HZ Hazeltine ESPRIT Terminal Emulator

AutoMate 35 Version

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Services Inc.

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HZ Terminal Emulator

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1 About HZ

HZ is a terminal emulator program for the IBM PC and compatibles. It emulates a Hazeltine ESPRIT video display terminal; nearly all of the control commands permitted by the ESPRIT's Hazeltine mode are emulated by HZ.

HZ was specifically designed to be used as a terminal for the Reliance Electric AutoMate 35 programmable controller. The emulator program has several features and extensions specifically designed to work with the A35 including a program file transfer mode.

1.1 HZ's System Requirements

HZ will run on the IBM PC and on most compatibles. It needs PC-DOS 2.11 or later, one serial communications port, 256K of RAM, and one floppy disk drive or a hard disk. A cable is also needed to connect with the AutoMate 35.

HZ supports both Monochrome and Color displays. By default, HZ uses colors appropriate for a monochrome display. However, the user may select the display colors and attributes used during conversation with the AutoMate. Please refer to the section 3 for more information on color preference selection.

1.2 Running HZ

To start HZ, simply connect the PC's serial port to the AutoMate and type:
        HZ <Enter>
at the DOS prompt.

The screen will clear and a signon banner will be displayed. When you first start HZ, you will be in online mode using the default communications parameters. You should begin by setting the correct parameters, as well as your color preferences and other information. To do this, press the F3 function key to bring up the Setup screen. Section 3 provides complete instructions for performing Setup.

Note: Do not write protect the HZ floppy disk if you intend to change the Setup options or capture data from the A35!

1.3 Conversation

Once HZ has displayed the signon banner, a white status line will appear across the bottom of the screen. Initially, the status line will contain only the word "Line", indicating that you are in Conversation Mode.

In Conversation Mode, anything you type will be sent directly to the AutoMate via the serial link. Any characters transmitted by the AutoMate will be interpreted and displayed on the screen.

Since you will probably use Conversation Mode most of the time, you may select all of HZ's functions from Conversation Mode. These special features (such as Buffered Transmission, AutoMate Program Transfer, Setup, etc.) are generally called up using function keys. For example, pressing **<F3>** in Conversation Mode brings up the Setup display.

To see a "quick reference" display that shows all of the features assigned to function keys, press F1 while in Conversation Mode.

1.4 Leaving HZ

To leave HZ and return to DOS, press function key F10 while in Conversation Mode. HZ will reply:

```
        Exit.  Are you sure ?
```

Type 'Y' to exit HZ, or 'N' to return to the current HZ session.

2 Copy Protection

Unfortunately, software piracy is a problem that plagues all program developers: the temptation to copy an unprotected disk is great, and there is little actual danger to the pirate. But copy protection often offends users and sometimes involves unnecessary "hassles". In order to keep everyone honest with a minimum of trouble for the user, ACS has decided to issue all of its products on diskettes protected by Vault Corporation's PROLOK copy protection system.

The PROLOK system places a permanent code "fingerprint" on each diskette. When you call up a protected program, PROLOK checks to make sure that a diskette containing the correct fingerprint is found in one of the system's floppy disk drives. Once the fingerprint has been located, the program begins executing. The PROLOK system only affects the operation of a protected program when you first load it. After the program is running, you may remove the original distribution diskette.

Make a Backup Copy! You can make a backup copy of the information on the distribution diskette, and in fact, we recommend that you do so. If you destroy the information on the distribution diskette, you can reformat the original diskette and restore the files from the backup. Note, however, that programs on the backup disk will not run.

Note: Do <u>not</u> use the PC-DOS `DISKCOPY` command to copy a protected diskette! You will get a whole series of errors. Make the backup copy using the `COPY` command instead: Format a blank disk and `COPY *.*` from the original disk to the backup.

Note: You must not place a write protect tab on the distribution diskette when you try to run the software. You will get an error if you do so.

2.1 Floppy Disk Systems

For floppy disk systems, we recommend that you start up your PC with a system (DOS 2.11 or later) diskette in Drive A and the HZ Diskette in Drive B. To run, simply switch to Drive B and type:
HZ ⏎Enter⏎

2.2 Hard Disk Systems

If you are using a hard disk system, there are three different ways that you can use protected software. First, you can leave the ACS program files on the diskette and load them as needed. This method guarantees that the fingerprinted diskette will be in the drive when PROLOK does its verify operation.

The second method is a compromise: load the ACS program files into a directory on your hard disk (they must all be in the same directory) and make sure that the distribution diskette is in one of the floppy drives when you want to run an ACS program. This method saves wear and tear on the distribution diskette and means that the programs will load faster.   However, if you forget to leave the original diskette in one of your floppy drives, you will get the message "Unauthorized Duplicate" when you try to call up an ACS program.

