

# Hazeltine 2000



## Operating Manual

HI 1004A  
MARCH 1972  
REVISED JANUARY 1975

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# Hazeltine 2000 Operating Manual

## INTRODUCTION

The Hazeltine 2000 Video Display Terminal is a product of advanced engineering technology which offers the user greatly enhanced ability to communicate with a remote computer system.

Speed, silence, and flexibility, coupled with the operator-oriented features of the Hazeltine 2000 can serve to greatly improve the efficiency of both software and programmer in data input/output operations.

With the addition of optional Hazeltine Printer and Tape Cassette units, increased off-line as well as on-line capabilities are realized.

This manual will familiarize you with the Hazeltine 2000, its operation and features. Should you need additional technical assistance, please contact your Hazeltine Representative.

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## INSTALLATION

### A. SET-UP AND CONNECTIONS

Following unpacking, place units to allow free air circulation around base and top of unit. Connect cables securely, insuring that they are free of kinks or tight bends, as follows:

1. Keyboard

Plug the keyboard cable into the marked, corresponding connector in the rear of the display unit. Pin locations and safety lugs will assure a correct connection. (Keyboard cable can be placed under the display, if desired.)

2. Accessory Units

Accessory connectors for optional Tape Cassette, Remote Monitors and Printer units are marked on the rear of the display unit near the **KEYBOARD CONNECTOR**. (See figure 1.)

3. Data Set or Acoustical Coupler

The standard connector extending from the rear of the display unit should be plugged into the appropriate data set or coupler connector.

4. Power Cords

Power cords should be plugged into grounded power outlets. Do not use adapters which would prevent the display unit from being properly grounded.

5. Cleaning

Dirt and smudges can be removed from the cabinet with any number of common household spray cleaners and a soft cloth. The faceplate should be cleaned only with a soft, damp cloth or tissue to avoid scratching.

### B. TURN-ON AND WARM-UP

A display unit brought in from a significantly colder environment should be allowed to sit out of the box for at least one hour prior to turn-on.



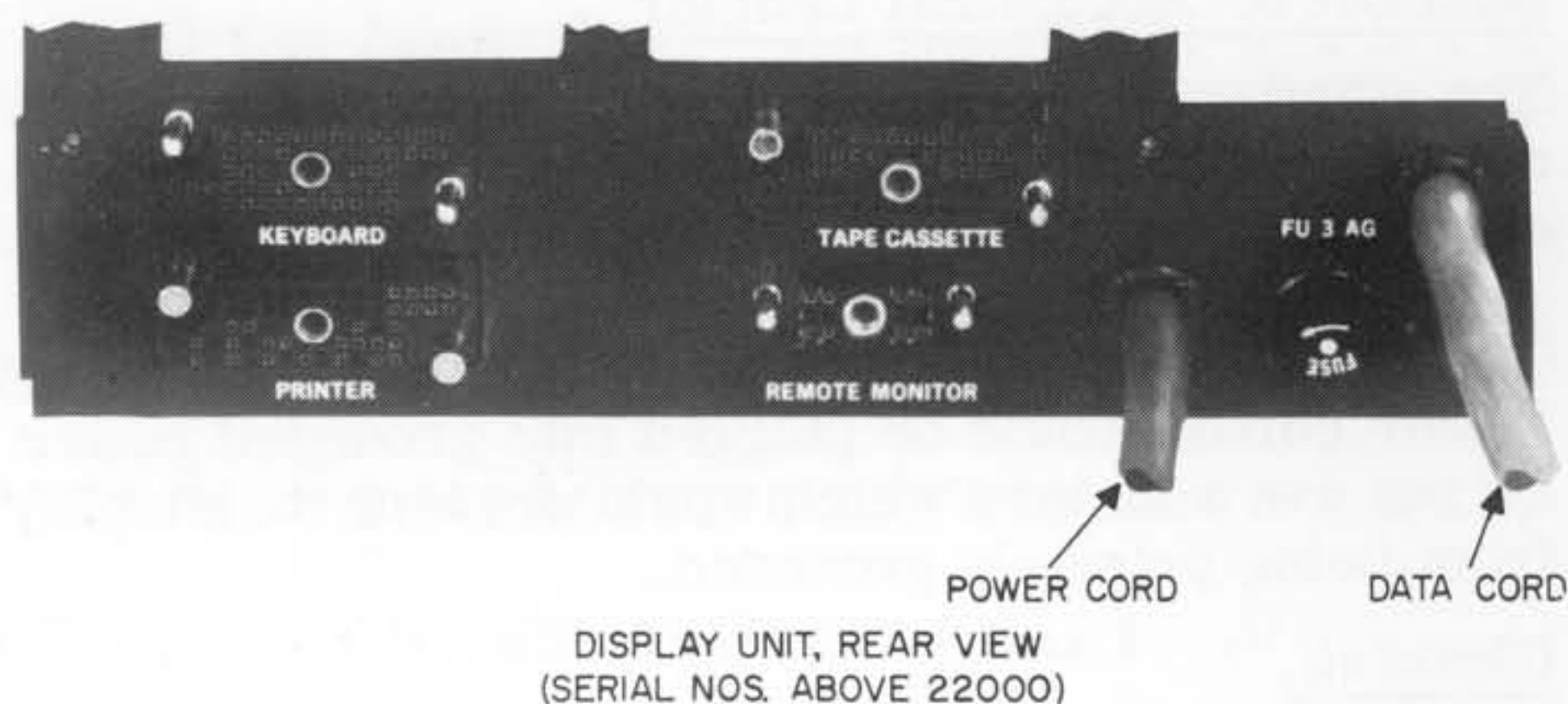
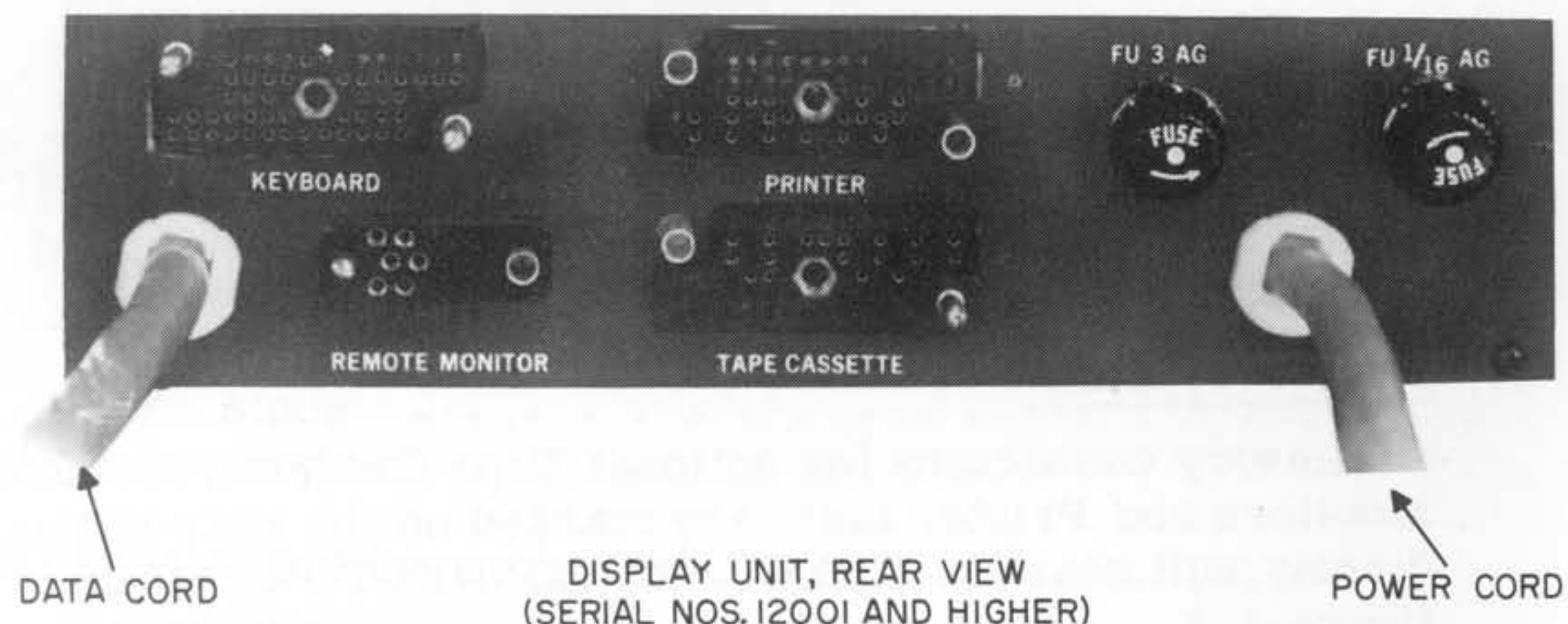
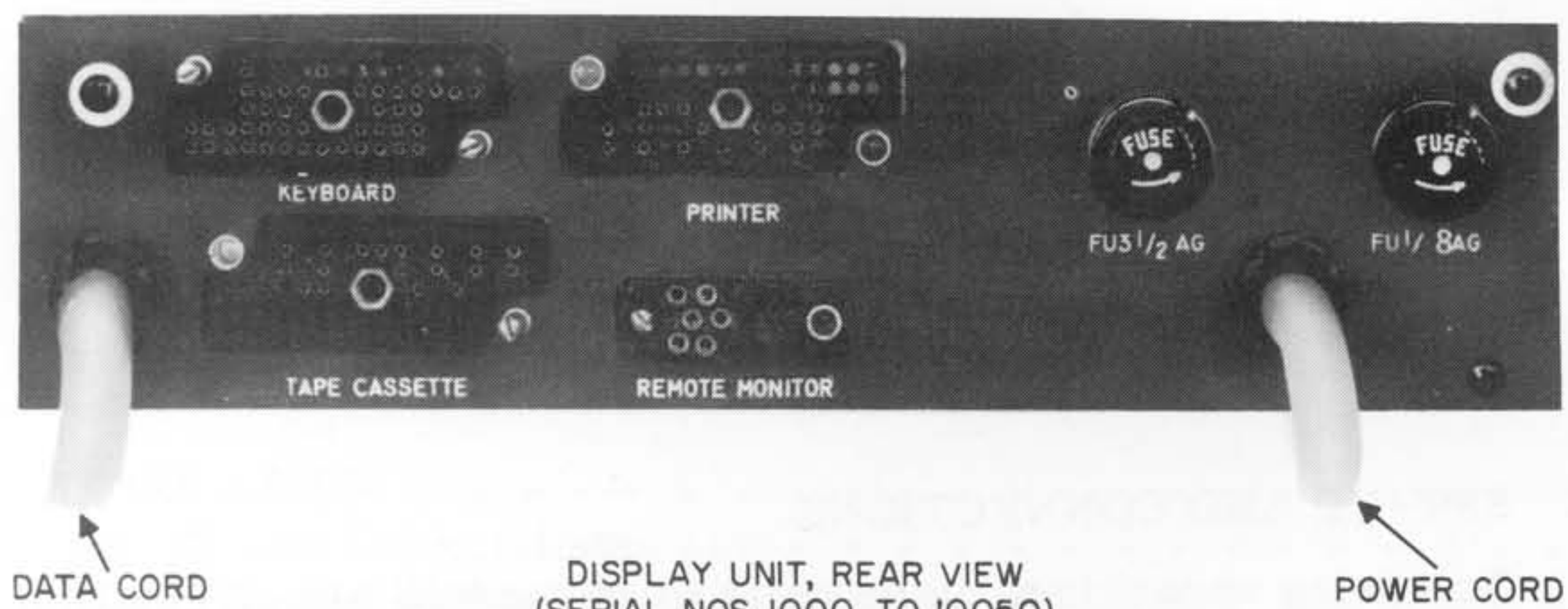


