octal 137 are replaced by the indicated graphic characters. The remainder of the Line Drawing set is identical to the U.S. character set.

Insert Line(s), ESC [Pn L

This command causes Pn lines to be inserted starting at the cursor line. If Vertical Editing mode is set, the Insert Line command will push the current line and all lines *above* the current line up to make room for the newly inserted lines. If Vertical Editing mode is reset, the Insert Line command will push the current line and all lines *below* the current line down to make room for the newly inserted lines. In either case, any lines pushed off the screen are lost from memory.

When operating in Block mode, Select Editing Extent mode must be set for edit in display and Protect mode must be reset for the Insert Line command to be executed.

When operating in Character mode, the Insert Line command will always be executed.

Delete Line(s), ESC [Pn M

This command causes Pn lines to be deleted starting at the cursor line. If Vertical Editing mode is set, the Delete Line command will delete the current line and Pn-1 lines *above* the current line. If Vertical Editing mode is reset, the Delete Line command will delete the current line and Pn-1 lines *below* the current line. In either case lines above/below the deletion will move down/up to fill the gap created by the deletion.

When operating in Block mode, Select Editing Extent mode must be set for edit in display and Protect mode must be reset for the Delete Line command to be executed.

When operating in Character mode, the Delete Line command will always be executed.

Insert Character(s), ESC [Pn

This command causes Pn space codes to be inserted starting at the cursor location. If Horizontal Editing mode is set, the Insert Character command will push characters at and to the left of the cursor location *left* to make room for the newly inserted space codes. If Horizontal Editing mode is reset, the Insert Character command will push characters at and to the right of the cursor location *right* to make room for the newly inserted space codes. In either case no cursor movement will occur.

When operating in Block mode, Select Editing Extent mode will limit the shifted character string to the current field, area, line or page. The shifted character string may "snake" from one area to the next provided no attempt is made to shift data into a right justify area or data of an improper type into an area, i.e., alpha data into a numeric only area. If an attempt is made to shift data into a right justify area the editing operation will end at that point and not continue on to its normal termination point. If an attempt is made to shift data of an improper type into an area, the editing operation will delete the improper data and move on to its normal termination point. Protected areas will not be affected by the shifted character string.

When operating in Character mode, Select Editing Extent mode will limit the shifted character string to the current line or page. If Select Editing Extent mode is set for edit in field or area it will default to edit in page and line respectively.

Regardless of whether Character or Block mode is currently enabled, any characters shifted past the currently selected edit termination point will be lost from memory.

Delete Character(s), ESC [Pn P

This command causes Pn characters to be deleted starting at the cursor location with Pn-1 following characters shifting right to close the gap created by the deletion. If Horizontal Editing mode is reset, the Delete Character command will delete characters at end to the right of the cursor location with Pn-1 following characters shifting left to close the gap created by the deletion. In either case no cursor movement will occur.

When operating in Block mode, Select Editing Extent mode will limit the shifted character string to the current field, area, line or page. The shifted character string may "snake" from one area to the next provided no attempt is made to shift data into a right justify area or data of an improper type into an area, i.e., alpha data into a numeric only area. If an attempt is made to shift data into a right justify area the editing operation will end at that point and will not continue on to its normal termination point. If an attempt is made to shift data of an improper type into an area, the editing operation will delete the improper data and move on to its normal termination point.

When operating in Character mode, Select Editing Extent mode will limit the shifted character string to the current line or page. If Select Editing Extent mode is set for edit in field or area it will default to edit in page and line respectively.

5.3.13 Set Communication Control Codes Command, ESC [P1; P2; P3; P4; P5; P6; P7 t

This command allows the user to remotely select any ASCII code for each of the seven communication control codes. The user may also select each communication control code from the keyboard in SET-UP C mode, see Section 3.2.2.41. In either case, once the communication control codes are defined they may be saved on a non-volatile basis by performing a SAVE operation (SHIFT-S in SET-UP mode).

Each time the Set Communication Control Code command is used it will change *all* of the seven codes, thus the command must specify each code even if it is not to be changed. Please note that each Communication Control Code (excluding the TACC) must be different unless set to null.

Each selective parameter in the command (P1 – P7) is defined using decimal notation for the desired ASCII code.

The designations for P1 through P7 are as follows:

- P1 = Start of Message Code (SOM)
- P2 = Area Separator Code (AS)
- P3 = First End of Line Code (FEOL)
- P4 = Second End of Line Code (SEOL)
- P5 = First End of Message Code (FEOM)
- P6 = Second End of Message Code (SEOM)
- P7 = Turnaround Control Code (TACC)

Codes P1 – P6 are used for "framing" buffering transmission from the VISUAL 400 and can also affect received data, see Sections 3.2.2.41 through 3.2.2.44. P7 applies primarily when the terminal is transmitting character by character in a half-duplex environment. A complete description of each communication control code is located in Section 3.2.2.41.

5.3.14 Video Attribute Command, (Select Graphic Rendition) ESC [Ps; . . . Ps m

Data on the screen may be displayed in any combination of the following video attributes: Bold, Underline, Blink and Reverse Video.

The attributes are enabled by using the Video Attribute command with the selective parameters specifying which attributes to enable. Table 5-5 summarizes all video attributes and their associated selective parameters. The video attributes are cumulative, i.e., received data will be displayed according to all attributes then enabled.

**TABLE 5-5
SUMMARY OF VIDEO ATTRIBUTES AND SELECTIVE PARAMETERS**

| Attribute | Selective Parameter | Control Sequence |
|----------------|---------------------|------------------|
| Attributes OFF | 0 (default) | ESC [m |
| High Intensity | 1 | ESC [1 m |
| Underline | 4 | ESC [4 m |
| Blink | 5 | ESC [5 m |
| Reverse Video | 7 | ESC [7 m |

Example:

Display on the screen the Blinking, Underlined word "NAME", then display on the screen the name "JONES" with no video attributes.

1. Turn on the Blink and Underline attributes with control sequence, ESC [4;5m or control sequences ESC [4m and ESC [5m.
2. Send the word "NAME" to the screen.
3. Turn off all attributes with the control sequence ESC [m (default value is 0).
4. Send the name "JONES" to the screen.

5.3.15 Remote Transmit Command, ESC S EOM

This command remotely initiates a block transmission. The portion of the screen transmitted depends on the various transmission modes then enabled. The EOM is the First or Second End of Message code then defined.

5.3.16 Reset Command ESC c

This command resets the terminal, and has the same effect as powering-down then powering-up the terminal.

5.3.17 Define Area Qualification Commands ESC [Ps; . . . Ps o

This command is used to define qualified areas on the screen. Qualified areas may be defined as numeric only, alpha only, alphanumeric, protected and guarded, protected and unguarded, right justify, must fill and total fill or any logical combination of these qualifications. The Define Area Qualification command may also set a tab stop at the cursor location.

The Define Area Qualification command causes an Area Attribute Code (AAC) to be set at the cursor location and a qualified area to begin at the AAC. Qualified areas may be defined in Character or Block mode, but are recognized only in Block mode. Protect mode is typically reset when qualified areas are being defined and set once all qualified areas have been defined, see Section 5.4.12.

The selective parameter(s) in the command defines the type of qualified area per Table 5-6. The qualified area will end at the beginning of the next AAC (defining the next qualified area) or the end of the screen if no more AAC's exist. A maximum of 32 AAC's may be set per line.

TABLE 5-6
SELECTIVE PARAMETERS ASSOCIATED WITH DEFINE
AREA QUALIFICATION COMMAND

| Area Qualification | Selective Parameter | Code Sequence | Comments |
|--------------------|---------------------|----------------------------|---|
| Accept All Input | 0 (default) | ESC [0 o or ESC [o | Area will accept all input. This is the power-up state for the VISUAL 400. |
| Protect and Guard | 1 | ESC [1 o | Area is protected against alteration and will not be transmitted unless Guarded Area Transfer mode is set. |
| Numeric only | 3 | ESC [3 o | Area will accept numeric input only. Numeric input is defined as zero through 9, plus (+), comma (,) minus (-), and period (.) characters. If an attempt is made to enter alpha data, the bell will sound and no character will be entered. |
| Alpha only | 4 | ESC [4 o | Area will accept alpha input only. Alpha input is defined as all ASCII codes except zero through nine. If an attempt is made to enter a number the bell will sound and no character will be entered. |

TABLE 5-6
SELECTIVE PARAMETERS ASSOCIATED WITH DEFINE
AREA QUALIFICATION COMMAND (Cont.)

| Area Qualification | Selective Parameter | Code Sequence | Comments |
|---------------------|---------------------|---------------|---|
| Right justify | 5 | ESC [5 o | Data entered into a right justify area will be right justified; i.e., entered into the rightmost position of the area after pushing existing data in the area left one position for each character entered. |
| Set Tab | 7 | ESC [7 o | Sets tab stop at cursor location. |
| Protect and Unguard | 8 | ESC [8 o | Area is protected against alteration and may be transmitted. |
| Must Fill | 10 | ESC [10 o | At least one character must be entered into this area before a block transmission containing this area can be accomplished. If a block transmission containing this area is attempted and no codes exist in the area the bell will ring twice and the cursor will be moved to the beginning of the must fill area. See notes 1 and 2. |

NOTE

When defining an AAC, all the desired characteristics of the area being defined must be included in a single command since each command clears any AAC previously defined at the cursor location.

**TABLE 5-6
SELECTIVE PARAMETERS ASSOCIATED WITH DEFINE
AREA QUALIFICATION COMMAND (Cont.)**

| Area Qualification | Selective Parameter | Code Sequence | Comments |
|---|---------------------|---------------|---|
| Total Fill | 20 | ESC [20 o | This area must be totally filled before a block transmission containing this area can be accomplished. If a block transmission containing this area is attempted and the area is not totally filled the bell will ring twice and the cursor will be moved to the beginning of the total fill area. See Notes 1 and 2. |
| Select for Transmission | 30 | ESC [30 o | Used when operating with Modified Data Area Transfer mode set. This parameter allows the host to set up an AAC with the same flag set that will be set when the operator modifies data in an area. |
| <p>Notes</p> <ol style="list-style-type: none"> 1. Space codes are valid characters for must fill and total fill areas. 2. If Transfer Termination mode is set and the cursor is positioned <i>before</i> the first character in a must fill area, transmission will not be allowed. 3. If Transfer Termination mode is set and the cursor is positioned in a total fill area that is totally filled up to cursor location, transmission may occur even though the entire area is not totally filled. | | | |

5.3.18 Clear Attribute Code Command

ESC [Ps u

This command clears one or many Area Attribute codes (AAC's) or all modified and/or all unguarded area "flags."

The selective parameter in the command specifies the AAC's and/or flags to be cleared per Table 5-7.

TABLE 5-7
SUMMARY OF SELECTIVE PARAMETERS
ASSOCIATED WITH CLEAR ATTRIBUTE CODE COMMAND

| AAC/Flags Cleared | Selective Parameter | Code Sequence | Comments |
|---------------------------------|---------------------|----------------------------|--|
| Clear AAC at cursor location | Ø (default) | ESC [Ø u or ESC [u | This command clears the AAC at the cursor location. This will result in the qualified area previously defined by the cleared AAC to become part of and take on the qualifications of the immediately preceding area. |
| Clear All AAC's in Current Line | 1 | ESC [1 u | This command clears all AAC's in the current line. This will result in the qualified areas previously defined by the cleared AAC's to become part and take on the qualifications of the immediately preceding area. |
| Clear All AAC's in Display | 2 | ESC [2 u | This command clears all AAC's in the display. This will result in the screen being a default area, i.e., will accept all input. |
| Clear All Unguarded Area Flags | 4 | ESC [4 u | This command causes all areas defined as protected and unguarded to be redefined as protected and guarded. |

TABLE 5-7
SUMMARY OF SELECTIVE PARAMETERS
ASSOCIATED WITH CLEAR ATTRIBUTE CODE COMMAND (Cont.)

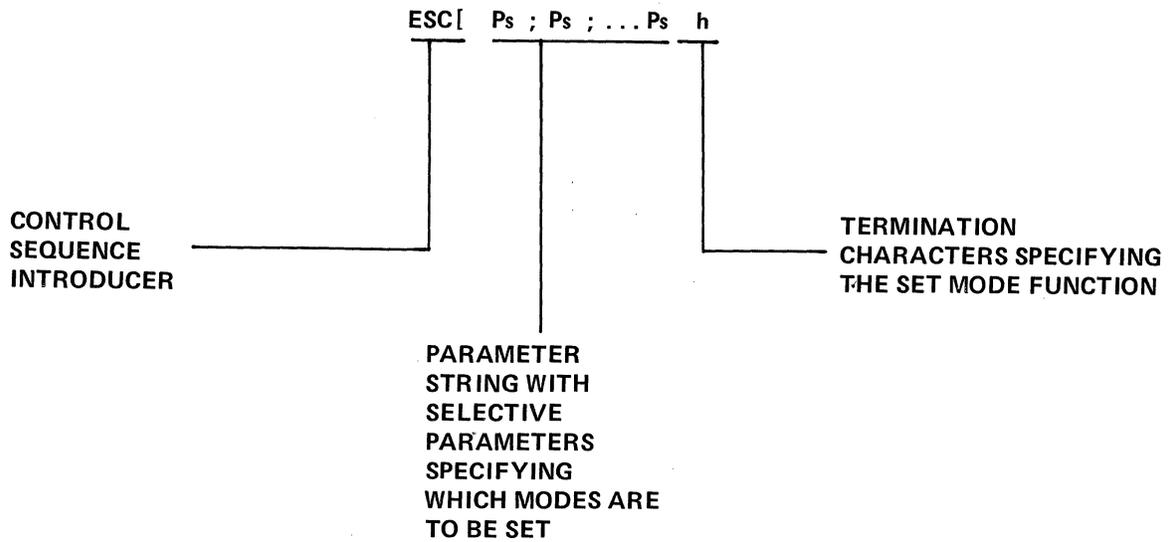
| AAC/Flags Cleared | Selective Parameter | Code Sequence | Comments |
|---|---------------------|---------------|--|
| Clear All Modified Area Flags | 3 | ESC [3 u | This command causes all areas defined as modified to be redefined as unmodified by resetting the modified flag associated with each area. This command is usually used when Modified Data Area Transfer mode is set, so that only fields modified since the last transmission will be transmitted. |
| Clear All Modified Area <i>and</i> Unguarded Area Flags | 5 | ESC [5 u | This command has the same effect as using <i>both</i> the Clear All Unguarded Area Flags and Clear All Modified Area Flags. |

5.4 MODES (SET/RESET)

This section describes the modes used to control the VISUAL 400. The highly flexible nature of the VISUAL 400 is accomplished through the use of modes that allow for local or remote selection of terminal parameters and condition how the terminal will function in response to control sequences. For example, modes exist that condition and provide flexibility to editing functions, erase functions and transmission.

Each mode described in this section has two possible states; set or reset. A single control sequence may set one or a maximum of 16 modes, or reset one or a maximum of 16 modes. Many of the modes are also selectable and changeable in SET-UP mode. Modes that are selectable in SET-UP mode may also be stored in non-volatile memory giving the user the ability to determine their power-up states.

The control sequence format for the Set Mode function is:



The control sequence format for Reset Mode is:

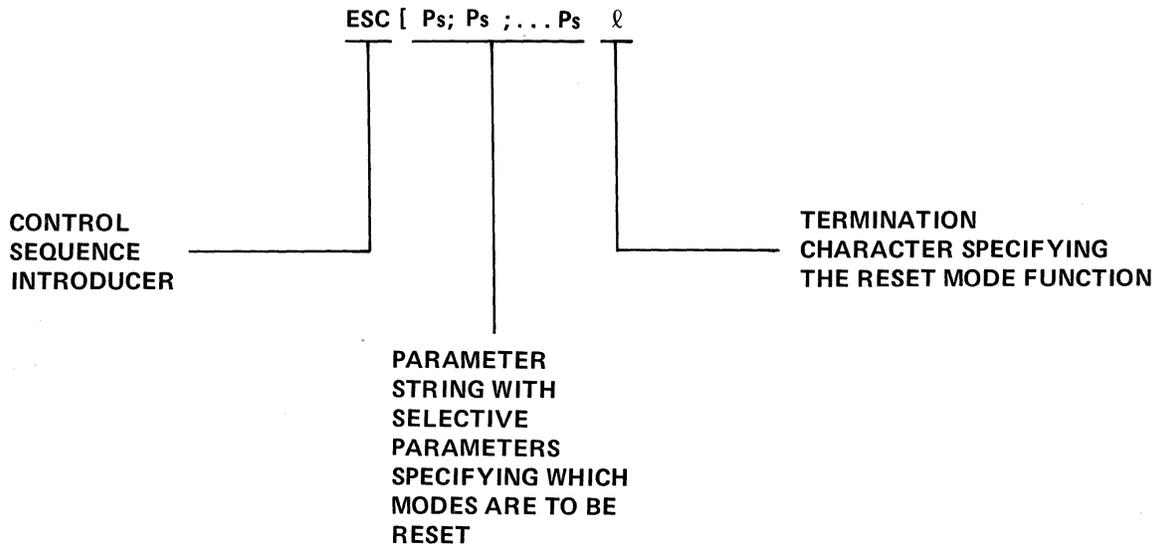


Table 5-8 lists all modes applicable to set/reset mode control sequences with their associated selective parameters. The modes that include the question mark character (?) as part of the selective parameter are private modes that have been added to enhance the operational capabilities of the terminal and are not actually specified in the ANSI X3.64 standard.