The last method is the simplest to use. On the distribution diskette you will find a file "HDUTIL.EXE". HDUTIL is a menu-driven program that allows you to install or uninstall the fingerprint code on your hard disk. If you have installed a fingerprint on your hard disk drive, you can copy the ACS program files into a directory on the drive and use them just like unprotected software; you don't need to put the distribution diskette in at all.

Installing on a Hard Disk. To install the Terminal Emulator on your hard disk, you will need the original distribution disk.

Place the original HZ Disk in Drive A. Type "A: Enter" to change the current drive to A, then type:

```
HDUTIL  Enter
```

After a few moments, a menu will appear. Among the menu choices is letter 'I' for Install. Choose this option. HDUTIL will prompt you for any information that it needs. Note that the install operation may take up to five minutes.

Eventually, the message "Install Completed Successfully" will appear. Press any key to return to the menu, then letter 'E' to exit to DOS.

Uninstalling the Software. To uninstall the software, simply perform the same procedure as for Installation, except choose letter 'U' for Uninstall. You should Uninstall the software before reformatting your Hard Disk, or if you wish to install it on another computer.

3 The Setup Screen

HZ has many parameters and options. Some parameters <u>must</u> be set before you can begin using HZ. Others may be set to tailor HZ's operation to your own preferences.

When you use HZ for the first time, it assumes certain defaults until you change them. These defaults should at least permit you to communicate with the A35, but you will probably want to modify them from time to time.

After you change the program setup, your new choices will be saved in a file called HZ.CFG. At the beginning of each session, the emulator reads in the HZ.CFG file from the current directory and sets the operating parameters according to your last choices.

If HZ cannot find the configuration file, it returns to the original defaults.

To activate Setup mode, press the **<F3>** function key while you are on the conversation screen.

In Setup mode, the current values of all the operating parameters are visible. Each parameter is labeled with a code letter and a text description. For example, the "communications port" option, which selects the serial port the HZ will use, is shown:

```
C  Comm Port     COM1
```

This means that the communications port option is code letter C, and that the current value is COM1.

To change a parameter, type its code letter. A highlight will appear over the option. You may then select the desired value with the Up and Down arrow keys on the PC's numeric keypad. Be sure that the "Num Lock" key is not active when trying to select Setup options.

Once the correct value has appeared under the highlight, press Enter to select it. You may cancel the operation by pressing **<Esc>**. If you cancel a change with the **<Esc>** key, the old value will reappear.

To leave the Setup display, press the **<Enter>** key. This will cause new option values to take effect on the Conversation screen. It will also save them in the HZ.CFG file for the next session.

You may also discard any changes you have made by pressing **<Esc>**. If you do so, the options will remain as they were before you entered the Setup screen. No change will be made to the HZ.CFG file.

Here are the setup options that you may select:

3.1 Communications Options

These options determine the serial port configuration that will be used when communicating with the AutoMate. You should take care to see that these options are set correctly; unlike most of the other options, an error in this section will make communications with the AutoMate impossible.

3.1.1 C   :   Communications Port

Select either COM1 or COM2. Defaults to COM1.

3.1.2 B   :   Baud Rate

You may choose from: 110, 150, 300, 600, 1200, 2400, 4800, or 9600. Normally, you will probably use the default rate of 9600 baud.

3.1.3 P   :   Parity

Select odd parity, even parity, or no parity (the default).

3.1.4 N   :   Number of data bits

You may use a data word of seven or eight bits. You <u>must</u> use an 8 bit data word when transferring programs to and from the AutoMate in STR-LINK mode. The default is set to seven bits, since the AutoMate 35 normally expects 7 bit words on Port 1.

3.1.5 S   :   Number of Stop Bits

Normally, this option should be left set at the default of 1 stop bit. You should only use 2 stop bits on very slow transmissions (less than 600 baud) over poor communications links.

3.2 Video Options

These options determine how text is displayed. You may select separate attributes for the Hazeltine "Foreground" and "Background" modes.

As you adjust the video attributes, the two "sample" lines will reflect the changes. Experimentation will show what the best choices are for your particular computer.

Changes to the video attributes take effect <u>after</u> you leave the Setup screen by pressing **<Enter>**. Characters displayed before the attribute change will <u>not</u> be affected.

3.2.1 U   :   Update Mode

The "update mode" option determines how HZ interacts with your video adapter card. There are three choices:

- **Direct Mode**. This is the default. In direct mode, HZ reads and writes directly to the display memory. Direct mode gives the fastest screen updates, but it may cause some "hashing" on certain color displays. Some laptop computers may not display at all in this mode.

- **Retrace Mode**. In retrace mode, HZ still writes directly to the display memory. However, it waits for the "vertical retrace" signal from the video adapter before placing characters on the screen. If your color display exhibits "hashing" during screen updates, try Retrace Mode.

  <u>Warning!</u> Do not use Retrace Mode on computers with non-CRT displays. Most laptops, for example, emulate an IBM display fairly well, but they rarely provide

retrace signal emulation. If no retrace signal appears, HZ will "hang up" without displaying anything. If this happens, reset your computer and delete the HZ.CFG file. HZ will then start up in the default mode (Direct).