Figure 1. Hazeltine 2000 Display Rear View

1. Turn-On

Set the power ON/OFF pushbutton on the keyboard to ON by depressing it. When power is on, the keyboard pushbutton/indicator will be lighted. The RECEIVE and LOCAL indicators on the keyboard will light indicating that the Model 2000 is in Ready mode. Depress reset followed by a simultaneous depression of shift and clear keys. This will reset the logic circuits to a normal state and clear any extraneous data from the screen. Allow at least 15 seconds between power "off" and power "on" in the event of unit power recycling.

## 2. Warm-Up

Allow 30 seconds for display warm-up. At the end of this period, the cursor will appear in the upper left corner of the display screen. With the unit in Batch mode, you are able to type characters on the screen. (See figure 2 for location of mode switch in front panel.)

- a. If the RECEIVE and LOCAL pushbutton/indicators do not light when the power switch is turned on, press the RESET pushbutton. If either or both indicators still do not light, check to see if the cooling fan inside the display unit is in operation. This can be done by listening for the fan motor or feeling air movement near the grill in the rear of the display.
- b. If the fan is not operating, turn the power switch off and check the fuses in the rear of the display (Figure 1). If a fuse is burned out, contact your Hazeltine Representative for a replacement.
- c. If the fan is operating and if after depressing RESET, the RECEIVE and LOCAL pushbuttons are not lit, turn the power switch off and carefully recheck all cable connections. Following this, turn the power switch on again. If after depressing RESET, the RECEIVE and LOCAL pushbutton/indicators do not light, contact your Hazeltine Representative.
- d. If the cursor does not appear after the display CRT has warmed for a reasonable period of time (no more than 3 minutes), depress the HOME key. This will bring the cursor to the "home" position in the upper left corner of the display. If the cursor does not appear and if the entire screen is blank, it is possible that the CONTRAST control is not adjusted properly. To make the adjustment, set the CONTRAST control completely clockwise. If the cursor still does not appear, turn the power switch off and contact your Hazeltine Representative.
- e. If the Hazeltine 2000 is used infrequently throughout the day, it is recommended that power be left on rather than continuously turning the unit off and on.