TABLE 5-8
SELECTIVE PARAMETERS ASSOCIATED
WITH SET/RESET MODE CONTROL SEQUENCES

| Mode Name | Selective Parameters (Ps) | Changeable and Savable in SET-UP Mode |
|-----------------------------|---------------------------|---------------------------------------|
| Guarded Area Transfer | 1 | Yes |
| Keyboard Action | 2 | No |
| Control Representation | 3 | Yes |
| Insert Replace | 4 | No |
| Erasure | 6 | Yes |
| Vertical Editing | 7 | Yes |
| Horizontal Editing | 10 | Yes |
| Character | 12 | Yes |
| Multiple Area Transfer | 15 | Yes |
| Transfer Termination | 16 | Yes |
| Linefeed New Line | 20 | Yes |
| Protect | ? 0 | No |
| Auto-Tab | ? 1 | Yes |
| Modified Data Area Transfer | ? 2 | Yes |
| Column | ? 3 | Yes |
| Scrolling | ? 4 | Yes |
| Screen | ? 5 | Yes |
| Origin | ? 6 | Yes |
| Autowrap | ? 7 | Yes |
| Autorepeat | ? 8 | Yes |
| Transmit Request | ? 9 | Yes |
| Line Transmit | 160 | Yes |

5.4.1 Guarded Area Transfer Mode, Ps=1

This mode applies to Block Mode only and determines whether areas defined as protected and guarded may be transmitted.

When set, protected guarded areas may be transmitted.

When reset, protected guarded areas will never be transmitted.

It is important to note that Guarded Area Transfer mode is only one of six modes that condition Block mode transmissions. See Section 6.1 for a description of the interaction between all five modes.

5.4.2 Keyboard Action Mode, Ps=2

When set, this mode causes the keyboard to be locked thus disallowing local data entry. The KBD LOCKED LED will come on to indicate the locked condition. Depressing the SET-UP key will clear the locked condition.

5.4.3 Control Representation Mode, Ps=3

When set, this mode causes control codes to be displayed as opposed to being acted upon and is primarily used as an aid in program debugging. The XOFF(DC3) and XON(DC1) synchronization codes will not be displayed unless the Receiver XON/XOFF SET-UP feature is disabled.

Appendix II details the graphic rendition assumed by each control code when received with Control Representation mode set.

When reset, control codes will be acted upon as usual.

5.4.4 Insert Replace Mode, Ps=4

When set, this mode causes the entry of displayable characters to be inserted at the cursor location after shifting existing data right or left to make room for the newly inserted characters. The INSERT MODE LED will be on to indicate the set state of Insert-Replace mode. Whether existing data shifts right or left depends on the current state of Horizontal Editing mode.

If Horizontal Editing mode is reset the cursor location and existing data will shift *right* one position for each displayable character entered. If Horizontal Editing mode is set, existing data will shift *left* one position for each character entered. The extent of the shifted character string will be determined by the current state of Select Editing Extent mode. In Character mode, the shifted character string may be limited to the current line or the entire page. If Select Editing Extent mode is set for edit in area or field it will default to edit in page and line respectively. In Block mode, the shifted character string may be limited to the current field, area, line or page. The shifted character string may "snake" from one area to the next provided no attempt is made to shift data into a right justify area or data of an improper type into an area, i.e., alpha data into a numeric only area. If an attempt is made to shift data into a right justify area, the editing function will end at that point and not continue on to its normal termination point. If an attempt is made to shift data of an improper type into an area, the editing operation will delete the improper data and move on to its normal termination point. Protected areas will not be affected by the shifted character string.

When Insert-Replace mode is reset, normal data entry will occur, i.e., no character strings will be shifted.

5.4.5 Erasure Mode, Ps=6

This mode is applicable to Block mode only and determines whether erase commands erase protected and unprotected data or only unprotected data.

When set, Erasure mode conditions erase commands to erase *all* data (protected and unprotected). All tab stops and AAC's may also be erased. Any double size lines completely erased will return to single size.

When reset, erase commands will erase only unprotected data. Tab stops, AAC's and double size lines will not be altered.

5.4.6 Verticle Editing Mode, Ps=7

This mode affects the Insert and Delete Line commands only and determines whether these commands affect lines above or below the current line.

When set, the Insert/Delete Line commands affect the current line and all lines *above* the current line.

When reset, the current line and all lines *below* the current line are affected.

5.4.7 Horizontal Editing Mode, Ps=10

This mode affects only the Insert and Delete Character commands and the operation of the Insert-Replace mode and determines whether these insert/delete character operations affect data at and to the *left* of the cursor location, or at and to the *right* of the cursor location.

When set, the Insert/Delete Character operations affect data at and to the left of the cursor location.

When reset, the Insert/Delete Character operations affect data at and to the right of the cursor location.

5.4.8 Character Mode, Ps=12

This mode determines whether the terminal operates in a character transmission mode or a block transmission mode.

When set, the terminal is in Character mode and transmission will be character by character as entered on the keyboard. The CHAR MODE LED will be on to indicate the set state of Character mode.

When reset, the terminal is in Block mode and transmission will not occur until the operator depresses the XMIT key or transmission is initiated by the Remote Transmit command. Data entered on the keyboard will be stored in terminal memory only and will not be transmitted with each keystroke.

When operating in Block mode a choice is provided for transmitting all or any part of the screen when transmission is initiated. The transmitted portion of the screen is determined by Multiple Area Transfer mode, Transfer Termination mode, Guarded Area Transfer mode, Line Transmit mode, and Modified Data Area Transfer mode. Each of these modes is described later in this section and also in Section 6.0.

5.4.9 Multiple Area Transfer Mode, Ps=15

This mode applies to Block mode only and determines whether one or many areas will be transmitted when transmission is initiated.

When set, many areas may be transmitted.

When reset, only the area containing the cursor may be transmitted.

It is important to note that Multiple Area Transfer mode is only one of six modes that condition Block mode transmissions. See Section 6 for a description of the interaction between all five modes.

5.4.10 Transfer Termination Mode, Ps=16

This mode applies to Block mode only and determines whether transmission of single/multiple areas will occur from the beginning of the area/page up to the cursor location or the entire area/page regardless of cursor location.

When set, area/page transmission will occur up to and including the cursor location.

When reset, the entire area/page will be transmitted regardless of cursor location.

It is important to note that Transfer Termination mode is only one of six modes that condition Block mode transmissions. See Section 6.

5.4.11 Linefeed New Line Mode, Ps=20

When set, this mode causes the RETURN key to generate the CR and LF codes, and a received LF causes a new line function. When reset, the RETURN key generates CR and a received LF causes only line feed.

5.4.12 Protect Mode, Ps=?0

This mode applies to Block mode only and determines whether or not Area Attribute Codes (AAC's) are recognized.

When set, all AAC's will be recognized. The PROTECT MODE LED will be on to indicate the set state of Protect mode.

When reset, the data protection defined by AAC's will not be recognized, however, tab stops defined as part of an AAC will be recognized.

This mode is typically reset while areas on the screen are being defined, and set once all areas have been defined.

5.4.13 Autotab Mode, Ps=?1

This mode applies to Block mode only and determines the action taken by the terminal in response to attempted data entry into a protected area.

When set, attempted data entry into a protected area will cause the bell to ring and the cursor to be moved to the next unprotected position.

When reset, attempted data entry into a protected area will cause the bell to ring and the cursor position to remain unchanged.

5.4.14 Modified Data Area Transfer Mode, Ps=?2

This mode applies to Block mode only, and when set allows for transmission of only modified and unguarded areas within a defined portion of the display.

Modified areas are defined as:

1. Any area in which data has been altered from the keyboard since the last transmission.
2. Any area in which erasure from the keyboard has occurred since the last transmission.*
3. Any area which has the modified flag set by the host, see Section 5.3.18.

Unguarded areas are defined as any protected area in which the unguard flag is set. The unguard flag is set via the Define Area Qualification command with the appropriate selective parameter, see Section 5.3.17. By setting the unguard flag the host may include any protected area when a block transmission occurs.

When Modified Data Area Transfer mode is set, each transmitted area will be preceded by a Cursor Positioning Report detailing the screen coordinates of each transmitted area. (See Section 5.3.9 for Cursor Positioning Report format.) Area separators are never used when Modified Data Area Transfer mode is set.

NOTE

When Modified Data Area Transfer mode is set, all areas will be guarded unless specifically defined as unguarded. Each time an area is unguarded it will maintain its' unguarded status until the Clear Attribute Code command resets the status of all unguarded areas or Modified Data Areas. This is accomplished via the Clear Attribute Code command with a selective parameter defining that all unguarded area flags and/or modified flags be reset, see Section 5.3.18.

It is important to note that Modified Data Area Transfer mode is only one of six modes that condition Block mode transmissions. See Section 6 for a description of the interaction between all five modes.

5.4.15 Column Mode, Ps=?3

When set, this mode conditions the terminal for 132 column display. When reset, the terminal will use 80 column display.

5.4.16 Scrolling Mode, Ps=?4

When set, this mode conditions the terminal for smooth scroll as defined in Section 3.2.2.5. When reset, the terminal is conditioned for jump scroll as defined in Section 3.2.2.5.

5.4.17 Screen Mode, Ps=?5

When set, this mode causes the screen to form characters by black dots on a white background.

When reset, the screen will form characters by white dots on a black background.

5.4.18 Origin Mode, Ps=?6

This mode applies only to Character mode and determines whether or not line numbers are dependent on the selected scrolling region.

When set, this mode causes line numbers to be dependent on the selected scrolling region of the screen. Column 1, line 1 will be the upper left-hand corner of the *scrolling region*.

When reset, line numbers will be independent of the selected scrolling region. Column 1, line 1 will be the upper left-hand corner of the *screen*.

5.4.19 Autowrap Mode, Ps=?7

When set, this mode will cause the cursor to automatically advance to the first position of the next line upon entering characters beyond the last position of the present line.

When reset, the cursor will not wrap around automatically. Any characters entered will overlay the last character on the line.

5.4.20 Autorepeat Mode, Ps=?8

When set, this mode causes certain keys to be autorepeating per Section 3.2.2.6.

When reset, no keys will be autorepeating.

5.4.21 Transmit Request Mode, Ps=?9

This mode applies to Block mode only. When set, this mode causes the XMIT Key to send a request for transmission as opposed to initiating a block transmission. The request format is ESC_Z ESC\. Typically the host will then set the desired transmission modes, allocate buffer space and initiate transmission via the Remote Transmit command.

When reset, the XMIT Key will initiate a block transmission in accordance with the modes then enabled.

5.4.22 Line Transmit Mode, P_s = 160

Line Transmission mode applies to Block Mode only, and when set, conditions the VISUAL 400 for transmitting only the line containing the cursor. All of the other transmission modes interact with Line Transmission mode to determine the transmitted portion of the line. For example, if Transfer Termination mode is set and a line transmission is initiated, only data on the line up to the cursor location will be transmitted.

Line Transmission mode may be set or reset remotely via control sequence or from the keyboard in SET-UP mode.

5.5 SELECTED EDITING EXTENT MODE ESC [Ps Q

This mode selects the extent of the display to be affected by the Insert/Delete Character commands and terminal operation with Insert-Replace mode set.

When in Block mode, these editing functions may be limited to the current field, line, area or display according to the value of the selective parameter in the control sequence.

Table 5-9 summarizes the selective parameters associated with Select Editing Extent mode.

**TABLE 5-9
SELECTIVE PARAMETERS ASSOCIATED
WITH SELECTED EDITING EXTENT MODE**

| Selective Parameter (Ps) | Meaning | Control Sequence |
|-------------------------------------|-----------------|----------------------------|
| Ø (default) | Edit in Display | ESC [Ø Q or ESC [Q |
| 1 | Edit in Line | ESC [1 Q |
| 2 | Edit in Field | ESC [2 Q |
| 3 | Edit in Area | ESC [3 Q |

When in Character mode fields and areas do not exist. In this case edit in field will default to edit in display and edit in area will default to edit in line.

6. DATA TRANSMISSION

The VISUAL 400 supports both character by character and block transmission. This section deals primarily with block transmissions.

6.1 MODES

When operating in Block mode, six transmission modes are used to condition the portion of the display to be transmitted when transmission is initiated. By using various set/reset combinations of these modes the user may condition transmission to include all or any part of the screen.

The five modes that condition Block mode transmissions are Multiple Area Transfer mode, Transfer Termination mode, Guarded Area Transfer mode, Modified Data Area Transfer mode, Line Transmit mode, and Transmit Request mode. Each of these modes is explained in Section 5.4.

Table 6-1 illustrates the portion of the screen transmitted for the various set/reset combinations of the transmission modes. Table 6-1 does not include Transmit Request mode since this mode does not condition the transmittable screen portion, but determines whether the XMIT key causes a data transmission or transmission of a request for permission to transmit data.

Table 6-1 also omits Line Transmit mode since this mode conditions the VISUAL for transmitting *only* the line containing the cursor. All other combinations of transmissions modes shown in Table 6-1 are valid with Line Transmit mode set, but transmission is limited to the current line.

In all cases, the VISUAL 400 will automatically delete insignificant space codes at the end of each transmitted line.

6.2 MESSAGE FRAMING

When the VISUAL 400 transmits a block of data, the transmitted data stream will be "framed" per the following:

- Start of Message Code (SOM) precedes all data characters in the transmitted message
- Area Separator Code (AS) is included in the data stream each time the end of an area is encountered
- First and Second End of Line Codes (FEOL and SEOL) are included in the data stream to signify the end of data on a line
- First and Second End of Message Codes (FEOM and SEOM) terminates all data characters in the transmitted message
- Turn Around Control Code (TACC) is used only in half-duplex Character mode operation and to terminate Answerback, Function Key, and Status transmissions in Character mode.

The message framing codes are user programmable and each may be defined to be any one of the 128 ASCII codes including NULL. The codes may be defined in SET-UP C Mode as described in Sections 3.2.2.41 – 3.2.2.45 or may be defined remotely as described in Section 5.3.13.

**TABLE 6-1
COMBINATIONS OF TRANSMISSION MODES**

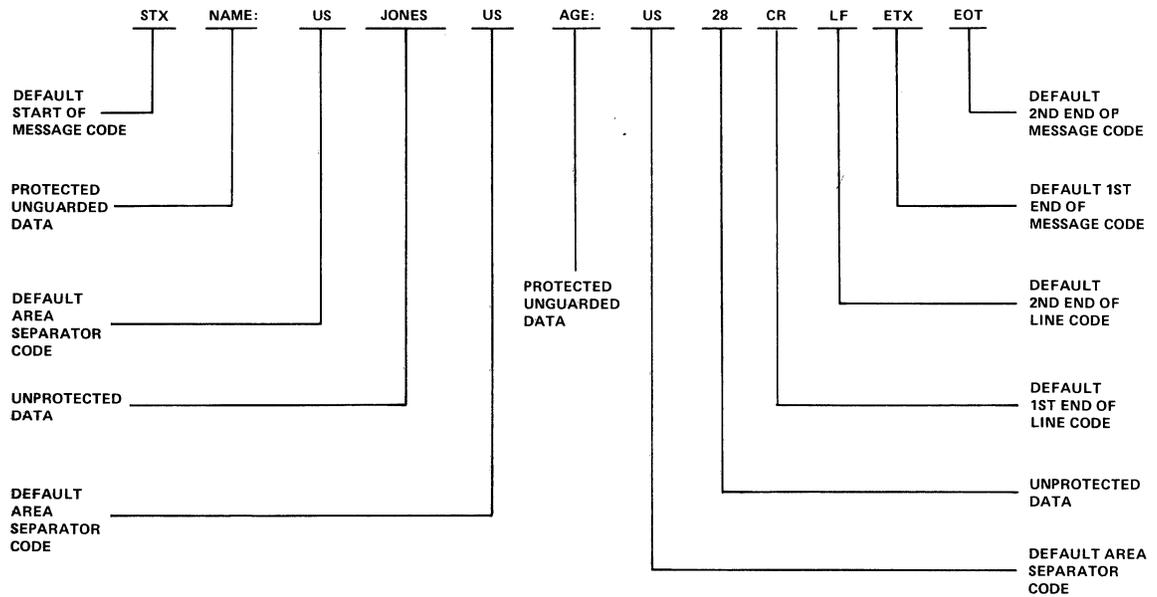
| TRANSMITTED PORTION OF SCREEN | MODE | R=RESET S=SET | | | | | | | | | | | | | | | | |
|--|-----------------------------|------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MULTIPLE AREA TRANSFER | S | R | R | R | S | S | S | R | R | R | R | S | S | S | R | S |
| | TRANSFER TERMINATION | R | S | R | R | S | S | R | S | R | S | S | S | R | R | R | S | |
| | GUARDED AREA TRANSFER | R | R | R | S | S | R | S | S | S | R | S | R | S | R | R | S | |
| | MODIFIED DATA AREA TRANSFER | R | R | S | R | R | S | S | S | S | S | R | R | R | S | R | S | |
| ONLY AREA CONTAINING CURSOR | | | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | | | | ✓ | |
| MANY AREAS | | ✓ | | | | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | | ✓ | |
| TO CURSOR LOCATION | | | ✓ | | | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | | | | ✓ | |
| ENTIRE AREA/PAGE REGARDLESS OF CURSOR LOCATION | | ✓ | | ✓ | ✓ | | | ✓ | | ✓ | | | | ✓ | ✓ | ✓ | | |
| ONLY MODIFIED AND UNGUARDED AREA(S) | | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | |
| INCLUDING GUARDED AREAS | | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | | ✓ | | | ✓ | |

6.2.1 Block Mode Transmission Framing

The following example illustrates the use of all six message framing codes as they relate to a block data transmission.

| | | | |
|------------------------------------|---------------------|------------------------------------|-----------------------|
| NAME: | JONES | AGE: | 28 |
| Protected and Unguarded Area | Unprotected Area | Protected and Unguarded Area | Right Justify Area |

If the above data appeared on the 23rd line of the screen and transmission was initiated, the data stream to the host would be:



NOTE:

THE ABOVE ASSUMES THAT A COMBINATION OF TRANSMISSION MODES IS ENABLED THAT ALLOWS THE DATA TO BE TRANSMITTED.

If the above data is transmitted and *Line Transmit mode* is set, the data stream to the host is as shown except the First and Second End of Line codes are not included. These codes are never included in the data stream when Line Transmit mode is set.

6.2.2 Function Key Answerback and Status Transmissions

All Function Key, Answerback and Status transmissions will be framed regardless of whether Character mode or Block mode is selected.

In Block Mode these transmissions will be framed as follows:

SOM DATA FEOM SEOM

In Character mode these transmissions will be framed as follows:

SOM DATA TACC

6.2.3 Line Drawing and Foreign Character Sets

The Standard VISUAL 400 provides for eight foreign character sets and also a line drawing character set. When a portion of the screen displaying more than one character set is transmitted, the code sequences for enabling the character sets are appended to the beginning of each screen portion containing the character set to signify the character set being transmitted. By "framing" character sets in this manner the host may distinguish between different character sets in a transmitted data stream.