- **BIOS Mode**. BIOS Mode is the "slow but sure" choice. In this mode, HZ uses IBM's ROM BIOS routines for screen display. It never writes directly to the video memory. This may be the only way to get HZ to work with non-compatible computers or display adapters.

3.2.2 F : Foreground Color

When you are in conversation mode with the AutoMate 35, it may choose to display text in either "Foreground" or "Background" colors.

This option allows you to select the color that HZ uses for "Foreground" text display. Foreground is used to distinguish user input fields from prompting text, which is usually shown in "Background".

You may choose from Black, Blue, Green, Cyan, Red, Magenta ("Magta."), Yellow ("Yel."), or White. On a Monochrome display, only White and Black are usually visible.

3.2.3 G : Foreground Background

This seemingly contradictory option permits you to select the background color against which Hazeltine "Foreground" text is shown. In other words, you can use the 'F', 'G', and 'H' options in combination to select one set of attributes for "Foreground" text. As an example, you might choose to have Foreground text shown as White letters ('F' command) on a Blue background ('G' command). A little experimentation with these three options will quickly clarify their operation.

3.2.4 H   :   Foreground Attributes

In addition to foreground and background colors, "Foreground" text may also be underlined, blinking, high-intensity, or any combination of the three. The exact effect of these attributes depends on your display adapter. In general, though, "underline" has no effect on color displays.

The current value of this option is shown as a string of three letters. For example, "BHU" means Blinking, High-intensity, and Underline.

3.2.5 I   :   Background Color

The 'I', 'J', and 'K' commands are analogous to the 'F', 'G', and 'H' commands, except they affect Hazeltine "Background" text. In other words, the 'I' command selects the text color used when the AutoMate has selected "Background" mode. For a more information, see section 3.2.2.

Background text is generally used for non-modifiable prompts, since HZ skips over background text when the Tab key is pressed.

3.2.6 J   :   Background Background

Sets the background color against which Hazeltine "Background" characters are displayed. See section 3.2.3.

3.2.7 K   :   Background Attributes

Sets blinking, underline, and high-intensity attributes for "Background" text. Refer to section 3.2.4.

3.2.8 L   :   Cursor

You may alter the cursor that HZ uses on the Conversation screen. The choices are: None (probably not much use), Thin, Normal, Fat, Block, and Dash. As you move through the choices with the arrow keys, the screen cursor will change to reflect your changes.

3.3 Miscellaneous Options

This section contains the options that don't fit into the other categories.

3.3.1 A   :   Auxiliary Device

HZ supports the use of an Auxiliary device. This device receives output when enabled by software or keyboard command. You may wish to use the Aux device to capture printouts from the AutoMate.

The Aux device defaults to PRN, the PC-DOS printer device. To change it, press 'O' and type a new file or device name and press Enter. Pressing Esc will cancel the change.

Once you have changed the Aux device, all output sent to the Auxiliary port will be appended to the new file or device.

Pressing 'O' followed immediately by **<Enter>** resets the Auxiliary Device to PRN. The old Aux device will be closed.

3.3.2 N   :   End-of-Message Character

This option selects the character used by HZ to end a message. The end-of-message character is transmitted after the reply to certain control commands. You may use CR (Hex 0D, Octal 015), ETX (Hex 03, Octal 003), EOT (Hex 04, Octal 004), or NUL (0).

3.3.3 X   :   Lead-In Character

The Lead-In character is transmitted by the AutoMate to indicate that a command string follows. This should usually be left at the default, which is ESC (Hex 1B, Octal 033). However, you may also choose the tilde ('~', Hex 7E, Octal 176).

3.3.4 O   :   Automatic Linefeed

This option determines what HZ does when it receives or transmits a Carriage Return (CR). If Auto-LF is enabled, a linefeed (LF, Hex 0A, Octal 012) will be transmitted with every Carriage Return (sent by typing Enter). Further, incoming linefeeds will be filtered out.

When Auto-LF is off, a newline sequence (CR followed by LF) must be sent to shift the cursor to the next line. When Auto-LF is on, a simple Carriage Return will start a new line.

4 The Status Line

When you are using HZ, a white status line appears across the bottom line of the display. This line is intended to provide you with information about HZ's status and operation.

Just after you start HZ, the status line will contain only the word "Line", indicating that you are connected to the AutoMate. Here are the other symbols that may appear in the Status Line:

4.1 Line / Local

Indicates HZ's connect status. "Line" means you are connected to the AutoMate, and any characters you type will be sent via the serial port.

"Local" means that the PC keyboard is "looped back" to HZ's input stream. In Local mode, you can experiment with command sequences by typing them and watching what happens.

To toggle Local mode, press function key **<F2>** in Conversation Mode.

4.2 Keyboard Lock

The word "Lock" will appear in the Status Line if the AutoMate has locked the keyboard. The keyboard will remain locked until the A35 transmits an "Unlock Keyboard" command.