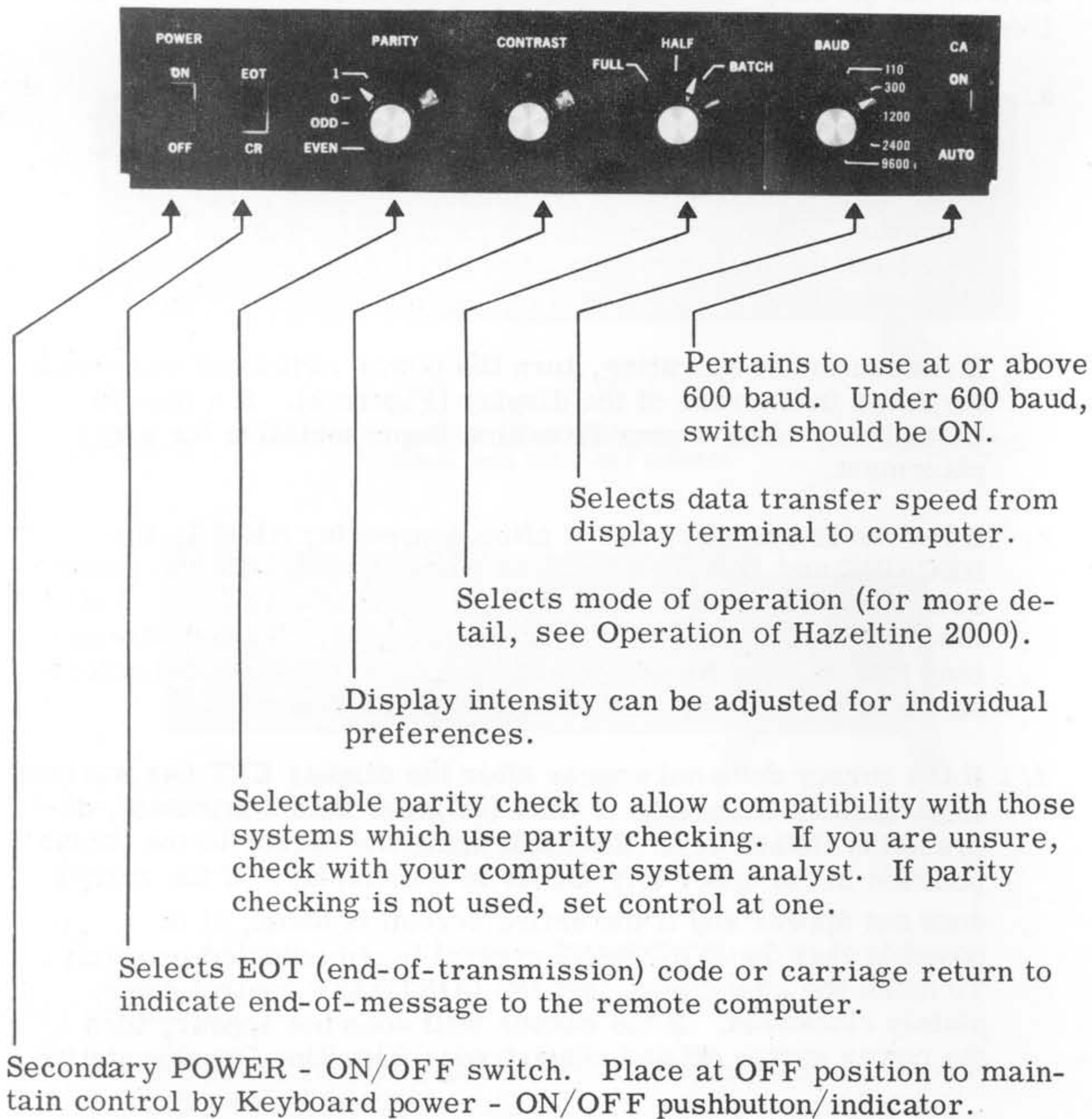


Figure 2. Hazeltine 2000 Front Panel Controls



## KEYBOARD AND FRONT PANEL CONTROLS

### A. KEYBOARD (Figure 3)

#### 1. TAB

The TAB key automatically moves the cursor to the next tab stop, if any, whether vertical, horizontal, or diagonal. Tab stops are set automatically when the display contains both background and foreground fields. The first foreground character following a background field is a tab stop. If there are

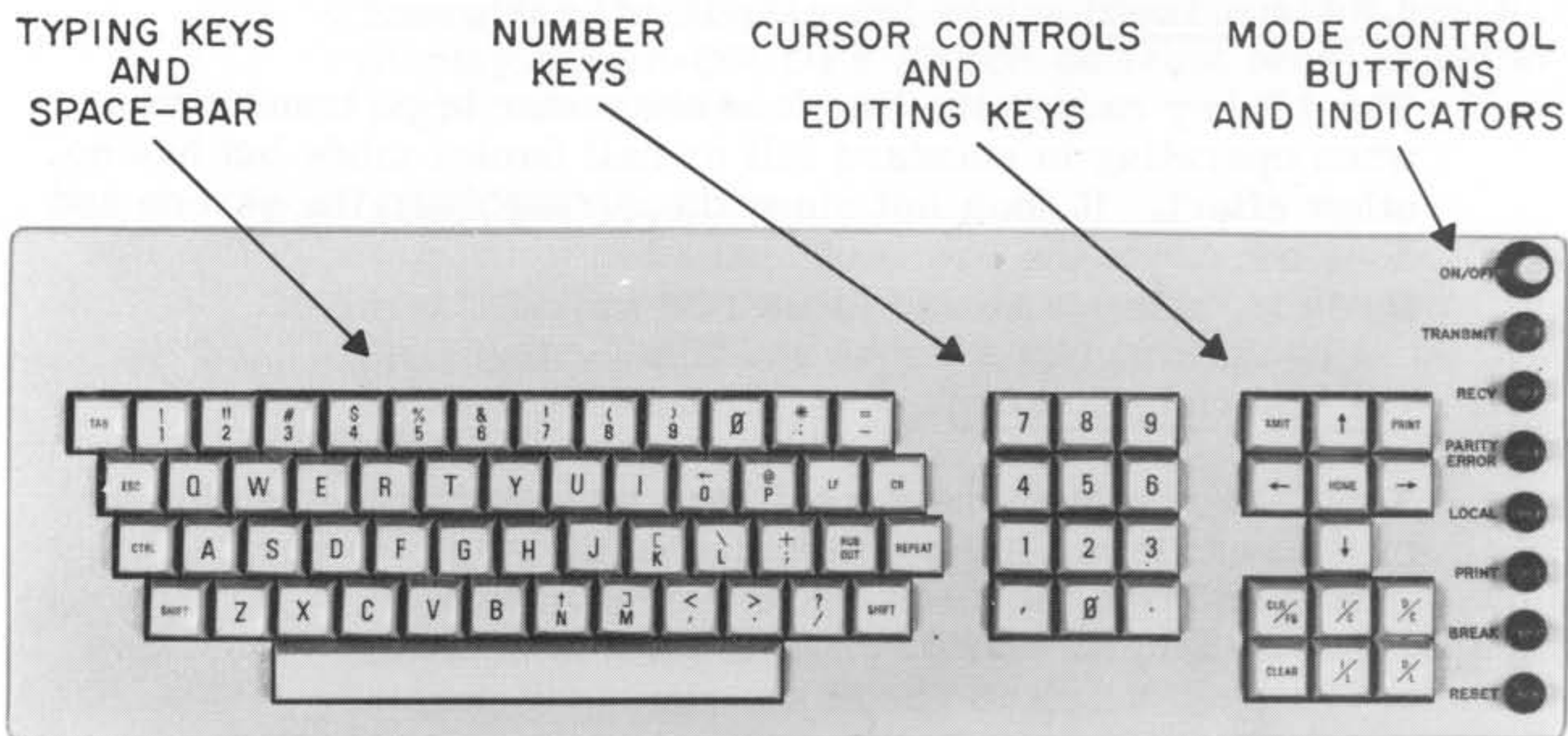


Figure 3. Hazeltine 2000 Keyboard

no tab stops set, the tab key will cause the cursor to move to the lower right hand corner of the display. (See discussion of foreground/background in "operation" section.

2. ESC Escape

Use of this key is optional depending on communication software being used. ESC generally is used to generate a program interrupt signal.

3. CTRL (Control)

The control key is used in conjunction with other character keys to generate non-printing characters for a number of reasons including security, function codes, etc. When CTRL is used it should be depressed and held while the other required character key is depressed. CTRL sends special codes by altering the code pattern of the other key used with it.