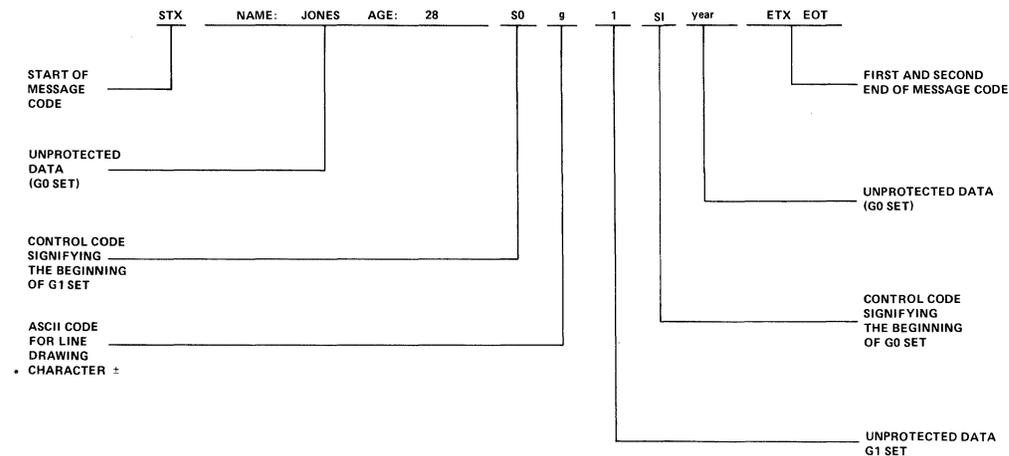
There are two cases to consider concerning framing of character sets.

Case 1. The transmitted data stream contains only characters from the presently defined G0 and G1 character sets.

In this case, only the SI and SO control codes will be used to frame the character sets since these are the codes used to enable the G0 and G1 character sets respectively. The following example illustrates the framing of G0 and G1 character sets in a transmitted data stream. The example assumes that the G0 character set is U.S., and the G1 set is line drawing. The example also assumes that the data is in the same area.

NAME: JONES AGE: 28 ± 1 year

If the above data is transmitted, the data stream to the host would be:



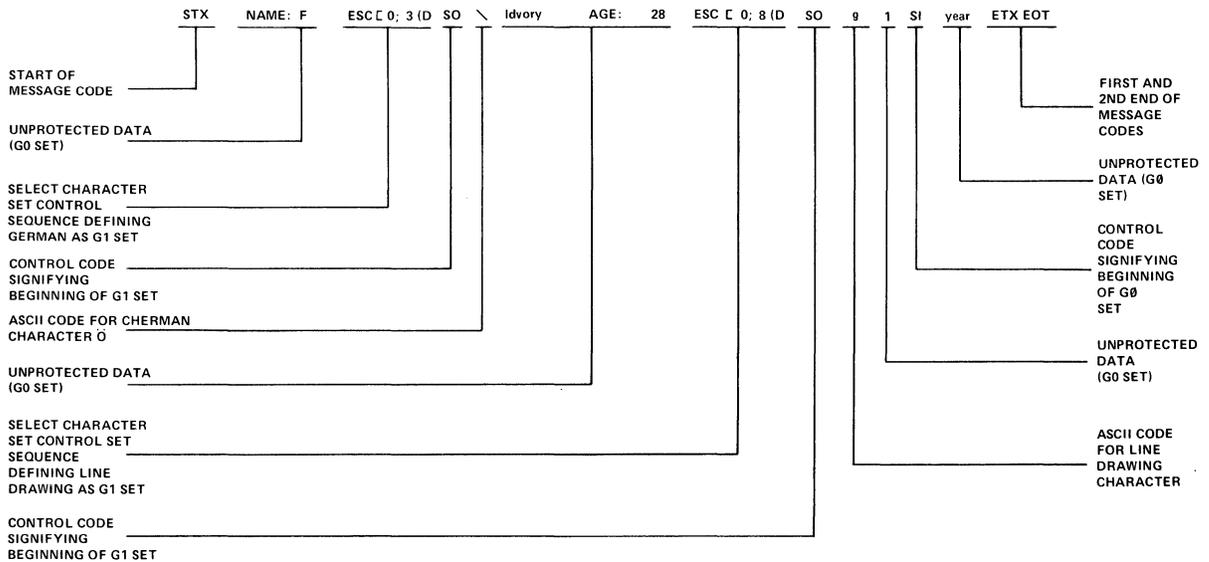
Case 2. The transmitted data stream contains characters from a character set not presently defined as the G0 or G1 character set.

In this case, the VISUAL 400 will frame characters from the G0 and G1 character sets with the SI and SO control codes as described in Case 1 until a character not from the G0 or G1 set is encountered. When such a character is encountered the character will be framed with the Select Character Set code sequence defining the newly encountered character set as the G1 set, then append the SO code to signify the beginning of the newly defined G1 set. This procedure is repeated for each character encountered that is not part of the presently selected G0 or G1 set. The terminal will maintain the newly defined G1 set until a new G1 set is needed or the end of the transmission when it will revert back to the G0 and G1 sets that were selected prior to the transmission.

The following example illustrates the framing of characters that are not part of the presently defined G0 or G1 set. The example assumes that the G0 set is U.S. and the G1 set is line drawing. The example also assumes that the data is in the same area.

NAME: Földvary AGE: 28 ± 1 year

If the above data appeared on the last line of the screen and is transmitted, the data stream to the host would be:



6.3 HALF/FULL-DUPLEX

The VISUAL 400 supports both half and full-duplex communication in either Character or Block mode. When operating in half-duplex the XON/XOFF protocol is disabled thus placing the burden of not overflowing the terminal's receive buffer on the host.

6.3.1 Half-Duplex

There is a problem unique to half-duplex operation, who is to be the transmitter and who is to be the receiver, i.e., when should the communications line be turned around. The terminal uses two methods to determine when the line should be turned around. The first is the use of a control code to signal the end of a transmission and the second is the use of the secondary channel of the modem if it is available and allowed by the user.

When the VISUAL 400 is in Character mode, the control code used to turn the line around is the turnaround control code (TACC). When the TACC is received from the host, the V400 will assume that it is the last character of the message and switch from the receive state (Request-To-Send low) to the transmit state (Request-To-Send high).

When the TACC is transmitted by the V400, it will switch from the transmit state to the receive state.

When the V400 is in Character mode and the use of the secondary channel is selected, the terminal will monitor the secondary channel for a "break". If a "breaking" signal is received, the V400 will switch to the receive state and monitor the carrier detect lead from the modem for incoming signal on the communications line. If no carrier is detected for a period of approximately 500 milliseconds after switching to the receive state, the V400 will switch back to the transmit state.

When the V400 is in Block mode, the TACC is not used since all transmissions are framed, i.e., they start with a Start of Message code and end with either of two End of Message codes. The End of Message code signals when the line is to be turned around. The secondary channel may be used the same as when the V400 is in Character mode.

6.3.2 Full-Duplex

When the VISUAL 400 is in full-duplex, the problem of line turnaround is not encountered. The terminal may send and receive data simultaneously, with the Request to Send Lead always high.

6.4 XON/XOFF PROTOCOL

The terminal can operate at transmission speeds up to 19,200 baud. However, the terminal may not be able to keep up with incoming data. The terminal stores incoming characters in a buffer called the FIFO, and processes them on a first-in/first-out basis. When the FIFO begins to fill up, the terminal will transmit an XOFF (DC 3) code. On this signal, the host is supposed to suspend its transmission to the V400. Eventually, if the host stops transmitting, the V400 will process all of the characters out of the FIFO. When the FIFO is nearly empty, the V400 will transmit and XON (DC 1) code to signal the host it may resume transmission.

If the host fails to respond to the XOFF from the V400, the FIFO will continue to fill up. When the capacity of the FIFO is exceeded, a condition occurs called "FIFO overflow".

If the FIFO overflows, the V400 will begin to discard incoming characters. The error character (checker board pattern) will be displayed on a FIFO overflow.

Two of the V400's functions, reset terminal and terminal self-test, re-initialize the terminal and erase the FIFO. This means that if characters received directly following commands to perform either of these two functions were placed in the FIFO, they would be destroyed before they were processed. For this reason, these two functions invoke an "implicit XOFF" rule: Immediately after sending the terminal commands to perform either of these functions, the host must act as if it had received XOFF from the terminal, sending no more characters until it receives XON. The V400 will transmit XON after it completes the specified operation.

The XOFF/XON synchronization scheme has an advantage over requiring the host to insert delays or filler characters in its data stream. Requiring a minimum of software support, XOFF/XON insures that every character or command sent to the V400 will be processed in correct order. It frees interface programs for all timing considerations, and results in more reliable operation.

Besides the FIFO filling condition, there are two other means of transmitting XOFF and XON, namely the NO SCROLL key, and Control S and Control Q. If the Transmitter XON/XOFF feature is enabled, the V400 will coordinate these three sources of XOFF and XON so that the desired effect occurs. For example, if the FIFO filling condition has caused an XOFF to be sent, and then the operator types the NO SCROLL key, a second XOFF is not sent. The V400 waits until the operator types the NO SCROLL key again before sending XON.

Also, entering SET-UP mode causes the V400 to temporarily stop taking characters from the FIFO. An XOFF will be sent if the FIFO becomes nearly full.

Use of the Control S and Control Q will also be synchronized with NO SCROLL key.

If the Transmitter XON/XOFF feature is disabled, the FIFO filling condition will not send an XOFF, the NO SCROLL key is disabled, and Control S and Control Q will be transmitted as typed if the V400 is in Character mode. There is no way to insure no loss of data.

The V400 also recognizes XOFF and XON. Receipt of XOFF will inhibit the V400 from transmitting any codes, if the Receiver XON/XOFF feature is enabled, except XOFF and XON. From three to seven keystrokes on the keyboard will store in a keyboard buffer (note that some keys generate a multiple code sequence). If the keyboard buffer overflows, keyclicks will stop and the "KEYBOARD LOCKED" LED will come on. Transmissions resume upon receipt of an XON code.

If the V400 is operating in Character mode on a full-duplex network with the host echoing back the data and the user transmits an XOFF to the host (by Control S or NO SCROLL), he should be aware that the host can no longer echo any further type-in until the user types an XON. This places the burden of not overloading the host's output buffer on the user.

Entering and exiting SET-UP mode clears the transmit and keyboard locked modes if the host has not set the "Keyboard-Action" mode. The "Keyboard Action" mode lock can only be cleared by the host.

The following is a summary of the various interactions of these occurrences assuming the Transmitter XON/XOFF feature is enabled.

Sending XOFF – the first occurrence of:

1. FIFO filling condition
2. Pressing the NO SCROLL key
3. Pressing Control S

Sending XON – if XOFF hasn't been sent, then control Q will send XON. – If XOFF has been sent, then the last occurrence of:

1. FIFO empty condition and
2. Either depressing NO SCROLL or Control Q

Inhibiting transmit (assuming Receiver XON/XOFF enabled) – Receiving XOFF. Locking Keyboard (in Character mode) – attempting to send too many keys after inhibiting transmit.

Allowing transmit and/or unlocking keyboard

1. Exiting SET-UP mode (assuming "Keyboard Action" mode not set) or
2. Receiving XON.

7. BUFFERED PRINTER INTERFACE OPTION

7.1 GENERAL

The buffered printer interface option allows the VISUAL 400 to be interfaced with a variety of serial printers via a 25-pin connector on the rear panel. Each connector pin is defined in Table 7-1.

The printer option incorporates the following key features:

- 128 Character FIFO Buffer.
- Independent Print/Communication Baud Rates.
- Independent Print/Communication Parity.
- 16 Print Baud Rate Selection.
- Printer Busy Monitored using XON/XOFF Protocol or Control Line.
- Printer Controller Mode.
- Auto Print Mode.
- Copy Mode.
- Print Line/Page from Keyboard or Remote.

**TABLE 7-1
PRINTER PORT PIN DESIGNATIONS**

| Pin Number | Signal Name | Definition |
|------------|-------------|---------------------------------|
| 1 | AA | Protective Ground |
| 2 | BA | Receive Data (From Printer). |
| 3 | BB | Transmit Data (To Printer). |
| 4 | | Printer Busy |
| 5 | CB | Clear to Send (always on). |
| 6 | CC | Data Set Ready (always on). |
| 7 | AB | Signal Ground |
| 8 | CF | Carrier Detect (always on). |

When the printer option is installed, SET-UP mode is divided into 4 parts; SET-UP A, SET-UP B, SET-UP C and SET-UP P.

SET-UP A, B and C are used for determining terminal features as described in Section 3.2. SET-UP P is used for determining buffered printer interface features.

SET-UP P may only be entered from SET-UP C and is entered per the following:

1. Enter SET-UP A by depressing the SET-UP key.
2. Enter SET-UP B by depressing the  key.
3. Enter SET-UP C by depressing the  key again.
4. Enter SET-UP P by depressing the  key again.

Subsequent depressions of the  key will cause the terminal to step through SET-UP A, B, C and P.

Once the terminal enters SET-UP P mode, the screen will display a presentation like the one shown in Figure 7-1.

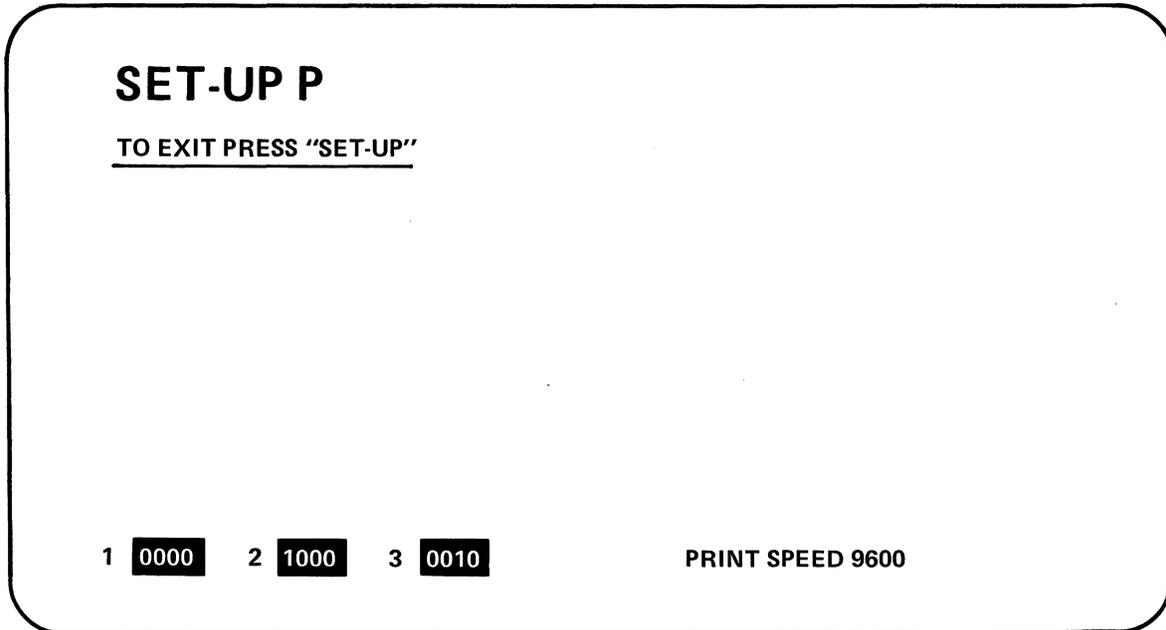


Figure 7-1. SET-UP P Presentation

This presentation shows which printer features are stored in non-volatile memory (per the summary in Figure 7-2) when the VISUAL 400 is shipped from the factory. These features may be recalled, changed and stored, just like any of the SET-UP A, B or C features thus allowing printer features to power up to any desired configuration. Refer to Sections 3.2.1.1 through 3.2.1.6.

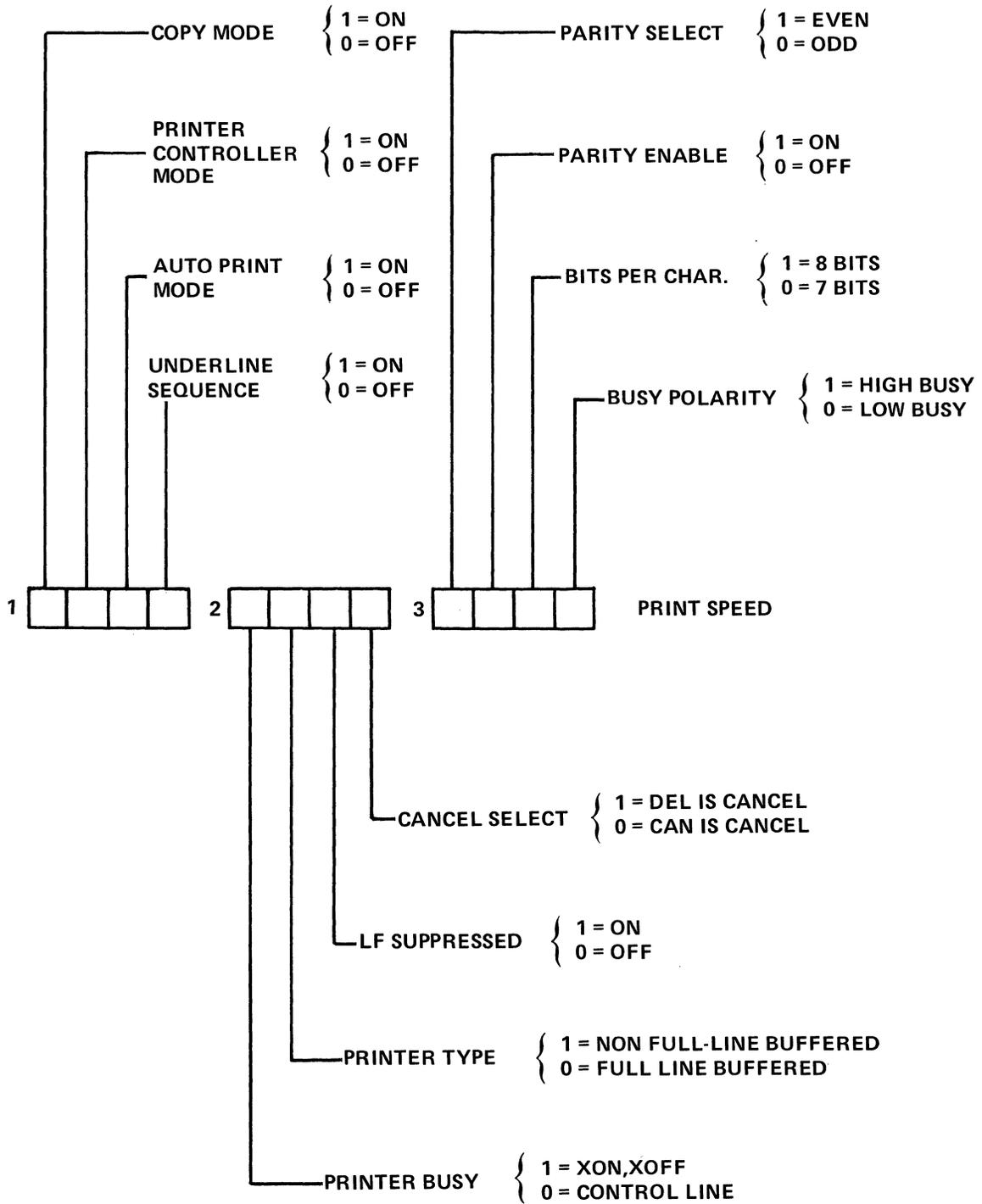


Figure 7-2. SET-UP P Summary

7.2 SET-UP P FEATURE DEFINITIONS

This section details each SET-UP P feature and their effects on the terminal and printer.