If you need to override a locked keyboard, you can type **<Ctrl-F2>**, which will cancel Keyboard Lock.

4.3 Keypad Mode

There are four keypad modes available. The AutoMate selects the keypad mode by sending command strings. The default keypad mode sends straight ASCII digits when the Num Lock key is engaged; no symbol is shown in the status line for Default Mode.

If the A35 has selected a non-default keypad mode, a symbol will appear indicating the

keypad mode: KP1, KP2, or KP3.

4.4 Block Mode

If HZ is in block mode, the word "Block" will appear in the Status Line. See section 6.2 for more information on Block Mode.

4.5 Line Mode

When HZ is in block mode, the A35 can also select Line Mode. If Line Mode is active, the symbol "LnM" will be shown in the Status Line.

4.6 Auxiliary Status

If the symbol "Aux" is visible, characters received at the serial port are being copied to the Auxiliary Device. See section 3.3.1 for information on how to select the Auxiliary Device, and section 7 for
a general description of the Auxiliary Device.

You may toggle the current Aux status by pressing the **<F4>** function key: if Auxiliary Output is off, **<F4>** will turn it on, and vice versa.

If the incoming stream is being <u>diverted</u> (not copied) to the Auxiliary Device, the message "Input diverted to Aux > " followed by a character count will replace the Status display. Section 7 describes Auxiliary Diversion in detail.

4.7 Lock Status

As a convenience to users who have no Lock Status lamps on their keyboards, HZ shows the current Lock Status in the extreme lower right corner of the screen. A simple letter code is used: 'C' means Caps Lock is active, 'N' means Num Lock, and 'S' means Scroll Lock.

For example, if "CN" shows in the lower right hand corner, both Caps Lock and Num Lock are active.

Num Lock status is extremely important as it determines whether the keypad buttons send cursor codes or keypad codes.

5 The Keyboard

In Conversation Mode, the keyboard sends characters directly to the serial port. The characters will only be displayed if the AutoMate returns (echoes) them.

The letter and number keys send their ASCII equivalents. The numeric keypad buttons send two different sets of codes. When the Num Lock key is engaged, the numeric keypad sends Hazeltine keypad codes. When the Num Lock key is <u>not</u> engaged, the keypad sends Hazeltine cursor movement commands.

Note that the AutoMate 35 normally expects digits (keypad codes) from the keypad. In other words, you will generally want Num Lock turned on when working with the A35, especially when editing ladders.

You may temporarily suspend Num Lock mode by pressing the Shift key. In other words, if you have engaged Num Lock, you can still send cursor movement codes by pressing Shift and the desired key. For example, in Num Lock mode, pressing Shift-Left Arrow sends a "Cursor Left" command.

> **Important Note!** The A35 "Mode" key is replaced by ⌨Esc⌨ in the Terminal Emulator

You will probably want to switch back and forth between the cursor movement keys and keypad keys fairly frequently. In order to prevent endless toggling of Num Lock mode, HZ has duplicate cursor keys on the function keypad.

When you are in Num Lock mode, you may send cursor-movement commands with the following function keys: F3 = UP, F5 = DOWN, F7 = LEFT, F8 = RIGHT. This arrangement should be easy to remember on the standard IBM keyboard.

Table 1 contains the codes sent by the keypad:

Table 1 : Keypad Codes

<u>Key</u>	<u>Default</u>	<u>Mode</u> 1	<u>Mode</u> 2	<u>Mode</u> 3
0	0	LI 0	STX 0 CR	LI ? p
1	1	LI 1	STX 1 CR	LI ? q
2	2	LI 2	STX 2 CR	LI ? r
3	3	LI 3	STX 3 CR	LI ? s
4	4	LI 4	STX 4 CR	LI ? t
5	5	LI 5	STX 5 CR	LI ? u
6	6	LI 6	STX 6 CR	LI ? v
7	7	LI 7	STX 7 CR	LI ? w
8	8	LI 8	STX 8 CR	LI ? x
9	9	LI 9	STX 9 CR	LI ? y
*	*	LI -	STX . CR	LI ? n
-	-	LI ,	STX , CR	LI ? l
+	+			LI ? M
.	.	LI .	STX . CR	LI ? n
Home	LI DC2	LI DC2	LI DC2	LI DC2
Left	BS	BS	BS	BS
Right	DLE	DLE	DLE	DLE
Up	LI FF	LI FF	LI FF	LI FF
Down	LI VT	LI VT	LI VT	LI VT

<u>Note</u>: In this and all tables, the code "LI" means the user-selected Leadin code. See section 3.3.3 for more information on the Leadin code. Other codes shown are standard ASCII definitions.

To send a "Break" signal to the serial port, press Alt and B together. This will send a Break signal lasting 200 to 250 milliseconds.