4. LF (Line Feed)

The LF key causes the line feed character to be transmitted when operating in standard full or half duplex mode but has no other effect. It does not move the cursor down the screen and does not cause the line feed character to be stored. The line feed character is stored in BATCH but not executed.

5. CR (Carriage Return)

The CR key moves the cursor back and down to the beginning of the next lower line thereby accomplishing both carriage return and line feed.

6. RUBOUT

The RUBOUT key causes a character of all "one" bits to be sent out. Usually rubouts are used as "filler" characters when program execution delays are required.

7. Number Key Cluster

These keys transmit the same code as the numeric keys across the top of the keyboard and are provided in an adding machine cluster to facilitate entry of numeric data.

8. Cursor Control Keys

The HOME key moves the cursor immediately to the home position (first character position in the top line). The cluster of four arrow keys are cursor-stepping keys. Each moves the cursor one space in the indicated direction.

These keys may be pressed in conjunction with the RPT key for rapid cursor movement. Cursor positioning with these keys is completely non-destructive; it will not alter any characters in the display.

9. Status Mode Indicator/Controls

a. ON/OFF Pushbutton/Indicator

Energizes the display and keyboard units when auxiliary display Power-ON/OFF switch on front panel is set at OFF. Lights when power is ON.

b. TRANSMIT Indicator

Lighted when transmit mode is initiated by pressing the SHIFT and XMIT key or when transmit mode is initiated by the computer.

c. XMIT Key

Used only during Batch operation. Initiates the batch transmission of a typed entry to the computer by switching the Model 2000 from the Ready mode or the Local mode to the Transmit mode. Has no effect during standard half or full

duplex operation. Must be used with the SHIFT key.

d. RECV Pushbutton/Indicator

Lighted whenever the Model 2000 is able to receive, or is receiving, characters from the computer or from the optional tape cassette unit. Therefore not lighted in any of the three modes which prevent receiving: Local, Print, or Transmit (in Batch operation). If pressed while in any of those modes, this button immediately terminates the mode and thereby returns the Model 2000 to the Ready mode.

e. PARITY ERROR Pushbutton/Indicator

Illuminates when a parity error has occurred in a character, or characters, as data transferred between computer and display unit. Depressing the pushbutton will reset the parity detection circuit and extinguish the light.

f. PRINT Indicator

Lighted when print mode is initiated by depressing the PRINT key or by the computer.

g. LOCAL Pushbutton/Indicator

Lighted whenever the keyboard is electrically enabled (unlocked). Therefore not lighted in any of the three modes which lock the keyboard to prevent garbling by inadvertent typing: Print, Transmit (in Batch operation), or Receive (while a character is arriving). When pressed, this button immediately switches the Model 2000 to the Local mode from any of the other modes.

h. PRINT Key

Initiates a batch readout of the contents of the display to optional equipment (serial-character hard copies or tape cassette unit), by switching the Model 2000 from the Ready mode or the Local mode to the Print mode. Must be used with the SHIFT key.



i. BREAK Pushbutton/Indicator

Equivalent to the corresponding button on a conventional teletypewriter terminal. When pressed while the RECEIVE button is lighted, this button causes a break signal to be transmitted to the computer. If the computer is transmitting to the Model 2000 the break signal requests the computer to cease transmitting and prepare to receive a transmission from the Model 2000.

j. RESET Pushbutton/Indicator

Interrupts and resets all internal functions while depressed, and returns the Model 2000 to the Ready mode when released (or to the Receive mode if incoming characters are being received). The interrupted functions include synchronization and display refresh, and as a result, the display goes completely blank when the RESET button is pressed and then reappears when the button is released. The reset button will reset the terminal to the background input modes.

10. EDIT KEYS

- a. CLR/FG - Clears out all data on screen in foreground (Bright) intensity.
- b. CLEAR - Clears entire screen of data
- c. I/C - Inserts character within field
- d. D/C - Deletes character from field
- e. I/L - Inserts line of data
- f. D/L - Deletes line of data

B. FRONT PANEL

1. CR/EOT Panel Switch

a. Purpose

Selects either the ASCII "Carriage Return" or "End-of-Transmission" character as the last character transmitted in Batch mode.

The CR/EOT switch also selects the line turnaround discipline the Hazeltine 2000 will observe.

- (1) In the CR position, the line turnaround will always be caused by the remote computer via the "supervisory" channel option of WE202 type modems.
- (2) In the EOT position, line turnaround is caused by the receipt or transmission of the EOT code.

b. Speed

The CR/EOT switch is operational at all speeds selectable in the terminal.

2. CA ON/CA Auto Panel Switch

- a. General - Use of Half Duplex Datasets such as the WE202C require transmit/receive conditioning by CA which is automatically controlled by line turnaround discipline. Observed transmit/receive status of the modem is therefore desirable for some applications.

b. Terminology

CA - Request to send (from EIA std. RS232 data set connector pin 4).

c. Purpose

With the CA switch set to CA ON, the RECEIVE indicator reflects the RECEIVE status of the terminal. With the CA switch set to CA AUTO, the RECEIVE indicator reflects the status of the modem control signal which in turn controls the modem transmit/receive status. When the RECEIVE light is OFF, the modem is conditioned to transmit. When the RECEIVE light is ON, the modem is conditioned to receive.

d. Intended Use

Normally, for speeds up to 300 baud, type 103 modems are used and the CA switch should be set to CA ON. For higher speeds (600, 1200, 1800 baud), a 202C-type modem is used and switch should be set to CA AUTO.

## OPERATION

### A. INTRODUCTION

There are two basic modes of operation under which the Hazeltine 2000 can be operated: Standard Transmission (switch setting at HALF or FULL DUPLEX); Batch Transmission (switch setting at BATCH).

When the unit is operating in either half or full duplex in the Standard Transmission mode, data which is keyed in is sent directly to the computer. Each line is terminated with a carriage return (CR) and any editing or correction that takes place becomes a function of the computer program under which you are operating. Most time shared software recognizes special characters and has special subroutines for backspacing and, in some cases, line and character replacement.

In the Batch mode, however, the data that is keyed in is held in the Hazeltine 2000 memory until the operator chooses to transmit it to the computer. The operator can prepare one line or several lines of data and, through use of the cursor control and editing keys, may make any corrections such as character and line insertion or deletion, as well as retyping prior to transmission to the computer system. When the operator is satisfied that his data is correct and ready for computer input, he depresses the SHIFT and TRANSMIT keys in addition to or in place of his last carriage return (CR). The data is then sent to the computer.

### B. OPERATION IN FULL DUPLEX

The full duplex mode of communication can only be used when the communication system is capable of simultaneous two-way transmission. In this mode, data entered from the keyboard is sent directly to the remote computer system. Upon reaching the computer, the data is "echoed" back to the Hazeltine 2000 screen. If modems are used, they must be "Full duplex" type.

### C. OPERATION IN HALF DUPLEX

The half duplex mode of communication is used when the communication system is not capable of simultaneous two-way transmission. In this mode, the terminal "echoes" all its own keyed data onto the screen for the operator to inspect.

## D. BATCH MODE

The Batch mode may be used with either half or full duplex communication systems. It is the Batch mode of operation that enables the operator to take advantage of the editing functions inherent in the Hazeltine 2000.

### 1. Preparing Data

Data is entered through the keyboard and displayed on the screen as it is held in the memory of the Hazeltine 2000.

The operator may wish to enter and transmit one or several characters, part of a line, a full line, or several lines of data. In each case the operator has Control of the Keyboard (local light is lit).