7.2.1 Copy Mode

The setting of this feature determines whether or not Copy mode is enabled. Copy mode is explained in Section 7.3.2.

NOTE

Resetting Copy mode will also reset Printer Controller mode.

7.2.2 Printer Controller Mode

The setting of this feature determines whether or not Printer Controller mode is enabled. Printer Controller mode is explained in Section 7.3.3.

NOTE

Setting Printer Controller mode will also set Copy mode. Resetting Printer Controller mode will also reset Copy mode.

7.2.3 Auto Print Mode

The setting of this feature determines whether or not Auto Print mode is enabled. Auto Print mode is explained in Section 7.3.4.

7.2.4 Underline Sequence

This feature is applicable to the Print Page command only. When enabled, this feature causes underlined data on the screen to also be underlined on the printer. This is accomplished by sending the data character followed by the backspace character (BS) followed by the underline character to the printer for every underlined character on the screen.

When this feature is disabled only the characters on the screen will be sent to the printer when the Print Page function is initiated.

7.2.5 Printer Busy

The setting of this feature depends on how the attached printer indicates a BUSY condition to the terminal.

If the printer uses a printer busy control line to indicate a BUSY condition, this feature should be set to "0", the control line state. If the printer uses XON/XOFF to indicate a BUSY condition, this feature should be set to "1", the XON/XOFF state.

NOTE

The Receiver XON/XOFF SET-UP feature must be enabled for the terminal to send XOFF/XON to the host when the printer is busy.

7.2.6 Printer Type

This feature applies to Printer Controller mode and Copy mode and determines whether or not the terminal will pass the code sequences for exiting these modes on to the attached printer.

When this feature is set to the OFF position, the ESC code sequences for exiting Printer Controller and Copy modes will be transmitted to the printer. The CANCEL SELECT feature will then append the CAN or DEL code to cancel the effect of the ESC code on the printer. This feature should be set to the OFF position for full-line buffered printers.

When this feature is set to the ON position, no codes in the sequences for exiting Printer Controller and Copy modes will be transmitted to the printer. Thus, the setting of the CANCEL SELECT feature is disregarded. This feature should be set to the ON position for FIFO buffered printers, or printers with no buffer at all.

7.2.7 LF Suppress

This feature determines whether or not LF codes received by the terminal are sent to the printer. In the ON state, no LF codes will be sent to the printer. In the OFF state, all LF codes will be sent to the printer.

The setting of this feature depends on how the attached printer reacts to received CR codes. Some printers perform a new line function (CR & LF) in response to the CR code. In this case, the LF Suppress feature should be enabled to prevent double line spacing on the printed data. Some printers perform only the carriage return function in response to the CR code. In this case, the LF Suppress feature should be disabled to allow LF codes to be sent to the printer.

7.2.8 Cancel Select

This feature applies to Printer Controller mode and Copy mode, (see Section 7.3.3) and determines whether the terminal will automatically append and transmit to the printer the CAN code or the DEL code immediately following the Control Sequence to exit Printer Controller mode, or exit Copy mode.

Select the CAN code if the printer interprets CAN as the "Cancel function", and select the DEL code if the printer interprets DEL as the cancel function. The cancel function causes the printer to erase its buffer.

7.2.9 Parity Select and Parity Enable

These two features determine if parity is enabled, and if it is, whether parity is odd or even.

Parity enable determines whether or not parity is enabled. Zero (0) corresponds to parity disabled and one (1) corresponds to parity enabled.

Parity select determines whether parity is odd or even. Zero (0) corresponds to odd parity and one (1) corresponds to even parity.

7.2.10 Bits Per Character

This feature determines whether 7 or 8 data bits will be used for each character. If 8 bit code is elected, the most significant bit (bit#8) is always set to space (0).

7.2.11 Busy Polarity

This feature determines whether the terminal interprets the Printer Busy signal as a true high level or a true low level.

The setting of this feature depends on the printer being used. Some printers "swing" their Printer Busy lead high when busy and some printers swing their Printer Busy lead low when busy. Check your printer documentation for the correct setting of this feature.

7.2.12 Print Speed

PRINT SPEED indicates the rate at which data will be transmitted to the attached printer.

The print speed is changed by depressing the  key when in SET-UP P mode. The printer option provides for the same 16 baud rates as the communication interface (50 – 19,200 baud).

7.3 PRINTER COMMANDS AND MODES

This section describes the commands and modes used to control an attached printer.

In all cases, space suppression is performed on a line basis, i.e., all trailing spaces on each printed line are not transmitted to the printer. Embedded spaces on a line are always transmitted.

NOTE

Space suppression is not applicable in Printer Controller or Copy mode.

7.3.1 Print Line/Page Commands

The Print Line/Page commands may be initiated via remote command from the host or by the operator from the keyboard. When the Print Line/Page function is initiated the terminal will use the XON/XOFF synchronization codes if the Receiver XON/XOFF feature is enabled. XOFF will be sent to the host upon initiation of a Print Line/Page function, and XON will be sent to the host on conclusion of the Print Line/Page function. Each line will be transmitted at the selected print rate and be ended with the CR/LF codes. (If LF suppress is enabled, only CR will be sent to the printer).

Table 7-2 summarizes the various ways to obtain hard copy via the Print Page/Line Commands.

7.3.2 Copy Mode

Copy mode allows a variable number of lines to be output to the printer.

When Copy mode is entered, all data received by the terminal will be sent to the screen and the printer simultaneously.

7.3.3 Printer Controller Mode

Printer Controller mode allows the host to pass all data through the terminal to the printer without affecting the terminal screen. In effect, the terminal acts as a controller for the printer by using the XON/XOFF synchronization codes to limit the transmitted data to a rate that the printer can accept. The Receiver XON/XOFF feature must be enabled for XON/OFF to be used.

7.3.4 Auto Print Mode

Auto Print mode allows a variable number of lines to be output to the printer.

When Auto Print mode is entered, a received LF code causes the line containing the cursor to be output to the printer. Each line transmitted to the printer will be ended with the CR/LF codes or the CR code as the LF suppress feature dictates. The XON/XOFF synchronization codes will be used in Auto Print Mode. See Table 7.2.

**TABLE 7-2
SUMMARY OF PRINT COMMANDS AND MODES**

| Function | From Keyboard | Remote | Action |
|------------------------|-----------------|-------------------|--|
| Print Page | PRINT Key | ESC [i | XOFF code sent to host to suspend transmission. Contents of screen transmitted to printer with CR/LF codes or only CR after each line. XON code sent to host to resume transmission once Print Page function complete. |
| Print Cursor Line | Echoed Sequence | ESC [? 1 i | XOFF code sent to host to suspend transmission. Contents of cursor line transmitted to printer with CR/LF codes or only CR after line. XON code sent to host to resume transmission once Print Line function complete. |
| Print Line "P" | Echoed Sequence | ESC [? 1 ; Pi | XOFF code sent to host to suspend transmission. Contents of line "P" transmitted to printer with CR/LF codes or only CR after line. XON code sent to host to resume transmission once Print Line function complete. Line P is in decimal notation between the limits of 1 and 24. |
| Print Lines "P" to "Q" | Echoed Sequence | ESC [? 1 ; P; Qi | XOFF Code sent to host to suspend transmission. Contents of lines "P" through "Q" transmitted to printer with CR/LF codes or only CR after each line. XON code sent to host to resume transmission once Print function complete. Line P and Q are both in decimal notation between the limits of 1 and 24. |

**TABLE 7-2
SUMMARY OF PRINT COMMANDS AND MODES (Cont.)**

| Function | From Keyboard | Remote | Action |
|-------------------------------|--|-------------|---|
| Enter Copy Mode | FUNCTION PRINT or change in SET-UP P | ESC [? 7 i | Received data displayed on screen and sent to printer simultaneously. XOFF code sent to host in response to printer busy. XON code sent to host in response to printer not busy. |
| Exit Copy Mode | FUNCTION PRINT or change in SET-UP P | ESC [? 6 i | Terminal exits Copy mode and automatically appends the CAN or DEL code as the CANCEL SELECT feature dictates. If the PRINTER TYPE feature is ON, no code will be appended. |
| Enter Printer Controller Mode | Echoed Sequence or change in SET-UP P | ESC [5 i | Data sent from host passed through terminal to printer. XOFF code sent to host in response to printer busy. XON code sent to host in response to printer not busy. |
| Exit Printer Controller Mode | Echoed Sequence or change in SET-UP P | ESC [4 i | Terminal exits printer Controller mode, and automatically appends the CAN or DEL code as the CANCEL SELECT feature dictates. If the PRINTER TYPE feature is ON, no code will be appended. |
| Enter Auto Print Mode | Echoed Sequence or change in SET-UP P | ESC [? 5 i | On receipt of LF code XOFF code sent to host. Contents of line transmitted to printer with CR/LF or only CR after-line. XON code sent to host after line is transmitted. |
| Exit Auto Print Mode | Echoed Sequence or change in SET-UP P. | ESC [? 4 i | Terminal exits Auto Print mode. |

8. PAGING OPTION

8.1 GENERAL

The standard VISUAL 400 has a display memory capacity equal to one page of data. The page of data may be arranged as 24 lines by 80 columns or 24 lines by 132 columns.

The Paging Option provides for added pages of display memory and is available in two different forms:

1. Three total pages of display memory (72 lines)
2. Five total pages of display memory (120 lines)

Regardless of whether the VISUAL 400 is configured as a three-page or five-page unit, the user may select either an 80 or 132 column display format.

8.2 MEMORY ORGANIZATION

The contents of display memory can be thought of as a large multi-line document, with the terminal's screen being a 24 line "window" to the document. The document may be moved up or down past the window to allow the user to view any 24 line segment of the document at any one time.

Figure 8-1 illustrates the memory organization of both three-page and five-page VISUAL 400 terminals. Upon power-up or reset, page number one (lines 1-24) will be visible to the operator.

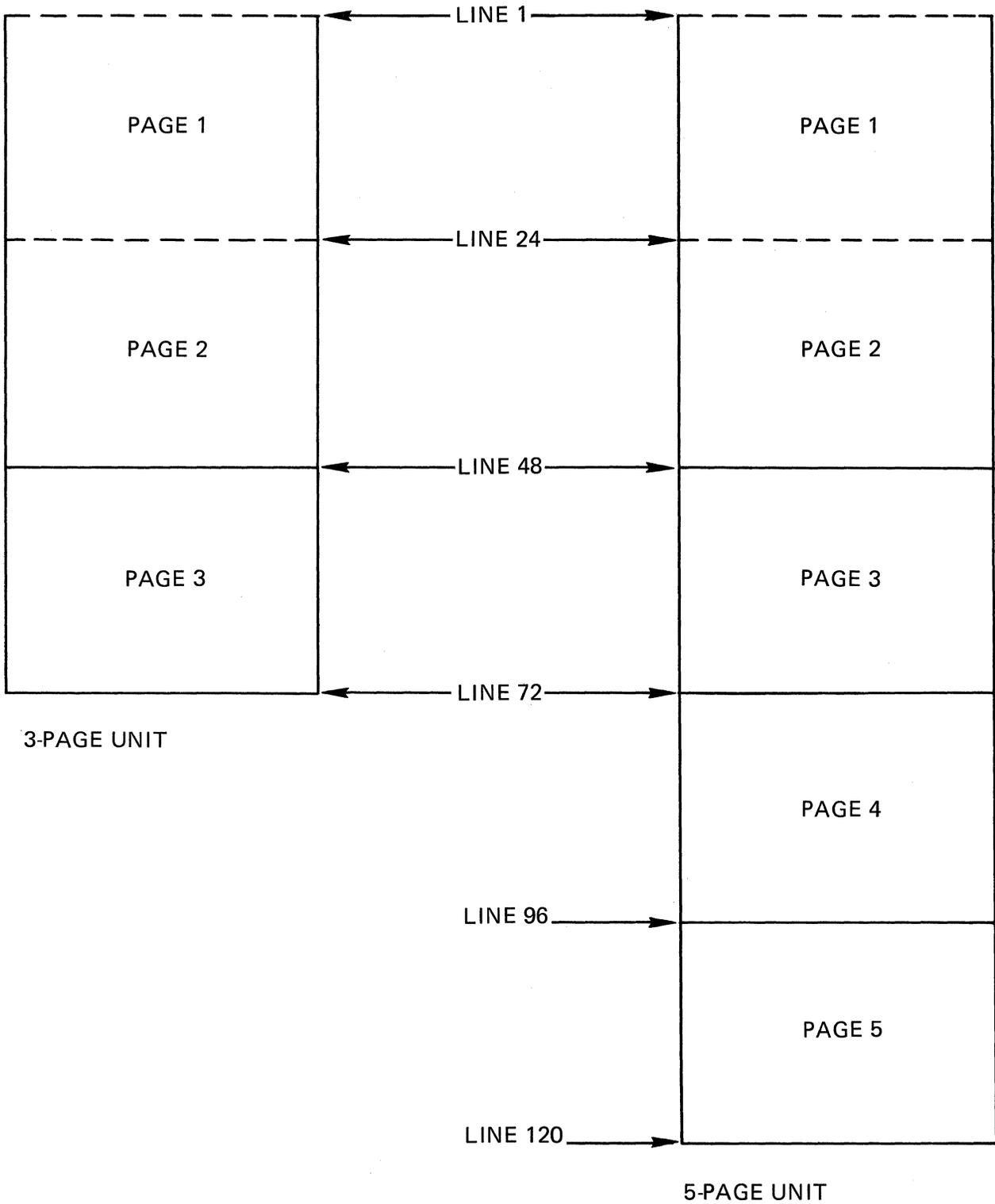
When operating in Block mode and the document is moved down to its lower-most line numbers (lines 1-24 currently visible), attempts to move the document down further will result in no action. Conversely, if the document is moved to its upper-most line numbers (lines 49-72 visible on three-page units and lines 97-120 visible on five-page units), attempts to move the document up further will result in no action.

When operating in Character mode, it is very important to note the distinction between Format Effectors and Editing Functions as they relate to movement of the document.

Format Effectors are commands that cause "destructive" movement of the document, i.e., any new lines that are scrolled into view of the operator will be *blank lines* even if data previously existed on these lines. Table 8-1 lists Format Effectors which cause destructive movement of the document if received in Character mode.

Editor Functions are commands that cause "non-destructive" movement of the document, i.e., any new lines that are scrolled into view of the operator will not be altered. Table 8-2 lists Editor Functions which may cause non-destructive movement of the document.

The following example contrasts non-destructive document movement caused by Editor Functions, and destructive document movement caused by Format Effectors. The example assumes the VISUAL 400 is in Character mode.



NOTE

The dotted lines indicate the currently displayed 24 lines.

Figure 8-1. Paging Memory Organization

**TABLE 8-1
FORMAT EFFECTORS WHICH CAUSE MOVEMENT OF THE DOCUMENT**

| Format Effector | Code | Octal Equivalent |
|---|-------|------------------|
| Line Feed | LF | 012 |
| Index | ESC D | 033 104 |
| Backspace | BS | 008 |
| Reverse Index | ESC M | 033 115 |
| Horizontal Tab* | HT | 010 |
| Form Feed | FF | 014 |
| Space** | SP | 040 |
| Entry of Any** Displayable Character | | |

*Autowrap mode must be set to cause destructive movement of the document.

**Autowrap mode must be set and the cursor must be on the last column of the line to cause destructive movement of the document.