There are also other keys on the PC keyboard that send control codes to the serial port. Table 2 contains a list of these other codes. In this table, you may notice that some key names are preceded by a lower case 's', 'c', or 'a'. These code letters mean that you must hold down (respectively) the Shift, Ctrl, or Alt key along with the indicated key in order to send the code shown. For example, the key symbol "sF4" means "Press Shift and F4 together". The symbol "aF6" means "Press Alt and F6 together".

Some keys are also preceded by a '#' sign. This means that the key sends the code shown when Num Lock is engaged. You can send specific control codes by holding down the Ctrl key and a letter, just as with the Hazeltine. These control codes are sent directly via the serial port.

Table 2 : Key Codes

Key	Command	Code	Octal
Bksp	Backspace	BS	010
cBksp	Rubout	DEL	177
Tab	Tab	HT	011
sTab	Rev Fld Tab	LI DC4	024
#F3	Cursor Up	LI FF	014
#F5	Cursor Down	LI VT	013
F6	Clr Field	LI SYN	026
sF6	Clr Foregd	LI GS	035
cF6	Clr EOL	LI SI	017
aF6	Clr EOS	LI ETB	027
#F7	Cursor Left	BS	010
#F8	Cursor Right	DLE	020
sF8	Ins Line	LI SUB	032
cF8	Del Line	LI DC3	023
F9	Home	LI DC2	022
sF9	Clear	LI FS	034

6 Hazeltine Control Sequences

HZ has been designed to emulate the Hazeltine ESPRIT terminal's control sequences. This means that there is a large selection of command sequences that the AutoMate can send to manipulate HZ's display.

This manual assumes that you are basically familiar with the Hazeltine protocol. Accordingly, Table 3 lists in short form all of the Hazeltine remote sequences accepted by HZ. Where appropriate (usually where the HZ command differs from the original), a reference to an HZ manual section is included. These are especially important for HZ's extensions, which are essentially additions to the ESPRIT protocol. Extensions are flagged with an asterisk.

The explanation sections follow Table 3.

Table 3 : Command Sequences

Command	Code	Octal	Notes
Cursor Home	LI DC2	022	
Cursor Up	LI FF	014	
Cursor Down	LI VT	013	
Cursor Left / Back-space	BS	010	
Cursor Right	DLE	020	
Line Feed	LF	012	
Carriage Return	CR	015	
Direct Cursor Address	LI DC1 x y	021	x and y are encoded row and column

Send Cursor Address	LI ENQ	005	
Send Character at Cursor Address	LI !	041	
Clear Screen Fgd	LI FS	034	
Clear to End of Screen Fgd	LI CAN	030	
Clear EOS Bgd	LI ETB	027	
Clear to End of Line Fgd	LI SI	017	
Clear Field	LI SYN	026	
Clear Foreground	LI GS	035	
Insert Line	LI SUB	032	Inserted line is fgd
Delete Line	LI DC3	023	New bottom line is fgd
Set Background	LI EM	031	
Set Foreground	LI US	037	
Field Tab	HT	011	
Horizontal Tab	LI :	072	
Reverse Field Tab	LI DC4	024	

Alarm	BEL	007	
Keyboard Unlock	LI ACK	006	Also Ctrl-F2
Keyboard Lock	LI NAK	025	
Set Keypad 0	LI >	076	(Default)
Set Keypad 1	LI ;	073	
Set Keypad 2	LI <	074	
Set Keypad 3	LI =	075	
Display 'H' Test Pattern	LI "	042	
Display ASCII Test Pattern	LI 8	070	
Enable Auxiliary Port WITH Display	LI /	057	Section 7
Enable Auxiliary Port WITHOUT Display	LI *	052	Section 7
Disable Auxiliary Output	LI ?	077	Section 7
Set Block Mode	LI #	043	Section 6.2
Cancel Block Mode	LI $	044	Section 6.2

Remote Page Trans-mit	LI SO	016	
* Remote Page Transmit, Delimited	LI R	122	Section 6.1
Remote Field Trans-mit	LI)	051	
* Load Screen	LI S x	123	Section 6.3
* Set User Color	LI C dh dl	103	Section 6.4
* Resume User Color	LI D	104	Section 6.5

Here are the command explanation subsections:

6.1 Remote Page Transmit, Delimited

When HZ receives this command (LI R), it will scan the current screen contents from top to bottom. The contents of each field will be transmitted, followed by a Carriage Return (and a Linefeed if Auto-LF is enabled). The normal Remote Page Transmit command does not place a CR delimiter between fields, which can make it difficult to separate the field values.

6.2 Block Mode

HZ's block mode is purposely designed to operate slightly differently from the Hazeltine's Block Mode. We hope the changes will make HZ easier to use with a PLC, while providing the PLC with a powerful input tool.

Block mode is intended for use with the Load Screen and Remote Page Transmit directives. When the AutoMate places HZ into Block Mode, HZ enters the equivalent of "Local" mode, echoing the user's keyboard commands immediately back. The operator can then enter and edit the data in all of the foreground fields on the screen.