### 2. Editing Data

The cursor control keys are a useful and important part of the editing function. The cursor can be moved in any direction on the screen to position it for a correction. The cursor keys can be used with the RPT key for rapid cursor movement.

- a. **Retyping** - To retype a character or series of characters, simply position the cursor at the appropriate starting point and make the correction. When correction is complete, reposition cursor at transmission point (end-of-message) or continuation point.
- b. **Character Insertion** - This feature precludes the necessity of retyping an entire line should a character or space be missing. Position the cursor under the character to the right of the desired correction, depress the I/C key, and while holding the I/C key down, depress the desired character (or space bar) to be inserted.
- c. **Character Delete** - Position the cursor under the character to be deleted and depress D/C key.
- d. **Insert Line** - Position the cursor anywhere on the line at which you wish to insert a new line and depress I/L key. Data on that line and below will move down one line allowing you to insert your new line of data.
- e. **Delete Line** - Position the cursor anywhere on the line you wish deleted and depress D/L key. Lines of data below the line deleted will roll up one line.



### 3. Transmitting Data

When you are ready to send the information on the screen to the computer, depress the SHIFT key and, while holding it down, depress the XMIT key. This will cause a transmit symbol to appear on the screen which indicates point of transmission. (The SHIFT key is used with XMIT, PRINT, CLEAR, and CLR/FG to prevent accidental transmission or clearing of data being prepared on the screen.) The cursor will return to the "home" position or to the line following the last transmit symbol and begin to transmit all foreground data.

The cursor will scan each line (assuming a multiple line entry) until it senses a carriage return or end-of-line and will go on to the next line until it returns to the transmit symbol. It will then send a CR or EOT (selectable) symbol to the computer and reposition to the beginning of the next line for a response from the computer or a new operator entry.

### 4. Clearing the Screen

Depress the SHIFT key and while holding it down, depress the CLR key. This will clear the screen and automatically "home" the cursor (first character position of first line).

### 5. Background/Foreground

When in Batch mode, data appears on the screen of the Hazeltine 2000 in background (dim) and foreground (bright) intensity.

Unless specified otherwise under "Applications", page 16, data received from the computer will be in background (protected), while data that is entered by the operator is in foreground (unprotected). **ONLY DATA IN FOREGROUND (BRIGHT) INTENSITY CAN BE EDITED BY THE OPERATOR.** This prevents the operator from accidentally destroying information from the computer such as a format and necessitating its regeneration.

By using the CLR/FG key in the same manner as the CLR key, the operator is able to clear the screen of only foreground data. This is extremely useful in an application such as repetitive form fill-out.

When using Background/Foreground in setting up a form, protected fields are created on the screen in which the TAB

feature can be used. The beginning of each foreground field becomes a TAB stop. Additional information regarding formatting and the TAB function are found in "Applications", page 16.

#### NOTE

**XMIT, PRINT, CLEAR, and CLR/FG keys must be depressed with SHIFT key to prevent inadvertent clearing or transmission of data being prepared on the display screen.**

#### E. STATUS MODES

1. Ready Mode - (RECEIVE and LOCAL indicators lighted)

This is the normal state of the unit when awaiting either keyboard inputs or incoming data from the computer system. The Model 2000 starts in the Ready mode when turned on and returns to the Ready mode at the completion of print, transmit, or receive functions. The operator may interrupt any function to return the unit to Ready mode by depressing either RECEIVE or RESET.

2. Transmit Mode - (TRANSMIT indicator lighted)

When in Transmit mode, LOCAL and RECEIVE indicators are extinguished and the keyboard is electronically disabled to prevent garbling by inadvertent typing. When in Transmit mode, the Hazeltine 2000 cannot receive incoming characters. This mode automatically resets to Ready when transmission is completed.

3. Receive Mode - (RECEIVE pushbutton/indicator lighted)

This mode is initiated from Ready mode when incoming characters arrive. When in Receive mode, the keyboard is electronically disabled to prevent garbling, except when in Standard Full Duplex mode where two-way transmission is permitted.

4. Print Mode - (PRINT pushbutton/indicator lighted)

This mode is initiated for the purpose of printing the contents of the display memory onto the optional hard copy printer or to the optional tape cassette. When in Print mode, the keyboard is electronically disabled.

5. Local Mode - (LOCAL pushbutton/indicator light ed and RECEIVE indicator off.)

The keyboard is electronically unlocked and is in full control of the display with all external communication prevented. Return to Ready mode is accomplished by depressing the RECEIVE or RESET pushbuttons.

## APPLICATIONS

### A. INTRODUCTION

The Hazeltine 2000 display terminal has twelve distinct functions that can be used through a unique combination of ASCII characters which can easily be made a part of your remote computer programs.

- |                             |                              |
|-----------------------------|------------------------------|
| 1. Transmit                 | 7. Clear Screen              |
| 2. Address Cursor           | 8. Clear Foreground Data     |
| 3. Home Cursor              | 9. Print                     |
| 4. Delete Line              | 10. Set Foreground Intensity |
| 5. Set Background Intensity | 11. Carriage Return          |
| 6. Insert Line              | 12. Backspace Cursor         |

### B. SOFTWARE CONTROL

In order to call a terminal function from software, it is always necessary to precede the function code with a lead-in code. The lead-in code (key stroke: Control-Shifted-Period) alerts the terminal that a function code is following. Function codes can then be transmitted to perform any of the above listed functions. For example:

1. You may find it desirable to start an output at the top of the screen. This would mean that just before the output stream, your program would issue a clear screen command.
2. You may want part of an error message highlighted. Your program would issue a set foreground command.
3. You may wish your program to output information in the left center of the screen. Your program would issue a) clear screen, b) address cursor followed by the X-Y coordinates (see cursor address chart - Appendix IV) of where exactly the output would begin.



4. Following is a listing of the functions, command codes, and key strokes required:

Function	Lead-In Code	Function Code	ASCII Equivalent
1. Transmit	cs'	c <sub>N</sub>	SO
*2. Address Cursor	cs'	c <sub>Q</sub>	DC1
3. Home Cursor	cs'	c <sub>R</sub>	DC2
**4. Delete Line	cs'	c <sub>S</sub>	DC3
5. Background Follows	cs'	c <sub>Y</sub>	EM
**6. Insert Line	cs'	c <sub>Z</sub>	SUB
**7. Clear Screen	cs'	cs <sub>L</sub>	FS
**8. Clear Foreground	cs'	cs <sub>M</sub>	GS
9. Print	cs'	cs <sub>N</sub>	RS
10. Foreground Follows	cs'	cs <sub>O</sub>	US
11. Carriage Return (Not Stored)	cs'	c <sub>M(CR)</sub>	CR
12. Backspace Cursor	Lead-in not re- quired	c <sub>H</sub>	BS

<sup>c</sup>Depress the Control (CTRL) Key while striking the character.

<sup>cs</sup>Depress both the Shift (SHIFT) and Control (CTRL) Keys while striking the character.

\*This command is then followed by an X and Y coordinate. See Cursor Address Chart (Appendix IV).

\*\*The terminal requires between 5 and 6 milliseconds to carry out these functions. During this time the terminal is unable to receive data. At speeds of 150 to 1200 baud it is recommended that these functions be followed by a DEL (RUBOUT) character (c<sub>S</sub>?). At speeds above 1200 baud, additional DEL characters are required.