**TABLE 8-2
EDITOR FUNCTIONS WHICH CAUSE MOVEMENT OF THE DOCUMENT**

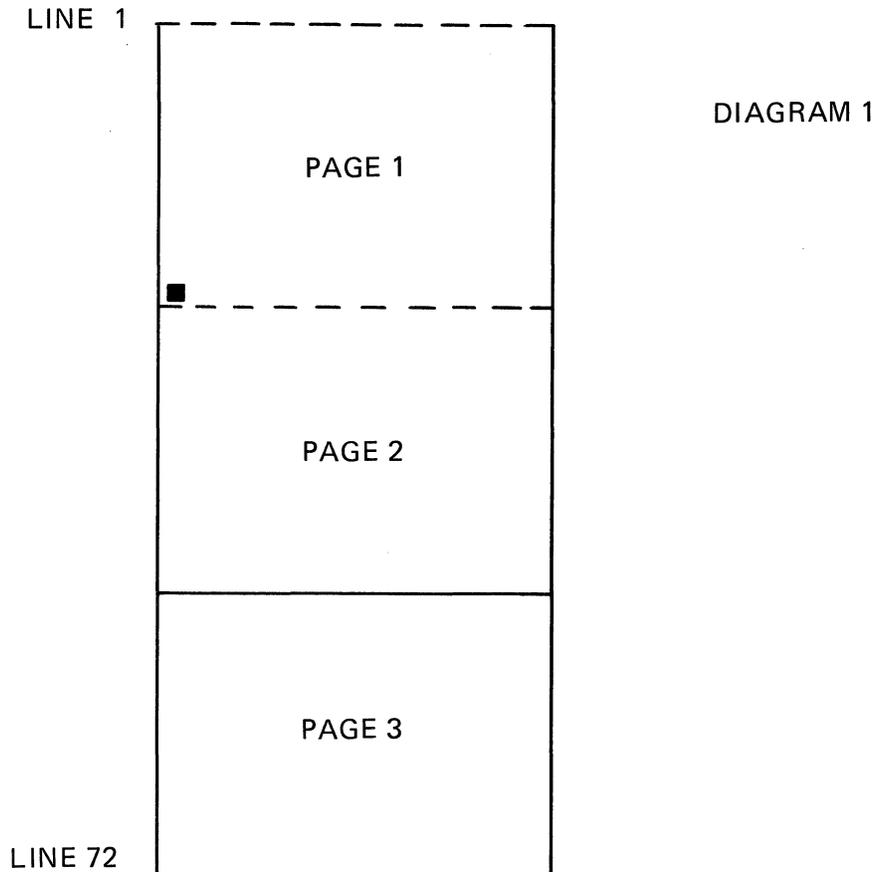
| Editor Function | Code | Octal |
|------------------------|------------|----------------|
| Next Line* | ESC [Pn E | 033 133 Pn 105 |
| Previous Line* | ESC [Pn F | 033 133 Pn 106 |
| Cursor Left* | ESC [Pn D | 033 133 Pn 104 |
| Cursor Right* | ESC [Pn C | 033 133 Pn 103 |
| Cursor Up* | ESC [Pn A | 033 133 Pn 101 |
| Cursor Down* | ESC [Pn B | 033 133 Pn 102 |
| Cursor Horizontal Tab* | ESC [Pn I | 033 133 Pn 111 |
| Cursor Back Tab* | ESC [Pn Z | 033 133 Pn 132 |
| Next Page** | ESC [Pn U | 033 133 Pn 125 |
| Previous Page** | ESC [Pn V | 033 133 Pn 126 |
| Scroll Down** | ESC [Pn T | 033 133 Pn 126 |
| Scroll Up** | ESC [Pn S | 033 133 Pn 123 |

*These Editor Functions will cause the document to move only if Edit Boundary mode is set, see Section 8.3.1.

**These Editor Functions will always cause the document to move. See Section 8.4.

Example 1

The document is positioned so that page one is currently visible to the operator (see Diagram 1) and the cursor is on the last line of page one (line 24).



If a Line Feed code (Format Effector) is now received by the terminal the result is:

1. The document moves up destructively one line.
2. Line number 25 becomes a blank line and is scrolled on to the last line of the screen.

The visible effect on the screen is that all lines will scroll-up one line and a new blank line will come into view on the last line of the screen.

In the aforementioned example, if a Cursor Down command (Editor Function) is received instead of the Line Feed Code, the result is:

1. The document moves up non-destructively one line.
2. Line number 25 is scrolled into view of the operator. No data on line 25 is altered.

8.3 ADDITIONAL MODES

There are two modes which concern the operation of VISUAL 400 multi-page units which do not appear in the standard VISUAL 400. These modes are:

8.3.1 Edit Boundary Mode, Ps = 19

Edit Boundary mode provides a choice for having certain Editor Functions affect the entire document or only the currently displayed 24 lines.

When reset, Edit Boundary mode allows certain Editor Functions to affect only the currently displayed 24 lines. When set, Edit Boundary mode allows certain Editor Functions to affect the entire document.

The Editor Functions that are affected by Edit Boundary mode are listed in Table 8-3.

Edit Boundary mode may be set or reset remotely via control sequence or from the keyboard in SET-UP mode. To set/reset Edit Boundary mode from the keyboard, the following procedure should be followed:

1. Depress the SET-UP key to enter SET-UP mode.
2. Depress the  key to enter SET-UP B mode. Position the cursor over bit 3 of group 7. Depress the  key to alternately set/reset Edit Boundary mode. A one (1) corresponds to Edit Boundary mode set and a zero (0) to Edit Boundary mode reset.

To set/reset Edit Boundary mode remotely, the following set/reset mode control sequences should be used:

| | |
|--------------------------|------------|
| Set Edit Boundary mode | ESC [19 h |
| Reset Edit Boundary mode | ESC [19 l |

8.3.2 Page Transfer Mode, Ps = 161

This is a VISUAL Technology Incorporated defined mode that applies to Block mode only. When Page Transfer mode is set, the terminal may transmit data from only the currently displayed 24 lines. When Page Transfer mode is reset, the terminal may transmit the entire display memory.

Page Transfer mode is used in conjunction with the other transmission modes to condition the transmittable portion of memory. (See Section 6.0.)

Page Transfer mode may be set or reset remotely via control sequence or from the keyboard in SET-UP mode. To set/reset Page Transfer mode from the keyboard, the following procedure should be followed:

TABLE 8-3
EDITOR FUNCTIONS AFFECTED BY EDIT BOUNDARY MODE

| Editor Function | Code Sequence | Octal Equivalent |
|---|----------------------|-------------------------|
| Insert Character | ESC [Pn @ | 033 133 Pn 100 |
| Delete Character | ESC [Pn P | 033 133 Pn 120 |
| Insert Line | ESC [Pn L | 033 133 Pn 114 |
| Delete Line | ESC [Pn M | 033 133 Pn 115 |
| Entry of Data with Insert Replace Mode Set | | |
| Erase in Area | ESC [Ps O | 033 133 Ps 117 |
| Erase in Display | ESC [Ps J | 033 133 Ps 112 |
| Erase in Field | ESC [Ps N | 033 133 Ps 116 |
| Erase Character | ESC [Pn,X | 033 133 Pn 130 |
| Cursor Back Tab | ESC [Pn Z | 033 133 Pn 132 |
| Cursor Horizontal Tab | ESC [Pn I | 033 133 Pn 111 |
| Cursor Left | ESC [Pn D | 033 133 Pn 104 |
| Cursor Right | ESC [Pn C | 033 133 Pn 103 |
| Cursor Up | ESC [Pn A | 033 133 Pn 101 |
| Cursor Down | ESC [Pn B | 033 133 Pn 102 |
| Cursor Next Line | ESC [Pn E | 033 133 Pn 105 |
| Cursor Previous Line | ESC [Pn F | 033 133 Pn 106 |

1. Depress the SET-UP key to enter SET-UP A mode.
2. Depress the

| |
|--------|
| % 5 |
|--------|

 key to enter SET-UP B mode. Position the cursor over bit 1 of group 9. Depress the

| |
|--------|
| ^ 6 |
|--------|

 key to alternately set/reset Page Transfer mode. A one (1) corresponds to Page Transfer mode set and a zero (0) to Page Transfer mode reset.

To set/reset Page Transfer mode remotely, the following set/reset mode control sequences should be used:

| | |
|--------------------------|-------------|
| Set Page Transfer mode | ESC [161 h |
| Reset Page Transfer Mode | ESC [161 l |

8.4 ADDITIONAL COMMANDS

There are five additional commands which concern the operation of VISUAL 400 multi-page terminals which do not appear in the standard VISUAL 400 terminal. The commands are:

8.4.1 Scroll-Up, ESC [Pn S

This command causes the document to move up Pn lines. Pn is specified in decimal notation. The visible effect on the screen is that data will move up from the bottom of the screen. If the top 24 lines of the document are currently displayed (lines 49-72 on three-page units and lines 97-120 on five-page units) all Scroll Up commands are ignored. The position of the cursor on the screen is not altered.

8.4.2 Scroll Down, ESC [Pn T

This command is the opposite of the Scroll Up command and causes the document to move down Pn lines. Pn is specified in decimal notation. The visible effect on the screen is that data will move down from the top of the screen. If the bottom 24 lines of the document are currently displayed (lines 1-24) all Scroll Down commands are ignored. The position of the cursor on the screen is not altered.

8.4.3 Next Page, ESC [Pn U

This command causes the document to move up (to higher numbered lines) to the beginning of the Pn'th page following the currently displayed window. Pn is specified in decimal notation. If the currently displayed window is not on a page boundary the document will be moved up to the Pn'th page following the page on which the bottom lines reside.

The Next Page command can never move the document beyond the top page.

8.4.4 Previous Page, ESC [Pn V

This command causes the document to move down (to lower numbered lines) to the beginning of the Pn'th page preceding the currently displayed window. Pn is specified in decimal notation. If the currently displayed window is not on a page boundary the document will be moved down to the Pn'th page preceding the page on which the top lines reside.

The Previous Page command can never move the document beyond to the bottom page.

8.4.5 Print All, ESC [? 9 i

This command is functional only if the Buffered Printer Interface Option is installed and causes the *entire* document to be transferred to an attached printer.

8.5 ADDITIONAL KEYBOARD CONTROLS

The user may perform the Scroll Up, Scroll Down, Next Page, Previous Page and Home commands from the keyboard by depressing the appropriate keys. Table 8-4 summarizes the additional keyboard controls on VISUAL 400 multi-page terminals.

8.6 MODIFIED COMMAND OPERATIONS

There are three commands which cause a different action on VISUAL 400 multi-page terminals as opposed to the standard VISUAL 400 terminal. These commands are:

8.6.1 Absolute Cursor Positioning Command ESC [y ; x H

This command is used for positioning the cursor anywhere within the *currently displayed* 24 lines as described in Section 5.3.2.

The above sequence will position the cursor to the line specified by "y" and the column specified by "x". Both line and column parameters are in decimal notation.

8.6.2 Horizontal and Vertical Position Command ESC [y ; x f

This command is used to position the cursor anywhere within the *entire display memory*. The above sequence will position the cursor to the line specified by "y" and the column specified by "x". Both line and column parameters are in decimal notation. This command may cause the cursor to move off the currently displayed 24 lines and thus disappear from view. It is recommended that the keyboard be locked while the cursor is off screen.

8.6.3 Form Feed (octal 014)

This control code will move the document to the beginning of the next page, erase the page, and home the cursor.

8.6.4 What is Cursor Location Relative to the Screen? ESC [6 n

This command will cause the terminal to respond as indicated in Section 5.3.9 of the VISUAL 400 Reference Manual provided the cursor is positioned within the currently displayed 24 lines. If the cursor is not positioned within the currently displayed 24 lines the response will be as follows:

**TABLE 8-4
ADDITIONAL KEYBOARD CONTROLS**

| Keys Depressed | Code Sequence Transmitted in Character Mode | Action Caused in Block Mode or in Character Mode if Sequence Echoed |
|---|---|--|
| FUNCTION with  | ESC [T | Scroll Down |
| FUNCTION with  | ESC [S | Scroll Up |
| FUNCTION with  | ESC [V | Previous Page |
| FUNCTION with  | ESC [U | Next Page |
| FUNCTION with  | ESC [99 V ESC [H | Cursor goes to Home Position of Page 1. Page 1 will also be displayed. |
| *SHIFT with  | None | Scroll Down |
| *SHIFT with  | None | Scroll Up |
| *SHIFT with  | None | Previous Page |
| *SHIFT with  | None | Next Page |
| *SHIFT with  | None | Cursor goes to Home Position of Page 1. Page 1 will also be displayed. |

*These keyboard controls are *local only* and are provided mainly for the user who is operating in Character mode. These controls allow the user to move the document up and down locally without transmitting any codes.

| Cursor Position | Terminal Response |
|--|-------------------|
| Cursor is positioned on a <i>lower</i> line number than the currently displayed 24 lines. | ESC [< y ; x R |
| Cursor is positioned on a <i>higher</i> line number than the currently displayed 24 lines. | ESC [> y ; x R |

In both responses, y is the current line number of the cursor (y = 1-72 on three-page units and y = 1-120 on five page units) and x is the column position. Both y and x are in decimal notation.

8.6.5 What is Cursor Location Relative to the Entire Memory? ESC [? n

This command will cause the terminal to respond with the absolute position of the cursor. The response from the terminal will be:

ESC [y ; x R

y is the current line number of the cursor (y = 1-72 on three-page units and 1-120 on five-page units) and x is the column position. Both y and x are in decimal notation.

8.7 RECEIVING DATA

When a multi-page VISUAL 400 terminal is receiving data, it is suggested that the Horizontal and Vertical Position command be used to address the cursor if data is to be written into a memory area not currently displayed. By using this command, the cursor will disappear from the operators view and no screen scrolling will occur thus significantly increasing throughput.

It is also suggested that prior to sending any data to the terminal the keyboard be locked (see 3.2.3.41, 3.2.3.44, 5.4.2 of the VISUAL 400 Reference Manual) so the operator does not interfere with the incoming data. After the data is received the keyboard can be unlocked.

8.8 OPERATION RESTRICTIONS

There is one notable restriction concerning the Scrolling Region command (see Section 5.3.1 of VISUAL 400 Reference Manual) on VISUAL 400 multi-page terminals. The restriction is that page number one (lines 1-24) should be currently displayed whenever the Scrolling Region command is issued. If page number one is not currently displayed and the Scrolling Region command is issued, loss of data may occur.

9. FIRST LEVEL MAINTENANCE

9.1 GENERAL

The VISUAL 400 terminal has been designed with subassembly exchange as the prime mode of service. Fault isolation is provided in this section to identify the failing subassembly. Unless otherwise noted the power cord should be disconnected before disassembly of the terminal. Hazardous voltages may be present.

9.2 REAR PANEL

The removal of the rear panel will allow the removal of the logic printed circuit board, removal of the TV monitor printed circuit board, and access to the AC terminal block allowing rewiring from 110 volts to 220 volts.

9.2.1 Rear Panel Removal

Consult Figure 9-1 to locate the four screws which attach the rear panel to the top cover.

9.2.2 Rear Panel Installation

As indicated in Figure 9-1 loosely install the two painted flat head screws on the top of the rear panel first. Rotate the bottom of the panel into position and install and tighten the lower two black screws. Tighten the two top screws.

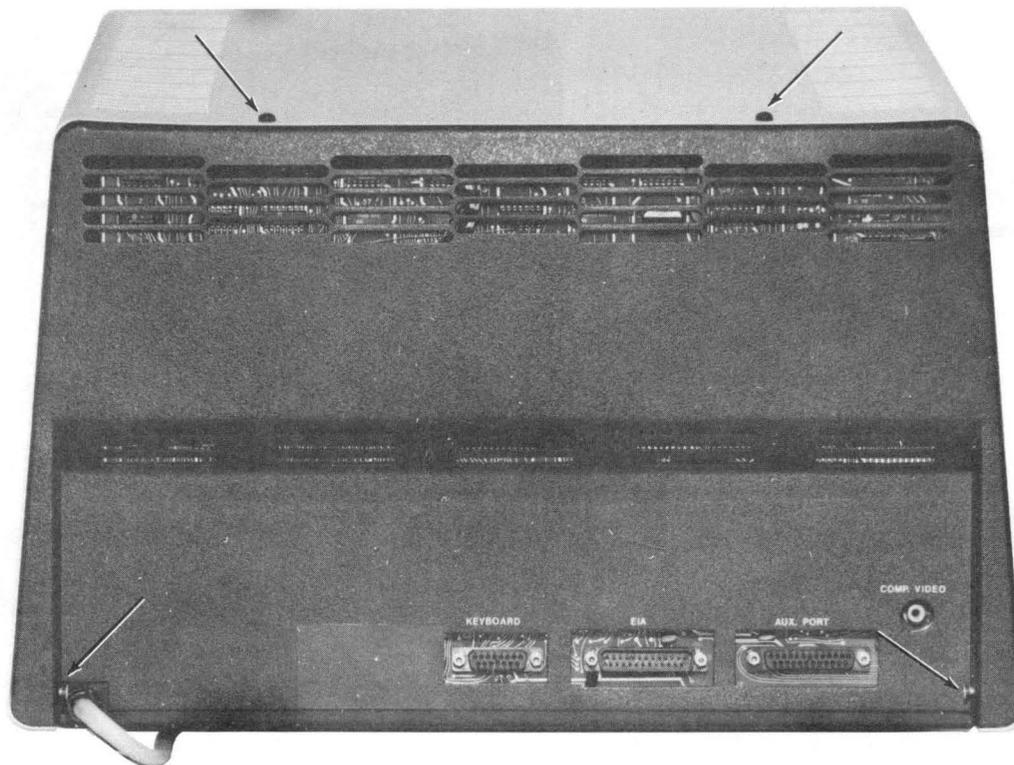


Figure 9-1. Rear Panel Screw Locations

9.3 TOP COVER

The top cover assembly consists of the top sheet metal cover and the front plastic bezel.

9.3.1 Top Cover Removal

First the rear panel must be removed per 9.2.1. Remove two screws from each side located at the bottom of the cover. Rotate the cover up from the rear while sliding the cover to the front as illustrated in Figure 9-2.

9.3.2 Top Cover Installation

The top cover is installed by sliding the cover to the rear of the terminal and lowering the cover as the bezel comes into contact with the face of the CRT. Insure that the lower edges of the cover on both sides are placed inside the base plate sides. Install two screws on each side and tighten.

9.4 PRINTED CIRCUIT BOARD REMOVAL AND INSTALLATION

Once the rear panel has been removed the printed circuit board is easily removed by unplugging two connectors and the removal of four cross head screws located near each of the PCB corners. The PCB is then rotated out at the top and lifted over the lower base edge. Installation is simply the reverse of the above steps.