When he has completed his changes, he can press **<Enter>** or **<Esc>**. These are the only characters the A35 should expect after entering Block mode. Normally, if the user pressed **<Enter>**, the A35 can assume that the screen data is valid, and read it in when time permits. If the user pressed **<Esc>**, the A35 should assume that the operator rejected the input screen.

HZ automatically ends Block mode when the user presses **<Esc>** or **<Enter>**. The AutoMate can manually end Block Mode by sending the Cancel Block Mode command listed above.

6.3 Load Screen

This command makes it easy for you to construct user-input screens for the A35. It enables you to place the initial contents of the desired screen into a file on the IBM PC and then load it with one command.

To do this, you must first prepare a text file with any text editor. The filename must be of the form HZx.SCR, where x is any ASCII letter (uppercase) or number. The file should contain 24 lines, each line ending with a CR/LF pair (this is standard PC-DOS procedure).

Each line of the file will occupy one line of the HZ conversation screen. By default, the text is displayed in Background mode, but you may shift into Foreground mode by including the ASCII characters "^f" in the file at the desired shift point. To return to Background mode, include "^b" in the file. To print a '^', place two '^' characters into the file.

To load a screen, the AutoMate should send the string LI S followed by the code x. For example, to load the screen defined in HZA.SCR, you would send LI S A.

A sample file, HZA.SCR, has been provided to clarify the operation of the "Load Screen" command. To demonstrate it, load HZ with the file HZA.SCR in the current directory. Press **<F2>** to place HZ in Local mode, then type **<Esc>** (or '~' if Leadin is set to tilde) S A. The screen will load. You can then experiment with the field movement keys, such as **<Tab>** and **<Shift-Tab>** to see how "Load Screen" can be used.

You can have a different screen definition for every letter and number. Careful use of screen files can give the A35 a powerful user input tool: all it has to do is issue the three correct character "Load Screen" string, enter BLOCK mode, wait for the **<Enter>** or Escape code, and then read the data.

6.4 Set User Color

In addition to the Foreground and Background colors, the AutoMate may also use any other color permitted by the PC's display adapter. The "Set User Color" command expects two ASCII hex digits that define a color. Any characters sent after the code digits will be in the selected color, until the AutoMate transmits a "Set User Color", "Set Foreground", or "Set Background" command.

For example, the sequence LI C 5 F selects color 5F, White letters on a Magenta background (on a color monitor). On a monochrome adapter, the same sequence selects "High Intensity". Sequence LI C C 9 selects color C9, flashing Light Blue letters on a Red background (flashing high-intensity underline on a Monochrome adapter).

The IBM BASICA manual has a summary list of the color codes. Your computer's Technical Reference manual also provides a complete table of color codes.

6.5 Resume User Color

This command returns to the last user color selected by "Set User Color".

7 The Auxiliary Port

The Auxiliary Port is used to make a record of transmissions from the AutoMate. It can be assigned to any PC-DOS file or device.

Normally, if Auxiliary Output is selected, incoming bytes pass through HZ's character interpreter before they are sent to the Auxiliary Device. In other words, you see everything that happens, and a record of the incoming stream is duplicated to the Aux device.

This record, though, is not complete. HZ removes (and interprets) all Hazeltine control codes and escape sequences before sending bytes to the Auxiliary Device.

Further, if the incoming data is intended for a non-Hazeltine device, the Aux output may not have much to do with the incoming data. In particular, if the incoming stream uses Tab characters to mean "jump to next 8-character boundary", the terminal display will be seriously disrupted, and an annoying series of Beeps will ensue. This happens because the Hazeltine expects Tabs to means "jump to next foreground field".

Other control sequences, such as Escape codes used to control a printer, may also be intercepted by the Hazeltine emulator.

To capture arbitrary streams of characters from the AutoMate, you should use the "Auxiliary Divert" command. Press **<Shift-F4>** to activate Aux Divert.

When Aux Divert is active, the status line is replaced with the message `"Input diverted to AUX >"`. Incoming characters from the serial port are then sent directly to the auxiliary device. A character counter, which is updated every 20 bytes, will appear after the message, indicating the progress of transmission.

Characters may still be sent from the keyboard, unless it is locked by the AutoMate. No echo will appear, as all incoming characters will be diverted. Please note that during Aux Diversion, **<F4>** (stop divert) is the only function key permitted. The keypad is also disabled.

To stop Aux Divert: You may cancel Aux Divert at any time by typing **<F4>** or **<Shift-F4>**.

Aux Divert is especially useful for capturing printouts (ladder listing, statement listing, etc.) from the AutoMate. Since no screen updates take place, the transfer takes place as efficiently as possible, with input sent directly to a file or device, such as a printer.

To capture a listing with Aux Divert, first set the Auxiliary Device on the Setup screen. Then move through the AutoMate menus until you have the prompt `"Press ENTER to con-` `tinue:"`. Press **<Shift-F4>** to begin diversion, then press the **<Enter>** key. This will send a CR code to the AutoMate, which will then begin sending the listing. You can watch the character counter to see how the capture is progressing.