### C. FORM FILL-OUT APPLICATION

The Hazeltine 2000 has been designed with the "Form Fill-out" application in mind. Such features as fixed and variable data

fields, Batch mode, cursor addressing and full editing of data are aimed primarily at form fill-out.

The form itself is composed of fixed data fields, or what we term background data, and is displayed at a low intensity. Variable, or foreground data is entered from the keyboard and appears in a bright intensity. Foreground data may be edited and then transmitted to either a computer or other compatible storage device. Only the foreground data is transmitted to the computer. The computer or the operator may then clear the foreground data from the screen leaving the background form present for further entries.

The TAB key allows the operator to tab the cursor to the first foreground character of the next field.

#### D. SETTING UP A FORMAT

Once the screen is cleared, all character positions are filled with foreground spaces. It is therefore not necessary to write blanks in the variable entry fields. Only the form or background fields need be generated. If the form is to be sent to the display from an external source, each background field must then be addressed to its screen location by using the cursor address commands. The cursor address sequence is lead-in code, cursor address code, x-coordinate, y-coordinate.

In the following example, the user wished to generate a form on a system storage device using the keyboard of the Hazeltine 2000. He intends to play back this form from storage from time to time and once retrieved, he intends to fill it in.

```

                                COLUMN
                                0 1 2 3 4 5 6 7 8 9 - - - 43 44 45 46 47 48 49 - - - 73
Line 0  N A M E (1)                                P H O N E (2)
        1  A D D R E S S (3)
        2  C I T Y (4)                                S T A T E (5)
        3  C O M M E N T S (6)
```

There are 74 columns starting with column zero and going up to column 73. There are 27 lines, zero through 26.

The above layout may be rewritten in tabular form as shown below:

Field No.	Field Title	Column No.	Line No.
1	NAME	0	0
2	PHONE	45	0
3	ADDRESS	0	1
4	CITY	0	2
5	STATE	43	2
6	COMMENTS	0	3

The Cursor Address Chart indicates the necessary keystrokes to generate the ASCII characters for a given screen location determined by column and line number intersection. By referencing this chart, the above table can be expanded to appear as follows:

Field Title	Column	Keystroke	Line	Keystroke
NAME	0	cs @	0	cs @
PHONE	45	-	0	cs @
ADDRESS	0	cs @	1	c A
CITY	0	cs @	2	c B
STATE	43	+	2	c B
COMMENTS	0	cs @	3	c C

<sup>c</sup>Depress the Control key while striking the character.

<sup>cs</sup>Depress the Control and Shift keys while striking the character.

The user is now ready to key in the address of each field followed by the field title. Remember each address begins with a lead-in and cursor address character.

Field Number	User Types These Characters				
1	cs	c <sub>Q</sub>	cs @	cs @	NAME
2	cs	c <sub>Q</sub>	-	cs @	PHONE
3	cs	c <sub>Q</sub>	cs @	c <sub>A</sub>	ADDRESS
4	cs	c <sub>Q</sub>	cs @	c <sub>B</sub>	CITY
5	cs	c <sub>Q</sub>	+	c <sub>B</sub>	STATE
6	cs	c <sub>Q</sub>	cs @	c <sub>C</sub>	COMMENTS

If the Hazeltine 2000 was set to half duplex, the addressing of each field would have taken place while the user was keying in the format. If the mode was set to BATCH, all the keyed in characters would appear in a continuous string and the actual formatting would only take place when this string was played back to the terminal.

## APPENDIX I. TECHNICAL SUMMARY

MEMORY SIZE	2048 x 8
OPERATING MODES	Full duplex, half duplex or batch (by switch).
CHARACTER STRUCTURE	5 x 7 dot matrix, using standard 525 line TV raster.
CHARACTER REPERTOIRE	64 alpha-numerics and symbols. 32 ASCII control codes. All 128 ASCII codes can be keyed.
SCREEN CHARACTER CAPACITY	1998 characters. 74 characters per line. 27 lines per display.
EDITING FEATURES	Fifteen distinct operations from the keyboard, including character and line insert/delete. Twelve distinct operations under computer control, including backspace and nonstored carriage return.
SPLIT SCREEN	Two level video intensity is utilized to distinguish computer derived and protected data, which can be modified by the keyboard operator.
CURSOR ADDRESSABILITY	Program may direct the cursor to any character position on the screen simply by transmitting X-Y coordinates.
FORMATTING	Protected "Background" data may be held on screen while unprotected "Foreground" data is transmitted and cleared.
TAB FUNCTION	Provides instant cursor advance - horizontally, vertically or diagonally in fixed format operation.
STATUS LIGHTS	Five status lights are provided to indicate the operational state of the system.
REFRESH RATE	60 fields per second.
KEYBOARD	Teletypewriter design, plus 10 key numerics.

STANDARD INTERFACE (EIA RS-232B)	Acoustic coupler, TTY33-ASR, or appropriate data set.
TRANSMISSION RATES	3 standard selections available: (1) 110, 150, 300, 600, 1200 (2) 110, 300, 1200, 2400, 9600 (3) 110, 1200, 2400, 4800, 9600
POWER	350 Watts, 117VAC, 60 Hz. Single phase. Supply fully fused.
CIRCUIT PROTECTED	Integral overvoltage protection and short circuit current limiting with automatic shutdown.
SCREEN SIZE	12" diagonal.
ACCESSORIES	Magnetic Tape Cassette. Printer Unit. Remote Monitors.
WEIGHT WITH KEY-BOARD	62 lbs. (28.2 kg) - Serial #1000 to 10050 63 lbs. (28.6 kg) - Serial #12000 - higher
DIMENSIONS	Depth with keyboard: 22.0" (55.9 cm). Depth without keyboard: 16.0" (40.6 cm). Height: 12.5" (31.8 cm). Width: 18.5" (47.0 cm).

Interface Connector Signal/Pin List

<u>RS232 Pin No.</u>	<u>Circuit Symbol</u>	<u>Description</u>
1	AA	Protective Ground
2	BA	Transmit Data
3	BB	Receive Data
4	CA	Request to Send
5	CB	Clear to Send
6	CC	Data Set Ready
7	AB	Signal Return
8	CF	Data Carrier Detect
11	SA	Supervisory Transmit Data
12	SB	Supervisory Receive Data
14	SBA	Secondary Transmit Data
16	SBB	Secondary Receive Data
20	CD	Data Terminal Ready



## APPENDIX II. TECHNICAL DESCRIPTION

### A. GENERAL

The Hazeltine 2000 Video Display Terminal is a stand-alone alpha-numeric CRT Terminal, having the overall capability to display 1998 alpha-numeric characters, to provide local and command editing and to transmit and receive digital information at speeds up to 9600 baud and beyond.

### B. DISPLAY CHARACTERISTICS

1. Character Capacity            27 lines of characters; 74 characters per line; screen capacity - 1998 characters.
2. CRT Display                    12-inch diagonal CRT;  
Standard Raster - 525 lines  
  30 frames/sec.  
Optional Raster - 625 lines  
  25 frames/sec.
3. Character Style                5 x 7 dot matrix pattern.
4. Character Repertoire         64 USASCII alpha-numeric characters plus one special symbol.
5. Character Size                 Nominal character height - 0.119 inch (6-inch raster height).  
Nominal character width - 0.082 inch (8-1/2-inch line width).
6. Split Screen                    Two video intensities are available and can be controlled by the remote CPU. Full intensity is foreground and low intensity is background.

## C. COMMUNICATION INTERFACE

1. Data Transmission Rates      Standard - 110, 300, 1200, 2400, 9600 baud; Optional - 110, 1200, 2400, 4800, 9600 baud; Optional - 110, 150, 300, 600, 1200 baud.
  