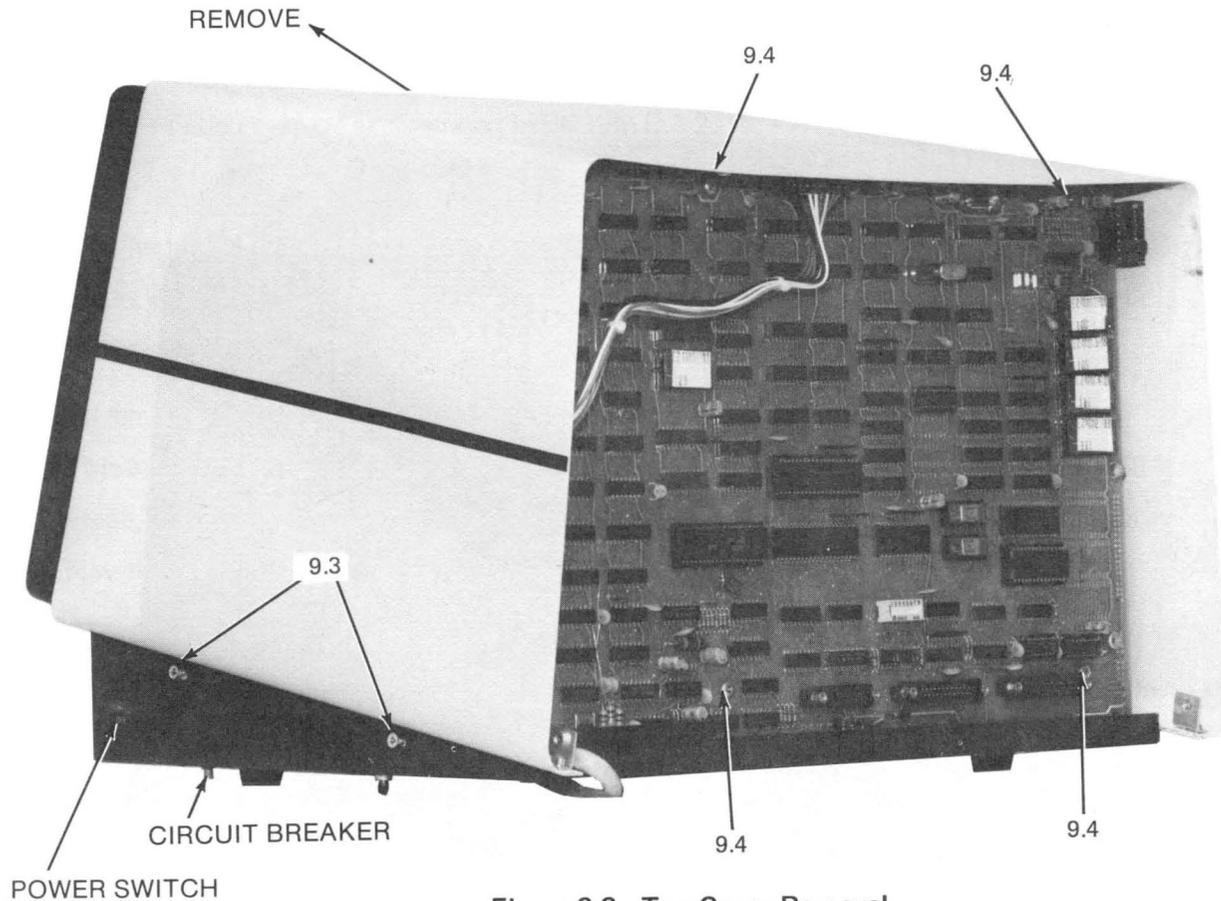


Figure 9-2. Top Cover Removal

9.5 TV MONITOR PCB REMOVAL AND INSTALLATION

In order for the TV monitor PCB to be removed it is necessary to remove the rear panel and top cover, or remove the rear panel and the logic PCB. Disconnect the cable connecting the logic PCB and the TV PCB at the TV end. Disconnect the yellow and black connector and the blue and red connector connecting the TV PCB to the yoke from the TV PCB, and the flyback transformer cable from the TV PCB. Unplug the connector assembly from the end of the picture tube. Squeeze and disconnect the black wire at the top corner of the picture tube. Slightly tip the unit and squeeze and press four plastic standoffs extending through the base plate. Lower the unit onto its feet and remove the TV PCB. Remove the four plastic standoffs from the PCB by squeezing the locking tab and remove. Reinstall these four standoffs into the base plate.

Installing the TV PCB is accomplished by pressing the PCB into place on the four plastic standoffs, pressing the board until the locking tabs snap into place. Plug the CRT socket onto the CRT. Plug the flyback connector onto the board. Plug the yellow and black yoke connector onto the board adjacent to the two wire wound coils. Plug in the blue and red yoke connector into the other socket, and plug in the PCB edge connector. Connect the black wire from the CRT socket assembly onto the ground finger tab at the top front corner of the CRT. CAUTION: When installing the yoke and flyback connectors observe orientation. Each of these connectors can be installed backwards. When they are installed backwards considerably more force is required.

9.6 CRT AND FLYBACK REMOVAL AND INSTALLATION

Before removing the picture tube it is necessary to discharge the tube. With an insulated handled screwdriver short out the high voltage lead to the tube. Carefully lift the top edge of the high voltage connector and insert the end of the screwdriver. Cause the screwdriver shaft to touch the sheet metal bracket and the contact of the high voltage connector simultaneously. The high voltage connector can now be removed by rocking it while pulling it up. Disconnect the yoke, ground wire, and the tube socket assembly as described in section 9.5. While holding the lower front edge of the picture tube in one hand, remove the four mounting screws, and remove the picture tube. The picture tube neck should not be subjected to any pressure or shock. Store the picture tube on its face. The flyback transformer can now be removed by unplugging it from the TV PCB and removing two mounting screws. When installing the picture tube install the lower two screws first. Insert the ground finger between the mounting bracket and the top picture tube mounting tab. Install the top two screws and connect the cables. Be sure that the black ground wire is installed!

9.7 TV MONITOR ADJUSTMENTS

Refer to Figure 9-3 for the location of the adjustments.

Enter SET-UP B and set light background screen (see Sec. 3-2).

Set full intensity by pressing and holding the ↑ key until the intensity no longer increases.

Brightness Control: Adjust it so that the raster lines are visible.

Horizontal Phasing Control: Adjust the phasing control so that the video area is centered horizontally within the raster area.

Brightness Control: Reduce the brightness until the raster just disappears.

Reduce the screen intensity using the ↓ key to a comfortable level.

Focus: Adjust the focus control for the best focus over the entire screen.

Set the terminal to local mode using the 4 key.

Exit SET-UP mode by depressing the SET-UP key.

Fill the screen with E's by typing this sequence: ESC [8 v

Vertical Size: Adjust so that the total height is 6.00 ± 0.25 inches (152.4 ± 6.4 mm).

Horizontal Size: Adjust so that the total width of the screen of data is 8.25 ± 0.25 inches (209.5 ± 6.4 mm).

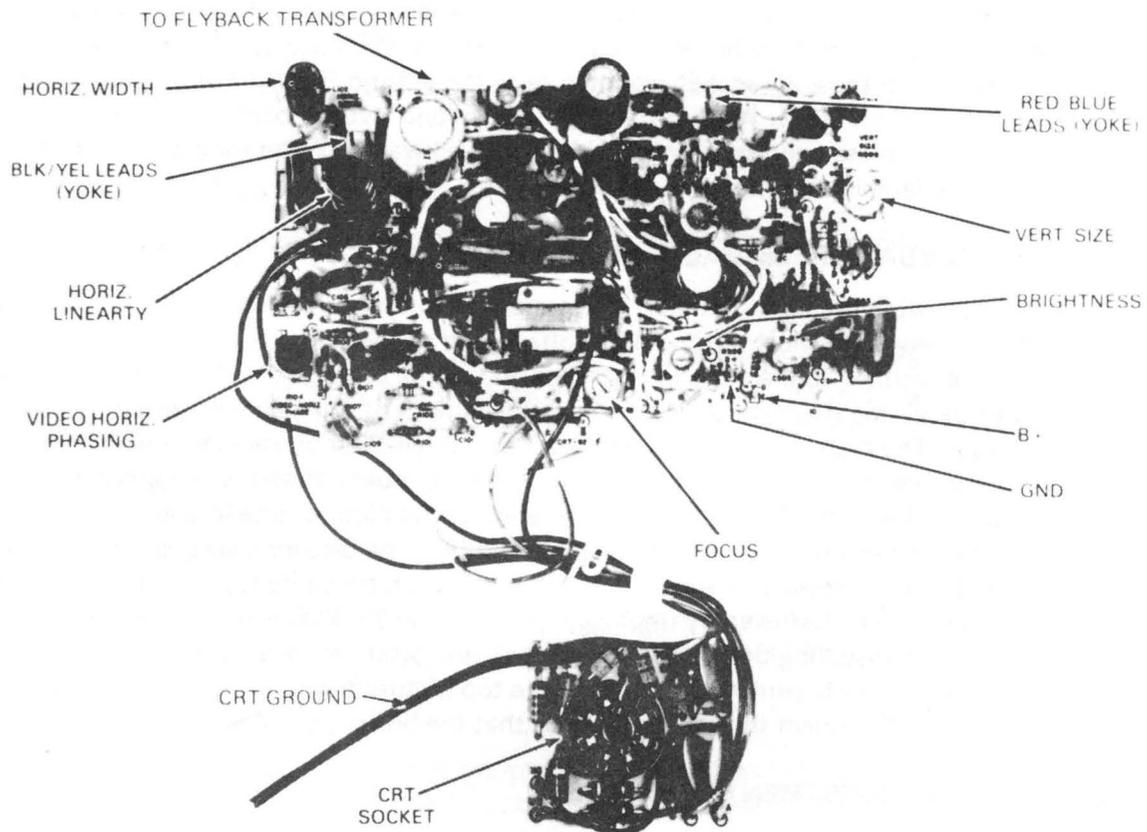


Figure 9-3. Location of TV Monitor Adjustments

9.8 110/220 VOLT SELECTION

Remove the rear panel and logic PCB. **MAKE SURE THE LINE CORD IS DISCONNECTED!** Refer to Figure 9-4 for new connection. 220 volt units are provided with two inputs, 220 volts nominal, and 250 volts nominal. The highest input resulting in satisfactory operation should be used.

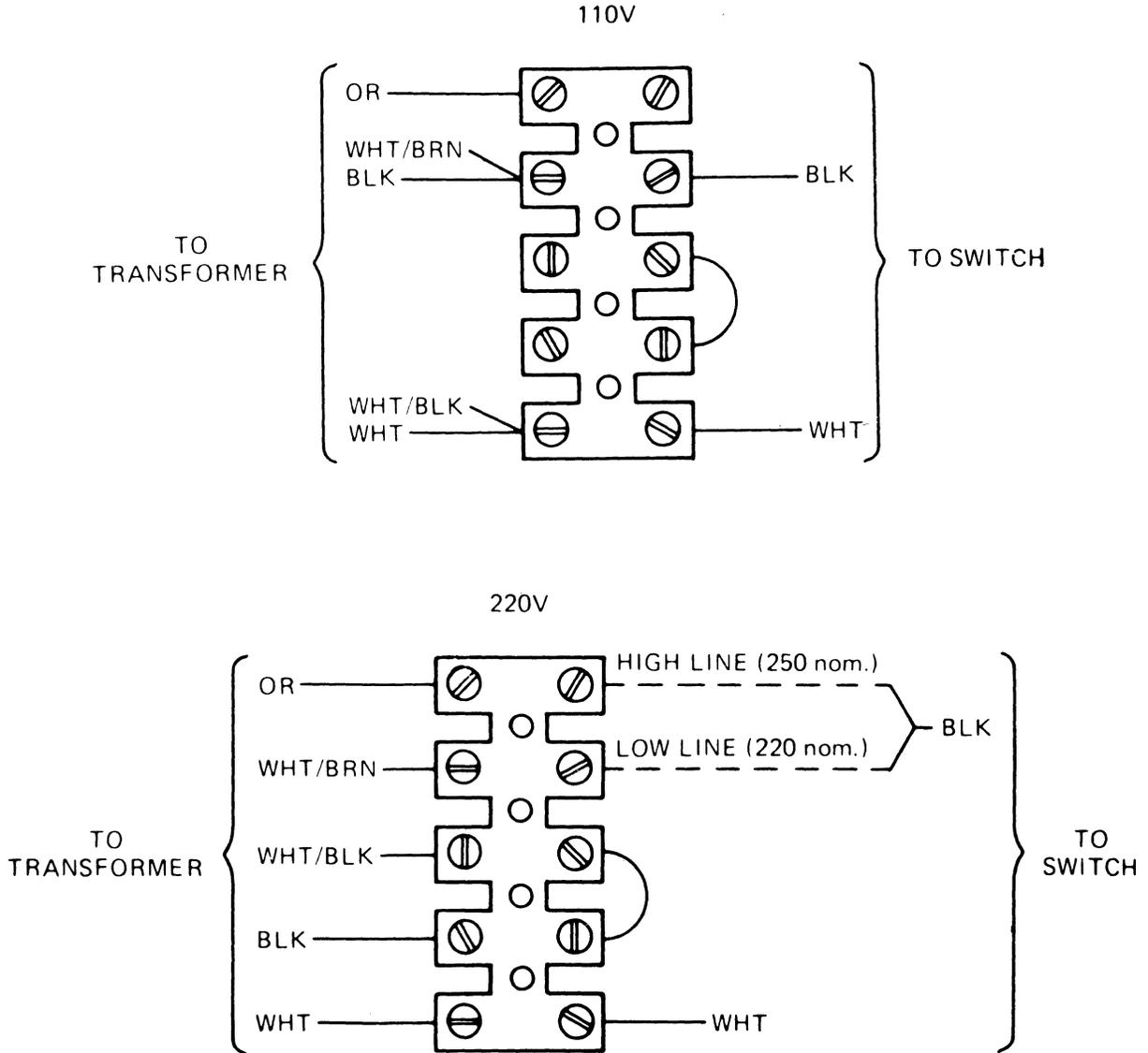


Figure 9-4. 110/220 Volt Selection

9.9 TROUBLESHOOTING

9.9.1 Self Test

The Visual 400 contains a self test feature which is activated each time the terminal is turned on. When the terminal is turned on, the Local LED is illuminated, the RAM, the non-volatile RAM and the PROMs are checked. Upon successful completion, the bell is sounded once, the screen is initialized (cursor displayed), and either the Local or Line LED is illuminated depending upon which state was previously stored in the non-volatile memory.

9.9.2 Fault Isolation

| Operation | Fault | Probable Cause | Remedy |
|----------------------|---|---|--|
| Turn On | No line or Local LED | Keyboard not plugged in Line cord not plugged in Circuit Breaker tripped Defective Logic PCB | Plug in Plug in Reset Replace |
| Turn On | LED's other than Line or Local On or bell rings 5 times | Self test failure | Seat PROMs Replace Logic PCB |
| Self test complete | No Cursor | Brightness set too low TV cable disconnected | Adjust (SET-UP A, ↑ Key) Plug in |
| No cursor | No Cursor | Flyback disconnected | Plug in |
| Bell sounds in local | | CRT connector disconnected Defective TV PCB Defective Logic PCB | Plug in Replace Replace |
| No height | Horizontal line on TV | Yoke disconnected | Plug in yellow-black connector |
| No width | Vertical line on TV | Yoke disconnected | Plug in blue-red connector |
| Video tilted | Yoke adjustment | Yoke rotated from normal position | Adjust |
| Video size too small | TV monitor | Yoke moved too far back Vert. size adjustment Horiz. size adjustment | Adjust Adjust Adjust |
| Video jittering | Wrong Frequency | 50/60 Hz. parameter incorrect | Set (SET-UP B) |
| Keyboard | No entry | Terminal On Line Defective keyboard Defective Logic PCB | Switch to Local Replace Replace |
| No data | Line or Local | Keyboard disconnected Defective keyboard Defective Logic PCB | Plug in Replace Replace |

| Operation | Fault | Probable Cause | Remedy |
|---------------------|--------------------------------------|--|--|
| On Line | Parity errors | Wrong Data Rate Wrong Parity Wrong bits/char. Defective PCB Receive Buffer Overflow | Set (SET-UP B) Set (SET-UP B) Set (SET-UP B) Replace Enable Transmitter XON/XOFF (SET-UP B) |
| On Line or Local | Wrong Characters | Wrong keyboard Layout or foreign character set enabled Defective keyboard Defective Logic PCB | See sections 3.2.2.40 and and 5.3.11 Replace Replace |
| On Line | EIA OK Current. Loop doesn't work | Internal switches not set. | Set (see Table 2-2) |
| On Line | Control Function not Recognized | Defective PCB | Replace |
| On Line or Local | Snapping sound | CRT ground wire not connected (Black wire) | Connect |

APPENDIX I VISUAL 400 CONTROL SEQUENCES

| Function | Sequence | Function | Sequence |
|--------------------------------------|--------------------------------------|---|--|
| <u>CURSOR MOVEMENTS COMMANDS</u> | | Erase in Field | ESC [Ps N Ps = 0 (default) Erase All Ps = 1 Erase from Start to Cursor Ps = 2 Erase from Cursor to End |
| Cursor Up | ESC [Pn A | Erase Character | ESC [Pn X |
| Cursor Down | ESC [Pn B | <u>TABBING COMMANDS</u> | |
| Cursor Right | ESC [Pn C | Cursor Tab Control | ESC [Ps W Ps = 0 (default) Set Tab at Cursor Ps = 2 Clear Tab at Cursor Ps = 4 Clear Tabs in Line in Block Mode, Clear Tabs in Display in Character Mode Ps = 5 Clear All Tabs in Display in Block Mode |
| Cursor Left | ESC [Pn D | Tab Clear | ESC [Ps g Ps = 0 (default) Clear Tab at Cursor Ps = 2 Clear Tabs in Line in Block Mode, Clear Tabs in Display in Character Mode Ps = 3 Clear Tabs in Display in Block Block Mode |
| Cursor Next Line | ESC [Pn E | Set Tab | ESC H |
| Cursor Previous Line | ESC [Pn F | Cursor Horizontal Tab(s) | ESC [Pn I |
| Cursor Addressing | ESC [y ; x H or ESC [y ; x f | Cursor Back Tabs(s) | ESC [Pn Z |
| Cursor Horizontal Absolute | ESC [Pn G | <u>CHARACTER SIZE AND SCREEN ALIGNMENT COMMANDS</u> | |
| Cursor Horizontal Relative | ESC [Pn a | Ps = 0 or 5 (default) Single Height-Single Width Line | |
| Cursor Vertical Absolute | ESC [Pn d | | |
| Cursor Vertical Relative | ESC [Pn e | | |
| Index | ESC D | | |
| Reverse Index | ESC M | | |
| <u>SCROLLING REGION COMMAND</u> | | | |
| | ESC [y ; x r | | |
| <u>ERASE COMMANDS</u> | | | |
| Erase in Page | ESC [Ps J | | |
| Erase in Line | ESC [Ps K | | |
| Erase in Area | ESC [Ps O | | |