For best results, capture listings to a disk file, then send them to the printer. This reduces the time that the AutoMate is tied up, as well as allowing you to have your AutoMate in one place and your printer somewhere else.

8 Buffered Send Mode

Habitual AutoMate 35 users are more than aware of the delays involved in editing the application program. These delays are particularly frustrating in the statement program editor.

By using the A35's key-ahead buffer, it is possible to "get ahead" of the AutoMate, especially if the user is familiar with the A35's command sequences. Unfortunately, though, the key-ahead buffer does not immediately echo back the characters you have typed. Therefore, it is easy to make simple errors

HZ has a special feature, called Buffered Send mode, which is specially designed to help the experienced user take advantage of the A35's key-ahead buffer to speed statement editing.

Buffered Send mode allows you to see and edit strings of characters before sending them to the AutoMate. To activate this feature, press **<Shift-F2>** in Conversation Mode. A small window labeled "Buffered Send" will appear in the lower half of your screen. Once the window is open, you are in Buffered Send mode.

To cancel Buffered Send mode, press **<Shift-F2>**.

In Buffered Send mode, characters that you type on the keyboard are not immediately sent to the AutoMate. Instead, they will appear in the Buffered Send window. A flashing cursor indicates your current position in the buffer.

You may delete characters on the current line by pressing the Backspace key, or cancel the entire line by pressing **<Esc>**. Once the line appears as you want it to be sent, press **<Enter>**. The line will be sent via the serial port exactly as it is shown, followed by a Carriage Return code. To transmit the current line without a terminating CR code, type **<Ctrl-Enter>** instead of **<Enter>**.

Since every A35 statement command and parameter is constructed with strings of characters followed by **<Enter>**, Buffered Send mode gives you a safe way to work ahead of the AutoMate. Not only can you see what you are currently typing, but you can also refer to the last few lines you have transmitted.

Incoming characters sent by the AutoMate are still processed as usual. A complete 24 line by 80 character window is maintained for conversation, but a portion of the screen will be hidden by the Buffered Send window.

HZ will always keep the conversation cursor visible; the conversation window will be scrolled to make sure that you can always "see what is going on". As you use Buffered Send mode to modify the A35 statement program, you can keep an eye on what the PLC is doing simply by glancing at the Conversation window.

9 Execute DOS function

You can execute PC-DOS functions from HZ. To do this, press **<Ctrl-F4>>**. HZ will display a prompt in the status line: `Enter DOS function to execute >`. Type the DOS command followed by **<Enter>**.

The current Hazeltine Emulator screen will clear, and HZ will attempt to execute the command you have requested. After the command is complete, press any key to return to the HZ session.

10 Transfer Menu

The Transfer Menu is used to move application programs back and forth between the A35 and the IBM PC. AutoMate programs can be stored in files on the PC and later reloaded.

To activate the Transfer Menu, Press <Alt-F9>.

The Transfer Menu looks something like this:

```
                    Transfer Menu


        F          Select File
        D          Set Comm. Delay     10

        1          FROM V3 A35 Port 1
        2          FROM V4/V5/V6 A35 Port 1

        3          TO V3 A35 Port 1
        4          TO V4/V5/V6 A35 Port 1

        5          Port 2 Transfer to/from A35
        6          STR-LINK Mode (Port 1)

    F10      Exit

Command >
```

Buffers. During program transfers, HZ uses a memory area called the "buffer" as an intermediary between the transfer source and destination. In other words, whenever you perform a program transfer, the actual data will be moved into the IBM PC's memory before being sent to the AutoMate processor (or to a disk file). This is meant to save wear and tear on floppy-only computer systems.

On a floppy-disk based system, you will see messages like "Loading memory" and "Saving memory" before and after program transfers. These messages mean that the memory buffer is being loaded from (or saved to) disk. The same messages will appear on hard-disk systems, but they will disappear so quickly that you may not see them.

> **Important Note!** In order for the Program Transfer commands to work correctly, the A35 *must* be in an 8-bit transmission mode. The A35's memory is 8 bits wide, so the default configuration of 2400 baud, 7 data bits, Even Parity, and 1 stop bit *will not work!*

Setting up A35 Port 1 (and HZ, of course) as 4800 baud, 8 data bits, no Parity, 1 stop bit usually provides excellent results. Over ninety percent of the Transfer Menu problem reports that we receive are the result of using 7-bit protocol.

Here is an explanation of the Transfer Menu commands:

10.1 F : Select File

Before you can perform a Transfer, you must select a Transfer File. Any legal DOS file-name can be used, but we recommend that you avoid reserved extensions such as ".EXE", ".COM", ".BAT", ".BAK", and so forth.

To select a file, type 'F' at the prompt followed by the filename and the **<Enter>** key. Press **<Esc>** to cancel the command.