2. Data Interface              EIA RS-232-C with:
  - (a) W. E. 103A type data set compatible
  - (b) W. E. 202C type data set compatible
  - (c) 8X baud rate clock (TTL level signal on pin 25 of the data set connector).

Front panel toggle switch permits channel turn around on EOT code or on CR code with supervisory channel control.

Data set cable is 10 feet long and fixed to the terminal. A Cinch or Cannon DB-25P connector is used.
  
3. Modes of Operation        Batch, Half duplex, Full duplex.

A three-position rotary switch on the front panel (under monitor) permits operational mode selection.
  
4. Parity                      Generates and checks parity. Four position rotary switch on front panel (under monitor) permits selection of:
  - (a) Odd parity
  - (b) Even parity
  - (c) Parity bit always a "one"
  - (d) Parity bit always a "zero"

## D. KEYBOARD

1. Solid State                The keyboard is shown in Figure 3. and contains three key groups:
  - (a) Teletypewriter arrangement
  - (b) Ten-key adding machine arrangement
  - (c) Thirteen-key editing and cursor control arrangement.

1. Solid State (cont.)      The Keyboard enclosure also contains the following:

Indicators:

- (a) Transmit
- (b) Print

Pushbuttons:

- (a) Power on/off
- (b) Break
- (c) System Reset

Indicator/pushbutton combinations:

- (a) Receive mode indicator/set to Receive and Local mode
- (b) Local mode indicator/set to Local mode only
- (c) Parity error indicator/Reset Parity error indicator.

2. Keyboard is Removable      An additional power on/off switch is on the front panel of the display for power turn-on when keyboard is removed.

#### E. POWER REQUIREMENTS

1. Primary Power      350 VA maximum, 50 hertz or 60 hertz, 115/230 volts nominal.  
Low: 90/180 - 110/220 VAC  
Medium: 104/208 - 126/250 VAC  
High: 114/224 - 136/272 VAC

2. Circuit Protection      D. C. Power supply shuts down automatically for over-voltage, short circuits or over-temperature condition. Power supply may be reset by turning primary power off for fifteen seconds.

#### F. ENVIRONMENTAL

1. Temperature      10<sup>0</sup> to 40<sup>0</sup>C
2. Humidity      90% Relative Humidity - non-condensing

### G. PHYSICAL CHARACTERISTICS (nominal)

1. Dimensions with Keyboard 12.5 in. (31.8 cm)H; 18.5 in. (47.0 cm)W; 22.0 in. (55.9 cm)D
2. Keyboard Removed 16 in. (40.6 cm)D
3. Keyboard Dimensions 2.8 in. (7.1 cm)H; 18.5 in. (47.0 cm)W; 6.1 in. (15.6 cm)D
4. Weight with Keyboard 62 lb. (28.2 kg) - Serial #1000 to 10050  
63 lb. (28.6 kg) - Serial #12000 higher  
571b. (25.9kg)-Serial #22000 higher
5. Electrical Cable/Connector Interfaces:
  - a. Keyboard to Display 5 foot (1.52 meters) cable from keyboard terminated with 54 pin HDR-series connector (AMP-Inc.). Mating connector on Display rear panel.
  - b. Display to Data Set 10 foot (3.05 meters) cable from Display terminated with DB25-P connector (Cannon or Cinch).
  - c. Display to Printer 54 pin HDR-series connector (AMP-Inc.) on Display rear panel.
  - d. Display to Tape Cassette 54 pin HDR-series connector (AMP-Inc.) on Display rear panel.
  - e. Display to Remote Monitor 14 pin Series "M" connector (AMP-Inc.) on Display rear panel.
  - f. Display to Power Source 7 foot (1.78 meters) cable, 3 wire, fixed to Display (50 Hz equipments have no connector, 60 Hz equipments have molded 3 conductor plugs).

### H. SUMMARY OF FUNCTIONS

The following table provides a list of functions, where they can be initiated, modes required, and a description of the operation.

FEATURE/ KEY	EXECUTE FROM		MODE		DESCRIPTION
	CPU	KB	BATCH	HALF/ FULL	
Insert Line	x	x	x	x	Insert a line of blanks where the cursor is positioned and roll down all data beneath the cursor by one line.
Delete Line	x	x	x	x	Line of data at cursor disappears and all data beneath the cursor rolls up one line.
Insert Character		x	x		Advance all characters from the cursor position to the end of the foreground field by one character position and display new character at the cursor location.
Delete Character		x	x		Erase the character at the cursor and move all data in the foreground field to the right of the cursor backwards one character position.
Clear Screen	x	x	x	x	Erase all data on the screen.
Clear Foreground	x	x	x	x	Erase all full intensity data only.
Home Cursor (see note)	x	x	x	x	Move cursor to upper left hand corner of screen.
Address Cursor	x		x	x	Cursor positioned, not incremented, to the X, Y coordinates designated by the CPU.
Print	x	x	x	x	Transfers all data entered since previous Print to hard copy device.

FEATURE/ KEY	EXECUTE FROM		MODE		DESCRIPTION
	CPU	KB	BATCH	HALF/ FULL	
Transmit	x	x	x		Send all high intensity data entered since previous transmission.
Set Foreground	x		x	x	All data from the CPU following "Set Foreground" command is displayed at full intensity.
Set Background	x		x	x	All data from the CPU following "Set Background" command is displayed at the lower intensity.
Cursor Controls		x	x	x	Move cursor up, down, right, and left without altering any data.

Note: Cursor addressing can be performed from the Keyboard in half duplex mode and would normally be used for designing formats, etc.



## APPENDIX III. CHARACTER CODE CHART

b4	b3	b2	b1	ROW
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15

CONTROL	
0 <sub>0</sub> 0	0 <sub>0</sub> 1
0	1
NUL	DLE
SOH	CURSOR *
STX	HOME *
ETX	DLT/LNE *
EDT	DC4
ENQ	NAE
ACK	SYN
BEL	ETB
BS	CAH
HT	BACKGND *
LF	INS/LNE *
VT	ESC
FF	CLEAR *
CR	CLR/FG *
XMIT	PRINT *
SI	FOREGND *

DISPLAYABLE CHARACTERS			
0 <sub>1</sub> 0	0 <sub>1</sub> 1	1 <sub>0</sub> 0	1 <sub>0</sub> 1
2	3	4	5
SP	0	@	P
:	1	A	Q
*	2	B	R
#	3	C	S
\$	4	D	T
%	5	E	U
&	6	F	V
'	7	G	W
(	8	H	X
)	9	I	Y
*	:	J	Z
+	;	K	[
,	<	L	\
-	=	M	]
.	>	N	^
/	?	O	_

NON DISPLAYABLE	
1 <sub>1</sub> 0	1 <sub>1</sub> 1
6	7
XMIT SYMBOL	p
a	q
b	r
c	s
d	t
e	u
f	v
g	w
h	x
i	y
j	z
k	{
l	}
m	
n	LEAD-IN **
o	DEL

### \*REMOTE COMMAND CODES FOR HAZELTINE 2000

Key Stroke	ASCII Symbol	2000-Function	Key Stroke	ASCII Symbol	2000-Function
C <sub>N</sub>	S0	TRANSMIT	C <sub>Z</sub>	SUB	INSERT LINE
C <sub>Q</sub>	DC1	ADDRESS CURSOR	C <sub>L</sub>	FS	CLEAR SCREEN
C <sub>R</sub>	DC2	HOME CURSOR	C <sub>M</sub>	GS	CLEAR FOREGROUND
C <sub>S</sub>	DC3	DELETE LINE	C <sub>N</sub>	RS	PRINT
C <sub>Y</sub>	EM	BACKGROUND FOLLOWS	C <sub>O</sub>	US	FOREGROUND FOLLOWS
C <sub>M</sub>	CR	CARRIAGE RETURN	C <sub>R</sub>	BS	BACKSPACE CURSOR