**APPENDIX I (Cont.)
VISUAL 400 CONTROL SEQUENCES**

| Function | Sequence | Function | Sequence |
|---|------------------------|---|------------------------|
| P _s = 6 Single Height-Double-Width Line | | What is Cursor Location? | ESC [6 n |
| P _s = 3 Double Height -Double Width Line Top Half | | Cursor on Line y, Column x | ESC [y; x R |
| P _s = 4 Double Height-Double Width Line, Bottom Half | | What are Terminal Parameters? | ESC [1x or ESC [0 x |
| P _s = 8 Align Display | | Parameters are | (See Table 5-3) |
| <u>PROGRAM FUNCTION KEY COMMAND</u> | ESC [PK; D1; . . D7 p | <u>TEST COMMANDS</u> | ESC [P _s y |
| <u>PROGRAM LED COMMAND</u> | ESC [P _s q | P _s = 0, Reset Terminal | |
| P _s = 0 (default) Turn Off | | P _s = 1 Power-Up Checksum | |
| P _s = 1 Turn On | | P _s = 2* Interface | |
| | | P _s = 4* EIA | |
| | | P _s = 8 Repeat Tests | |
| <u>SAVE/RESTORE CURSOR COMMANDS</u> | ESC [P _s s | (Use Combined Weight of P _s Values to Determine Test(s)) | |
| P _s = 7 Save Cursor, Character Set, and Attributes | | *Turn Around Required, see Appendix IV. | |
| P _s = 8 Restore Cursor, Character Set and Attributes | | <u>CHARACTER SET COMMAND</u> | ESC [P0;P1 (D |
| <u>REPORT COMMANDS AND RESPONSES</u> | | P0/P1 Values | |
| What are you? | ESC [0 c | 0 (default) U.S. | |
| V400 or V400 with Printer Option | ESC [0 c | 1 U.K. | |
| Is Terminal OK? | ESC [2 c | 2 French | |
| Terminal OK | ESC [5 n | 3 German | |
| | ESC [0 n | 4 Swedish/Finnish | |
| | | 5 Norwegian/Danish | |
| | | 6 Spanish | |
| | | 7 Portuguese | |
| | | 8 Line Drawing | |

**APPENDIX I (Cont.)
VISUAL 400 CONTROL SEQUENCES**

| Function | Sequence | Function | Sequence |
|---|---|--|--------------------|
| <u>EDITING COMMANDS</u> | | <u>CLEAR ATTRIBUTE CODE COMMAND</u> | |
| Insert Line | ESC [Pn L | ESC [Ps u | |
| Delete Line | ESC [Pn M | Ps = 0 (default) Clear AAC at Cursor | |
| Insert Character | ESC [Pn @ | Ps = 1 Clear AAC's in Line | |
| Delete Character | ESC [Pn P | Ps = 2 Clear AAC's in Display | |
| | | Ps = 3 Clear Modified Flags | |
| | | Ps = 4 Clear All Unguard Flags | |
| | | Ps = 5 Clear All Modified and Unguard Flags | |
| <u>SET COMMUNICATION CONTROL CODES COMMANDS</u> | ESC [SOM; AS; FEOL; SEOL; FEOM; SEOM; TACC t | | |
| <u>VIDEO ATTRIBUTE COMMAND</u> | ESC [Ps; . . Ps m | <u>MODES</u> | |
| Ps = 0 (default) Attributes OFF | | Set Mode | ESC [Ps; . . Ps h |
| Ps = 1 High Intensity | | Reset Mode | ESC [Ps; . . Ps l |
| Ps = 4 Underline | | Ps = 1 Guarded Area Transfer | |
| Ps = 5 Blink | | Ps = 2 Keyboard Action | |
| Ps = 7 Reverse | | Ps = 3 Control Representation | |
| | | Ps = 4 Insert-Replace | |
| <u>REMOTE XMIT COMMAND</u> | ESC S EOM | Ps = 6 Erase | |
| <u>RESET COMMAND</u> | ESC c | Ps = 7 Verticle Editing | |
| <u>DEFINE AREA QUALIFICATION COMMAND</u> | ESC [Ps o | Ps = 10 Horizontal Editing | |
| Ps = 0 (default) Accept All | | Ps = 12 Character/Block | |
| Ps = 1 Protect and Guard | | Ps = 15 Multiple Area Transfer | |
| Ps = 3 Numeric Only | | Ps = 16 Transfer Termination | |
| Ps = 4 Alpha Only | | Ps = 20 Linefeed Newline | |
| Ps = 5 Right Justify | | Ps = ? 0 Protect | |
| Ps = 7 Set Tab | | Ps = ? 1 Auto Tab | |
| Ps = 8 Protect and Unguard | | Ps = ? 2 Modified Data Area | |
| Ps = 10 Must Fill | | Ps = ? 3 Column | |
| Ps = 20 Total Fill | | Ps = ? 4 Scrolling | |
| Ps = 30 Select for Xmit | | Ps = ? 5 Screen | |
| | | Ps = 160 Line Transmit | |

| Function | Sequence |
|--|------------------------|
| PAGING COMMANDS AND MODES | |
| Next Page | ESC [P _n U |
| Previous Page | ESC [P _n V |
| Scroll Down | ESC [P _n T |
| Scroll Up | ESC [P _n S |
| Set Edit Boundary Mode | ESC [19 h |
| Reset Edit Boundary Mode | ESC [19 ℓ |
| Set Page Transfer Mode | ESC [161 h |
| Reset Page Transfer Mode | ESC [161 ℓ |
| Print All ** | ESC ? 9 i |
| What is Cursor Location Relative to Entire Memory | ESC [? n |

Note: The full shaded sequences are applicable only when the buffered printer interface option is installed. The half shaded sequences are applicable only when the paging option is installed.

*P and Q are in decimal notation within the limits on 1 to 24.

** Requires paging and printer options.



APPENDIX II

GRAPHIC RENDITION OF CONTROL CODES

| Control Code | Graphic Rendition | Control Code | Graphic Rendition |
|--------------|-------------------|--------------|-------------------|
| SOH | S _H | DLE | D _E |
| STX | S _X | *DC1/XON | D ₁ |
| ETX | E _X | DC2 | D ₂ |
| EOT | E _T | *DC3/XOFF | D ₃ |
| ENQ | E _Q | DC4 | D ₄ |
| ACK | A _K | NAK | N _K |
| BEL | B _L | SYN | S _N |
| BS | B _S | ETB | E _B |
| HT | H _T | CAN | C _N |
| LF | L _F | EM | E _M |
| VT | V _T | SUB | S _B |
| FF | F _F | ESC | E _C |
| CR | C _R | FS | F _S |
| SO | S _O | GS | G _S |
| SI | S _I | RS | R _S |

*The XON(DC1) and XOFF(DC3) characters will not be displayed unless the Receiver XON/XOFF SET-UP feature has been disabled.

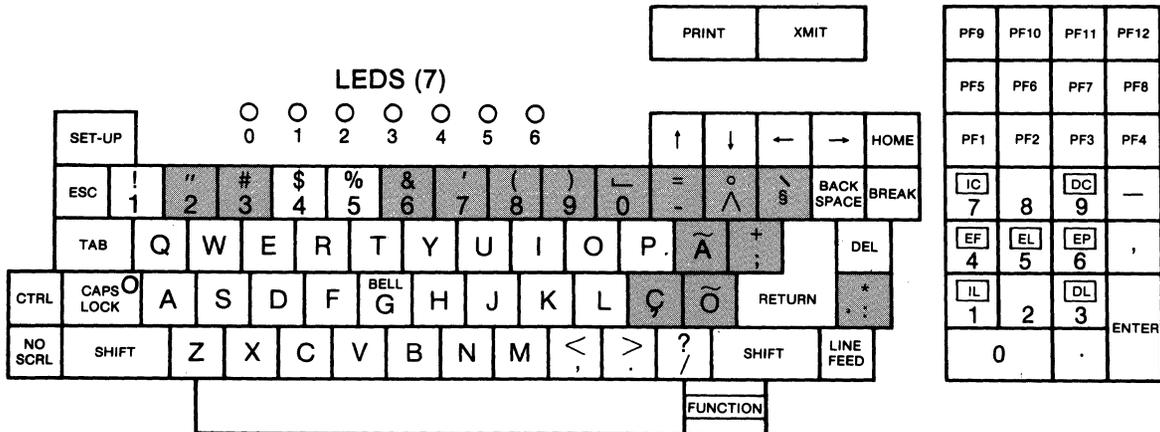
APPENDIX III U.S./U.K. CODE CHART

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

U.K. version uses £ in Column 2 Row 3 in place of #

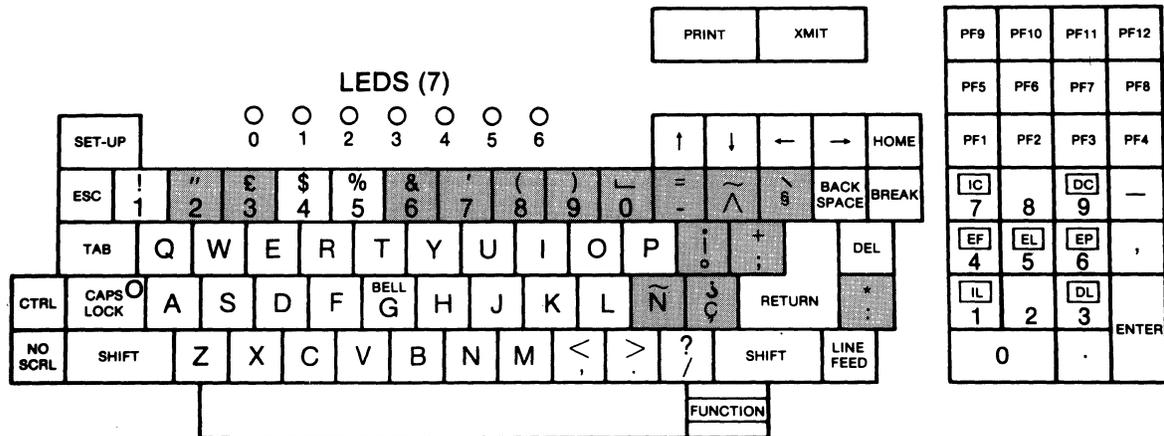
APPENDIX III PORTUGUESE CODE CHART

| | | | | | BIT 7 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
|-------|-------|-------|-------|------------|-------|-----|----|---|---|---|---|-----|---|
| | | | | | BIT 6 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| | | | | | BIT 5 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| BIT 4 | BIT 3 | BIT 2 | BIT 1 | COL ROW | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| 0 | 0 | 0 | 0 | 0 | NUL | DLE | SP | 0 | § | P | ` | p | |
| 0 | 0 | 0 | 1 | 1 | SOH | DC1 | ! | 1 | A | Q | a | q | |
| 0 | 0 | 1 | 0 | 2 | STX | DC2 | " | 2 | B | R | b | r | |
| 0 | 0 | 1 | 1 | 3 | ETX | DC3 | # | 3 | C | S | c | s | |
| 0 | 1 | 0 | 0 | 4 | EOT | DC4 | \$ | 4 | D | T | d | t | |
| 0 | 1 | 0 | 1 | 5 | ENQ | NAK | % | 5 | E | U | e | u | |
| 0 | 1 | 1 | 0 | 6 | ACK | SYN | & | 6 | F | V | f | v | |
| 0 | 1 | 1 | 1 | 7 | BEL | ETB | ' | 7 | G | W | g | w | |
| 1 | 0 | 0 | 0 | 8 | BS | CAN | (| 8 | H | X | h | x | |
| 1 | 0 | 0 | 1 | 9 | HT | EM |) | 9 | I | Y | i | y | |
| 1 | 0 | 1 | 0 | A | LF | SUB | * | : | J | Z | j | z | |
| 1 | 0 | 1 | 1 | B | VT | ESC | + | ; | K | Ã | k | ã | |
| 1 | 1 | 0 | 0 | C | FF | FS | , | < | L | Ç | l | ç | |
| 1 | 1 | 0 | 1 | D | CR | GS | - | = | M | Õ | m | õ | |
| 1 | 1 | 1 | 0 | E | SO | RS | . | > | N | ^ | n | ° | |
| 1 | 1 | 1 | 1 | F | SI | US | / | ? | O |  | o | DEL | |



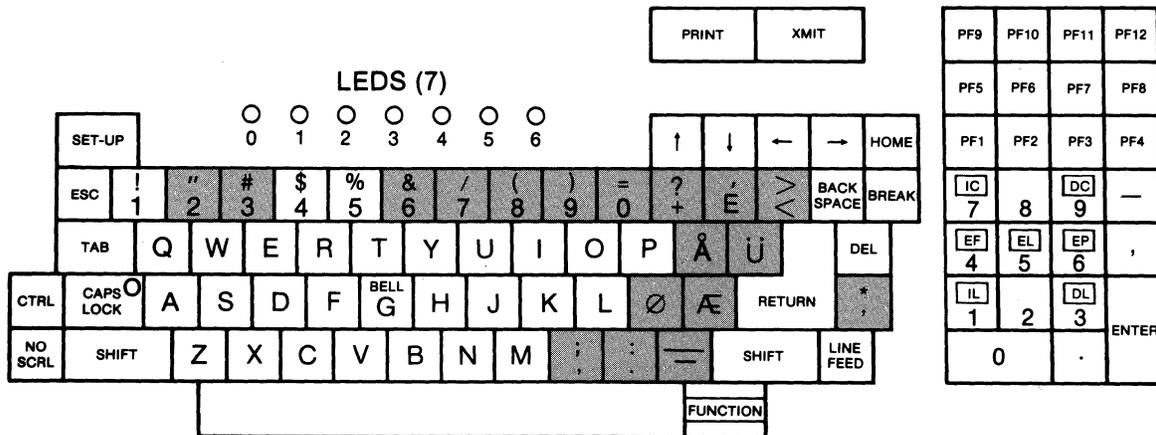
APPENDIX III SPANISH CODE CHART

| | | | | BIT 7 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
|-----|-----|-----|-----|-------|-----|-----|----|---|---|---|---|-----|
| | | | | BIT 6 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| | | | | BIT 5 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| BIT | BIT | BIT | BIT | COL | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4 | 3 | 2 | 1 | ROW | | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | NUL | DLE | SP | 0 | § | P | ` | p |
| 0 | 0 | 0 | 1 | 1 | SOH | DC1 | ! | 1 | A | Q | a | q |
| 0 | 0 | 1 | 0 | 2 | STX | DC2 | " | 2 | B | R | b | r |
| 0 | 0 | 1 | 1 | 3 | ETX | DC3 | £ | 3 | C | S | c | s |
| 0 | 1 | 0 | 0 | 4 | EOT | DC4 | \$ | 4 | D | T | d | t |
| 0 | 1 | 0 | 1 | 5 | ENQ | NAK | % | 5 | E | U | e | u |
| 0 | 1 | 1 | 0 | 6 | ACK | SYN | & | 6 | F | V | f | v |
| 0 | 1 | 1 | 1 | 7 | BEL | ETB | ' | 7 | G | W | g | w |
| 1 | 0 | 0 | 0 | 8 | BS | CAN | (| 8 | H | X | h | x |
| 1 | 0 | 0 | 1 | 9 | HT | EM |) | 9 | I | Y | i | y |
| 1 | 0 | 1 | 0 | A | LF | SUB | * | : | J | Z | j | z |
| 1 | 0 | 1 | 1 | B | VT | ESC | + | ; | K | í | k | ° |
| 1 | 1 | 0 | 0 | C | FF | FS | , | < | L | Ñ | l | ñ |
| 1 | 1 | 0 | 1 | D | CR | GS | - | = | M | ¿ | m | Ç |
| 1 | 1 | 1 | 0 | E | SO | RS | . | > | N | ^ | n | ~ |
| 1 | 1 | 1 | 1 | F | SI | US | / | ? | O | — | o | DEL |