If you are transferring a program TO the AutoMate, you must of course select a file that already exists.

If you are transferring a program FROM the AutoMate, HZ takes certain precautions to prevent losing valuable data. For example, suppose that you have selected the name "TEST.A35" for a program that you will be transferring FROM the AutoMate.

When the transfer begins, HZ will determine if a file by the name "TEST.A35" already exists. If it does, it will be renamed to "TEST.BAK". Any previous file with the name "TEST.BAK" will be lost.

HZ will then create a new "TEST.A35" file to contain the incoming data.

10.2 D : Set Communications Delay

The AutoMate 35 cannot accept continuous serial transmission of data. If incoming characters arrive too quickly, it will abort the transfer.

Accordingly, HZ provides a variable Communications Delay. If the Delay is greater than zero, HZ will wait an interval between each outgoing character.

The default value of 10 should be adequate for normal use. However, you may wish to experiment with faster (lower) or slower (higher) values. The Delay is only used when transmitting bulk data to the A35; it does not affect routine communications.

The current Communications Delay setting is stored in the HZ.CFG file from session to session.

10.3 1 : From A35, Version 3, Port 1

This is the standard transfer command used to import a program from a Version 3 A35 system.

To use it, move through the A35 menus ("Memory Transfer", "R/W to Tape") until the "Port (1 or 2) ?" message is shown on the Conversation screen. Then press **<Alt-F9>** to invoke the Transfer Menu.

Select a destination file for the incoming application program. Then press '1'. You should see a screen that looks something like this:

```
┌─────────────────────────────────────────────────────────────┐
│                     Transfer Menu                            │
│                                                              │
│                 FROM V3 --- TO File:                         │
│                                                              │
│        Punch        :              Reader    :               │
│                                                              │
│        Blocks       :              Blocks    :               │
│                                                              │
│        Transparent :               Verify    : _             │
│                                                              │
│        Checksum T=R:                                         │
│                                                              │
└─────────────────────────────────────────────────────────────┘
```

HZ is now expecting you to tell it whether or not to perform a Verify operation. Normally, when the A35 has finished transferring the program to the PC, it will read back the entire program. This ensures that the memory has transferred successfully.

In practice, however, this step is largely redundant. HZ verifies the checksum of each incoming program block, so it will automatically detect and report any transmission errors. Further, the "verify" step doubles the time required to transfer the program.

You can avoid the "verify" step by responding 'N' to the prompt. If you do this, HZ will deliberately send back bad data when the A35 starts its verify cycle. The A35 will flag a "TRANSFER ERROR", but this does *not* mean that the program transferred incorrectly. Unless HZ reports a checksum error, the program arrived intact.

You can also choose to perform the Verify step by responding 'Y' to the prompt. In this case, the complete transfer cycle (write, then read back) will be performed.

Once you have enabled or disabled the "verify" cycle, HZ will transmit the '1' character (answering the A35's prompt) to the AutoMate and begin accepting the A35 program.

When the transfer has completed, press any key to return to the Transfer Menu. To cancel the transfer, press **<Esc>**.

10.4 2 : From A35, Version 4/5/6, Port 1

Normally, you will use this command to import a program from a Version 4,5, or 6 A35 system.

To use it, move through the A35 menus ("Memory Transfer", "R/W to Tape") until the "Port (1 or 2) ?" message is shown on the Conversation screen. Then press **<Alt-F9>** to invoke the Transfer Menu.

Select a destination file for the incoming application program. Then press '2'. Indicate whether or not you wish to "verify" the transfer (see section 10.3), then HZ will transmit a '1' character to the AutoMate and begin accepting the A35 program.

When the transfer has completed, press any key to return to the Transfer Menu. To cancel the transfer, press **<Esc>**.

10.5 3 : To A35, Version 3, Port 1

This command transfers an existing A35 file on the IBM PC <u>to</u> the Version 3 AutoMate 35. To use it, move through the A35's menus ("Memory Transfer", "Tape to R/W") until the "Port..." prompt is shown on the Conversation screen.

Press **<Alt-F9>** to summon the Transfer Menu, select the source file name with the 'F' command, and press '3'.

HZ will then transfer the program to the AutoMate. To cancel the transfer, press **<Esc>**.

10.6 4 : To A35, Version 4/5/6, Port 1

The '4' command performs the same functions as the '3' command for V4/V5/V6 Auto-Mate 35s. Use the same procedure as in section 10.5, except choose '4' instead of '3' after selecting your source file.

10.7 6 : STR-LINK Mode

This command is provided to permit any device using the STR-LINK protocol to transfer files.

If you select a file and press '6', HZ will enter STR-LINK mode until the user presses **<Esc>**. The host device can create a file using the STR-LINK Write Tape command (again, HZ will rename any old file), or read a file with the Read Tape command.

Note that STR-LINK mode always communicates at 1200 baud.

10.8 F10 : Exit

Press F10 to return to Conversation Mode.