\*EVERY REMOTE FUNCTION MUST BE PRECEDED BY A LEAD IN CODE KEY STROKE = CONTROL, SILENT PERIOD

## APPENDIX IV. CURSOR ADDRESS CHART

Bit Pattern $b_7 \dots b_1$	Dec. Value	ASCII Char.	Key Stroke	Coordinates	
				Col. No. (X)	Line No. (Y)
0000000	0	NUL	$c^S_e$	0	0
0000001	1	SOH	$c^A$	1	1
0000010	2	STX	$c^B$	2	2
0000011	3	ETX	$c^C$	3	3
0000100	4	EOT	$c^D$	4	4
0000101	5	ENQ	$c^E$	5	5
0000110	6	ACK	$c^F$	6	6
0000111	7	BEL	$c^G$	7	7
0001000	8	BS	$c^H$	8	8
0001001	9	HT	$c^I$	9	9
0001010	10	LF	$c^J$	10	10
0001011	11	VT	$c^K$	11	11
0001100	12	FF	$c^L$	12	12
0001101	13	CR	$c^M$	13	13
0001110	14	SO	$c^N$	14	14
0001111	15	SI	$c^O$	15	15
0010000	16	DLE	$c^P$	16	16
0010001	17	DC1	$c^Q$	17	17
0010010	18	DC2	$c^R$	18	18
0010011	19	DC3	$c^S$	19	19
0010100	20	DC4	$c^T$	20	20
0010101	21	NAK	$c^U$	21	21
0010110	22	SYN	$c^V$	22	22
0010111	23	ETB	$c^W$	23	23
0011000	24	CAN	$c^X$	24	24

Bit Pattern b <sub>7</sub> ... b <sub>1</sub>	Dec. Value	ASCII Char.	Key Stroke	Coordinates	
				Col. No. (X)	Line No. (Y)
0011001	25	EM	<sup>c</sup> Y	25	25
0011010	26	SUB	<sup>c</sup> Z	26	26
0011011	27	ESC	<sup>CS</sup> K	27	
0011100	28	FS	<sup>CS</sup> L	28	
0011101	29	GS	<sup>CS</sup> M	29	
0011110	30	RS	<sup>CS</sup> N	30	
0011111	31	US	<sup>CS</sup> O	31	
0100000	32	SP	SP	32	0
0100001	33	!	!	33	1
0100010	34	"	"	34	2
0100011	35	#	#	35	3
0100100	36	\$	\$	36	4
0100101	37	%	%	37	5
0100110	38	&	&	38	6
0100111	39	'	'	39	7
0101000	40	(	(	40	8
0101001	41	)	)	41	9
0101010	42	*	*	42	10
0101011	43	+	+	43	11
0101100	44	,	,	44	12
0101101	45	-	-	45	13
0101110	46	.	.	46	14
0101111	47	/	/	47	15
0110000	48	0	0	48	16
0110001	49	1	1	49	17
0110010	50	2	2	50	18
0110011	51	3	3	51	19
0110100	52	4	4	52	20

Bit Pattern $b_7 \dots b_1$	Dec. Value	ASCII Char.	Key Stroke	Coordinates	
				Col.No.(X)	Line No.(Y)
0110101	53	5	5	53	21
0110110	54	6	6	54	22
0110111	55	7	7	55	23
0111000	56	8	8	56	24
0111001	57	9	9	57	25
0111010	58	:	:	58	26
0111011	59	;	;	59	
0111100	60	<	<	60	
0111101	61	=	=	61	
0111110	62	>	>	62	
0111111	63	?	?	63	
1000000	64	@	@	64	0
1000001	65	A	A	65	1
1000010	66	B	B	66	2
1000011	67	C	C	67	3
1000100	68	D	D	68	4
1000101	69	E	E	69	5
1000110	70	F	F	70	6
1000111	71	G	G	71	7
1001000	72	H	H	72	8
1001001	73	I	I	73	9
1001010	74	J	J		10
1001011	75	K	K		11
1001100	76	L	L		12
1001101	77	M	M		13
1001110	78	N	N		14
1001111	79	O	O		15
1010000	80	P	P		16

Bit Pattern $b_7 \dots b_1$	Dec. Value	ASCII Char.	Key Stroke	Coordinates	
				Col. No. (X)	Line No. (Y)
1010001	81	Q	Q		17
1010010	82	R	R		18
1010011	83	S	S		19
1010100	84	T	T		20
1010101	85	U	U		21
1010110	86	V	V		22
1010111	87	W	W		23
1011000	88	X	X		24
1011001	89	Y	Y		25
1011010	90	Z	Z		26
1011011	91	[	[		
1011100	92	\	\		
1011101	93	]	]		
1011110	94	↑	↑		
1011111	95	←	←		
1100000	96	`	$c_{SP}$	0	0
1100001	97	a	$cs_1$	1	1
1100010	98	b	$cs_2$	2	2
1100011	99	c	$cs_3$	3	3
1100100	100	d	$cs_4$	4	4
1100101	101	e	$cs_5$	5	5
1100110	102	f	$cs_6$	6	6
1100111	103	g	$cs_7$	7	7
1101000	104	h	$cs_8$	8	8
1101001	105	i	$cs_9$	9	9
1101010	106	j	$cs_{:}$	10	10
1101011	107	k	$cs_{,}$	11	11
1101100	108	l	$c_{,}$	12	12

Bit Pattern b <sub>7</sub> ... b <sub>1</sub>	Dec. Value	ASCII Char.	Key Stroke	Coordinates	
				Col. No. (X)	Line No. (Y)
1101101	109	m	c <sub>-</sub>	13	13
1101110	110	n	c <sub>.</sub>	14	14
1101111	111	o	c <sub>/</sub>	15	15
1110000	112	p	c <sub>0</sub>	16	16
1110001	113	q	c <sub>1</sub>	17	17
1110010	114	r	c <sub>2</sub>	18	18
1110011	115	s	c <sub>3</sub>	19	19
1110100	116	t	c <sub>4</sub>	20	20
1110101	117	u	c <sub>5</sub>	21	21
1110110	118	v	c <sub>6</sub>	22	22
1110111	119	w	c <sub>7</sub>	23	23
1111000	120	x	c <sub>8</sub>	24	24
1111001	121	y	c <sub>9</sub>	25	25
1111010	122	z	c <sub>:</sub>	26	26
1111011	123	{	c <sub>;</sub>	27	
1111100	124	'	cs <sub>,</sub>	28	
1111101	125	}	cs <sub>-</sub>	29	
1111110	126	(Lead in)	cs <sub>.</sub>	30	
1111111	127	DEL	cs <sub>/</sub>	31	

Note:

As indicated by the above chart, cursor addresses can be selected from the lower case ASCII set to avoid conflicts that may be caused by addresses selected from the control set.

It is recommended that X coordinates start with decimal value 96 and proceed through 127 to yield screen addresses of 0 through 31. Addresses 32 through 73 may be taken directly from their decimal equivalents. Similarly, Y coordinates should be selected from values 96 through 122 to yield screen addresses of 0 through 26.