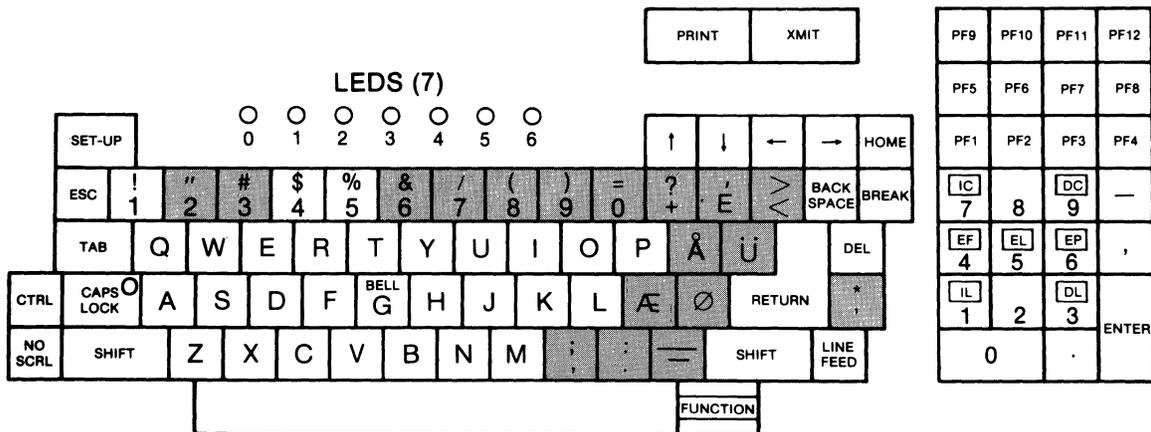
APPENDIX III NORWEGIAN CODE CHART

| | | | | | BIT 7 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
|-------|-------|-------|-------|---------|-------|-----|----|---|---|----|---|-----|---|
| | | | | | BIT 6 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| | | | | | BIT 5 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| BIT 4 | BIT 3 | BIT 2 | BIT 1 | COL ROW | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| 0 | 0 | 0 | 0 | 0 | NUL | DLE | SP | 0 | É | P | é | p | |
| 0 | 0 | 0 | 1 | 1 | SOH | DC1 | ! | 1 | A | Q | a | q | |
| 0 | 0 | 1 | 0 | 2 | STX | DC2 | " | 2 | B | R | b | r | |
| 0 | 0 | 1 | 1 | 3 | ETX | DC3 | # | 3 | C | S | c | s | |
| 0 | 1 | 0 | 0 | 4 | EOT | DC4 | \$ | 4 | D | T | d | t | |
| 0 | 1 | 0 | 1 | 5 | ENQ | NAK | % | 5 | E | U | e | u | |
| 0 | 1 | 1 | 0 | 6 | ACK | SYN | & | 6 | F | V | f | v | |
| 0 | 1 | 1 | 1 | 7 | BEL | ETB | ' | 7 | G | W | g | w | |
| 1 | 0 | 0 | 0 | 8 | BS | CAN | (| 8 | H | X | h | x | |
| 1 | 0 | 0 | 1 | 9 | HT | EM |) | 9 | I | Y | i | y | |
| 1 | 0 | 1 | 0 | A | LF | SUB | * | : | J | Z | j | z | |
| 1 | 0 | 1 | 1 | B | VT | ESC | + | ; | K | AE | k | ae | |
| 1 | 1 | 0 | 0 | C | FF | FS | , | < | L | Ø | l | ø | |
| 1 | 1 | 0 | 1 | D | CR | GS | - | = | M | Å | m | å | |
| 1 | 1 | 1 | 0 | E | SO | RS | . | > | N | Ü | n | ü | |
| 1 | 1 | 1 | 1 | F | SI | US | / | ? | O | — | o | DEL | |



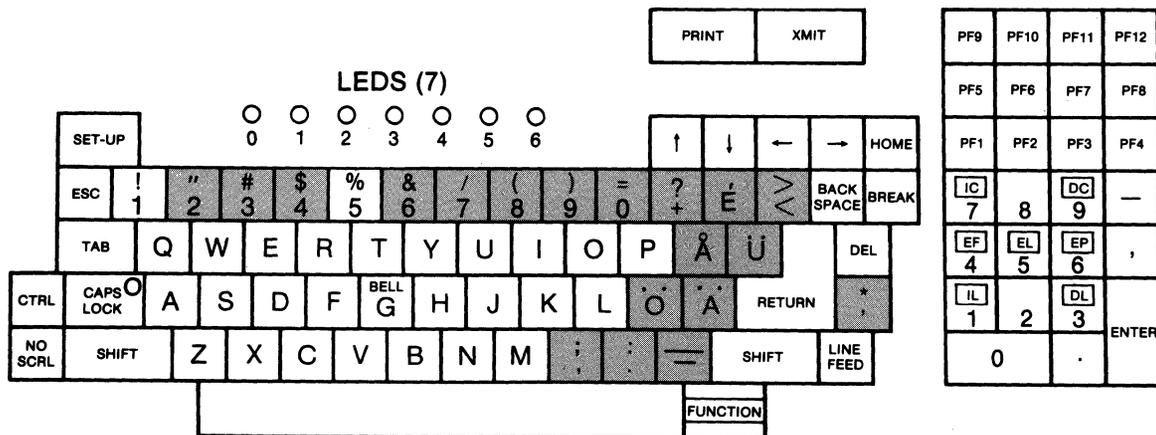
APPENDIX III DANISH CODE CHART

| | | | | | BIT 7 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
|-------|-------|-------|-------|---------|-------|-----|----|---|---|----|---|-----|---|
| | | | | | BIT 6 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| | | | | | BIT 5 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| BIT 4 | BIT 3 | BIT 2 | BIT 1 | COL ROW | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| 0 | 0 | 0 | 0 | 0 | NUL | DLE | SP | 0 | É | P | é | p | |
| 0 | 0 | 0 | 1 | 1 | SOH | DC1 | ! | 1 | A | Q | a | q | |
| 0 | 0 | 1 | 0 | 2 | STX | DC2 | " | 2 | B | R | b | r | |
| 0 | 0 | 1 | 1 | 3 | ETX | DC3 | # | 3 | C | S | c | s | |
| 0 | 1 | 0 | 0 | 4 | EOT | DC4 | \$ | 4 | D | T | d | t | |
| 0 | 1 | 0 | 1 | 5 | ENQ | NAK | % | 5 | E | U | e | u | |
| 0 | 1 | 1 | 0 | 6 | ACK | SYN | & | 6 | F | V | f | v | |
| 0 | 1 | 1 | 1 | 7 | BEL | ETB | ' | 7 | G | W | g | w | |
| 1 | 0 | 0 | 0 | 8 | BS | CAN | (| 8 | H | X | h | x | |
| 1 | 0 | 0 | 1 | 9 | HT | EM |) | 9 | I | Y | i | y | |
| 1 | 0 | 1 | 0 | A | LF | SUB | * | : | J | Z | j | z | |
| 1 | 0 | 1 | 1 | B | VT | ESC | + | ; | K | AE | k | ae | |
| 1 | 1 | 0 | 0 | C | FF | FS | , | < | L | Ø | l | ø | |
| 1 | 1 | 0 | 1 | D | CR | GS | - | = | M | Å | m | å | |
| 1 | 1 | 1 | 0 | E | SO | RS | . | > | N | Ü | n | ü | |
| 1 | 1 | 1 | 1 | F | SI | US | / | ? | O | — | o | DEL | |



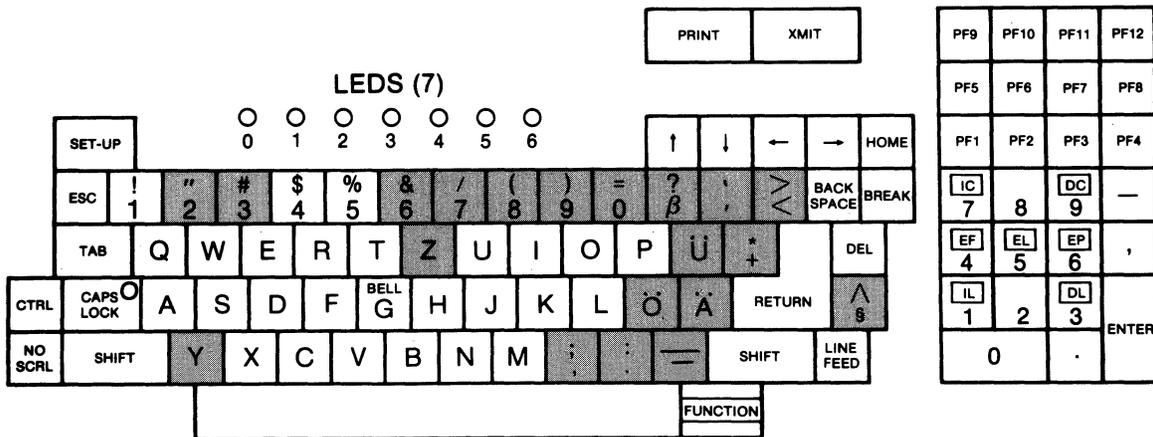
APPENDIX III SWEDISH/FINNISH CODE CHART

| | | | | | BIT 7 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
|-------|-------|-------|-------|---------|-------|-----|----|---|---|---|----|-----|---|
| | | | | | BIT 6 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| | | | | | BIT 5 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| BIT 4 | BIT 3 | BIT 2 | BIT 1 | COL ROW | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| 0 | 0 | 0 | 0 | 0 | NUL | DLE | SP | 0 | É | P | e' | p | |
| 0 | 0 | 0 | 1 | 1 | SOH | DC1 | ! | 1 | A | Q | a | q | |
| 0 | 0 | 1 | 0 | 2 | STX | DC2 | " | 2 | B | R | b | r | |
| 0 | 0 | 1 | 1 | 3 | ETX | DC3 | # | 3 | C | S | c | s | |
| 0 | 1 | 0 | 0 | 4 | EOT | DC4 | \$ | 4 | D | T | d | t | |
| 0 | 1 | 0 | 1 | 5 | ENQ | NAK | % | 5 | E | U | e | u | |
| 0 | 1 | 1 | 0 | 6 | ACK | SYN | & | 6 | F | V | f | v | |
| 0 | 1 | 1 | 1 | 7 | BEL | ETB | ' | 7 | G | W | g | w | |
| 1 | 0 | 0 | 0 | 8 | BS | CAN | (| 8 | H | X | h | x | |
| 1 | 0 | 0 | 1 | 9 | HT | EM |) | 9 | I | Y | i | y | |
| 1 | 0 | 1 | 0 | A | LF | SUB | * | : | J | Z | j | z | |
| 1 | 0 | 1 | 1 | B | VT | ESC | + | ; | K | Ä | k | ä | |
| 1 | 1 | 0 | 0 | C | FF | FS | , | < | L | Ø | l | ø | |
| 1 | 1 | 0 | 1 | D | CR | GS | - | = | M | Å | m | å | |
| 1 | 1 | 1 | 0 | E | SO | RS | . | > | N | Ü | n | ü | |
| 1 | 1 | 1 | 1 | F | SI | US | / | ? | O | — | o | DEL | |



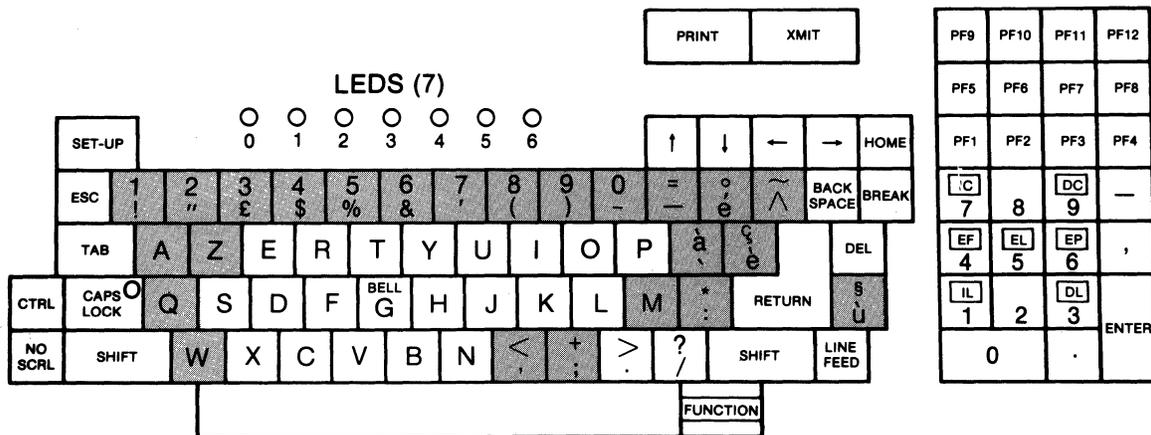
APPENDIX III GERMAN CODE CHART

| | | | | | BIT 7 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
|-----|-----|-----|-----|-----|-------|-----|----|---|---|---|---|-----|---|
| | | | | | BIT 6 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| | | | | | BIT 5 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| BIT | BIT | BIT | BIT | COL | | | | | | | | | |
| 4 | 3 | 2 | 1 | ROW | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| 0 | 0 | 0 | 0 | 0 | NUL | DLE | SP | 0 | § | P | ` | p | |
| 0 | 0 | 0 | 1 | 1 | SOH | DC1 | ! | 1 | A | Q | a | q | |
| 0 | 0 | 1 | 0 | 2 | STX | DC2 | " | 2 | B | R | b | r | |
| 0 | 0 | 1 | 1 | 3 | ETX | DC3 | # | 3 | C | S | c | s | |
| 0 | 1 | 0 | 0 | 4 | EOT | DC4 | \$ | 4 | D | T | d | t | |
| 0 | 1 | 0 | 1 | 5 | ENQ | NAK | % | 5 | E | U | e | u | |
| 0 | 1 | 1 | 0 | 6 | ACK | SYN | & | 6 | F | V | f | v | |
| 0 | 1 | 1 | 1 | 7 | BEL | ETB | ' | 7 | G | W | g | w | |
| 1 | 0 | 0 | 0 | 8 | BS | CAN | (| 8 | H | X | h | x | |
| 1 | 0 | 0 | 1 | 9 | HT | EM |) | 9 | I | Y | i | y | |
| 1 | 0 | 1 | 0 | A | LF | SUB | * | : | J | Z | j | z | |
| 1 | 0 | 1 | 1 | B | VT | ESC | + | ; | K | Ä | k | ä | |
| 1 | 1 | 0 | 0 | C | FF | FS | , | < | L | Ö | l | ö | |
| 1 | 1 | 0 | 1 | D | CR | GS | - | = | M | Ü | m | ü | |
| 1 | 1 | 1 | 0 | E | SO | RS | . | > | N | ^ | n | β | |
| 1 | 1 | 1 | 1 | F | SI | US | / | ? | O | — | o | DEL | |



APPENDIX III FRENCH CODE CHART

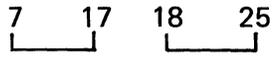
| | | | | | BIT 7 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
|-----|-----|-----|-----|-----|-------|-----|----|---|---|---|---|-----|---|
| | | | | | BIT 6 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| | | | | | BIT 5 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| BIT | BIT | BIT | BIT | COL | | | | | | | | | |
| 4 | 3 | 2 | 1 | ROW | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| 0 | 0 | 0 | 0 | 0 | NUL | DLE | SP | 0 | à | P | ` | p | |
| 0 | 0 | 0 | 1 | 1 | SOH | DC1 | ! | 1 | A | Q | a | q | |
| 0 | 0 | 1 | 0 | 2 | STX | DC2 | " | 2 | B | R | b | r | |
| 0 | 0 | 1 | 1 | 3 | ETX | DC3 | £ | 3 | C | S | c | s | |
| 0 | 1 | 0 | 0 | 4 | EOT | DC4 | \$ | 4 | D | T | d | t | |
| 0 | 1 | 0 | 1 | 5 | ENQ | NAK | % | 5 | E | U | e | u | |
| 0 | 1 | 1 | 0 | 6 | ACK | SYN | & | 6 | F | V | f | v | |
| 0 | 1 | 1 | 1 | 7 | BEL | ETB | ' | 7 | G | W | g | w | |
| 1 | 0 | 0 | 0 | 8 | BS | CAN | (| 8 | H | X | h | x | |
| 1 | 0 | 0 | 1 | 9 | HT | EM |) | 9 | I | Y | i | y | |
| 1 | 0 | 1 | 0 | A | LF | SUB | * | : | J | Z | j | z | |
| 1 | 0 | 1 | 1 | B | VT | ESC | + | ; | K | ° | k | é | |
| 1 | 1 | 0 | 0 | C | FF | FS | , | < | L | Ç | l | ù | |
| 1 | 1 | 0 | 1 | D | CR | GS | - | = | M | § | m | è | |
| 1 | 1 | 1 | 0 | E | SO | RS | . | > | N | ^ | n | ~ | |
| 1 | 1 | 1 | 1 | F | SI | US | / | ? | O | — | o | DEL | |



APPENDIX IV TURN-AROUND CONNECTOR FOR INTERFACE TESTS

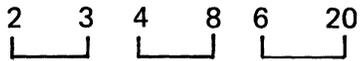
Turn-around Connector for Current Loop tests.

Switches 2,3,6 ON 4,5 OFF



Turn-around Connector for EIA tests.

Switches 1,2,3,4,5,6,7 OFF 8 ON





APPENDIX V DECIMAL EQUIVALENT OF ASCII CODES

| ASCII Code | Decimal |
|------------|---------|------------|---------|------------|---------|------------|---------|
| NUL | 0 | SP | 32 | @ | 64 | | 96 |
| SOH | 1 | ! | 33 | A | 65 | a | 97 |
| STX | 2 | " | 34 | B | 66 | b | 98 |
| ETX | 3 | # | 35 | C | 67 | c | 99 |
| EOT | 4 | \$ | 36 | D | 68 | d | 100 |
| ENQ | 5 | % | 37 | E | 69 | e | 101 |
| ACK | 6 | & | 38 | F | 70 | f | 102 |
| BEL | 7 | ' | 39 | G | 71 | g | 103 |
| BS | 8 | (| 40 | H | 72 | h | 104 |
| HT | 9 |) | 41 | I | 73 | i | 105 |
| LF | 10 | * | 42 | J | 74 | j | 106 |
| VT | 11 | + | 43 | K | 75 | k | 107 |
| FF | 12 | , | 44 | L | 76 | l | 108 |
| CR | 13 | - | 45 | M | 77 | m | 109 |
| SO | 14 | . | 46 | N | 78 | n | 110 |
| SI | 15 | / | 47 | O | 79 | o | 111 |
| DLE | 16 | 0 | 48 | P | 80 | p | 112 |
| DC1 | 17 | 1 | 49 | Q | 81 | q | 113 |
| DC2 | 18 | 2 | 50 | R | 82 | r | 114 |
| DC3 | 19 | 3 | 51 | S | 83 | s | 115 |
| DC4 | 20 | 4 | 52 | T | 84 | t | 116 |
| NAK | 21 | 5 | 53 | U | 85 | u | 117 |
| SYN | 22 | 6 | 54 | V | 86 | v | 118 |
| ETB | 23 | 7 | 55 | W | 87 | w | 119 |
| CAN | 24 | 8 | 56 | X | 88 | x | 120 |
| EM | 25 | 9 | 57 | Y | 89 | y | 121 |
| SUB | 26 | : | 58 | Z | 90 | z | 122 |
| ESC | 27 | ; | 59 | [| 91 | { | 123 |
| FS | 28 | < | 60 | \ | 92 | | 124 |
| GS | 29 | = | 61 |] | 93 | } | 125 |
| RS | 30 | > | 62 | ^ | 94 | ~ | 126 |
| US | 31 | ? | 63 | - | 95 | DEL | 127 |

