

EPSON

USER'S MANUAL

NEW APPLE II INTELLIGENT PARALLEL INTERFACE

8133

EPSON

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INTERFACE**

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TRADEMARK ACKNOWLEDGEMENTS

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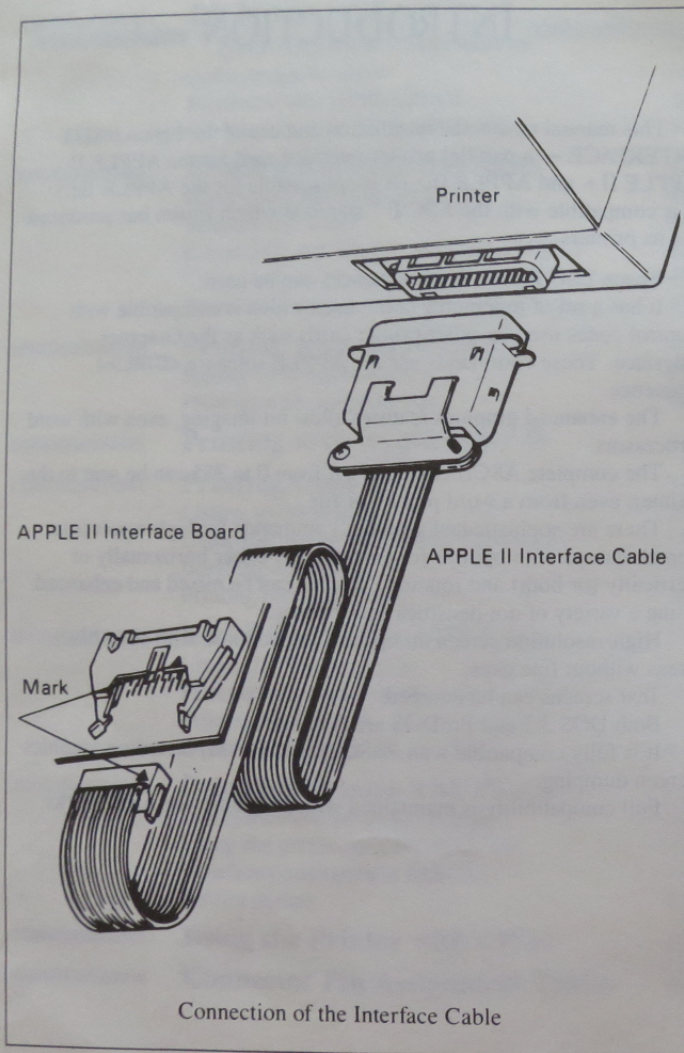
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INTRODUCTION

This manual covers the installation and use of the Epson #8133 INTERFACE — a parallel printer interface card for the APPLE II, APPLE II+ and APPLE IIe. (It is not suitable for the APPLE IIc.) It is compatible with the ESC/P™ standard which Epson has produced for its printers.

- Epson ESC/P command sequences can be used.
- It has a set of mnemonic commands which is compatible with control codes used by other printer cards such as the Grappler interface. These commands use the APPLE software <CTRL>-I sequence.
- The enhanced graphics features allow bit imaging, even with word processors.
- The complete ASCII character set from 0 to 255 can be sent to the printer, even from a word processor file.
- There are sophisticated graphics commands for high-resolution screen dumps with options for enlargement either horizontally or vertically (or both) and rotation. Screens can be mixed and enhanced using a variety of dot-densities and shading.
- High-resolution screen dumps can be produced with solid black areas without fine gaps.
- Text screens can be dumped.
- Both DOS 3.3 and ProDOS are supported.
- It is fully compatible with PASCAL and CP/M, including graphics screen dumping.
- Full compatibility is maintained with programs like AppleWorks.



GETTING STARTED

This section deals with fitting the #8133 interface into the connecting to the printer and starting to print.

FITTING THE INTERFACE

In addition to the interface board, you will require an #8231 interface cable.

- 1 Insert the connector of the #8231 cable into the socket on the #8133 board as shown in the diagram. It is only possible to insert the plug one way round; the wires coming from the plug should be on the side away from the surface of the interface board.
- 2 Make sure the APPLE is SWITCHED OFF. If you try to insert or remove a card while the APPLE is switched on, you are likely not only to damage the card, but also the APPLE. Any such damage is not covered under warranty agreements.
- 3 Remove the cover from the APPLE and locate the slots at the back of the circuit board. Details of how to remove the cover and the position of the slots are given in the documentation supplied with the APPLE.
- 4 Insert the card in slot 1. This is the left-hand slot on the APPLE IIe (with the keyboard at the front) and the second from the left on an APPLE II or II+. If you are not sure how to insert cards, consult your APPLE documentation.
- 5 Replace the cover of the APPLE and connect the socket on the back of the printer as described in the printer manual.
- 6 Check with the printer manual that the DIP switches are correctly set. The APPLE automatically sends a line feed with every carriage return, so the following printer DIP switches should be set to OFF:

printer series	DIP switch
LX	SW 2-3
MX	SW 2-3
RX	SW 2-3
FX	SW 2-4

7 Make sure there is paper in the printer, then switch on the APPLE, followed by the printer.

You are now ready to print.

BEGINNING PRINTING

The printer can be used with or without DOS booted. The following sequence allows you to test that you have inserted the card correctly and that it is working satisfactorily.

- 1 Boot the APPLE SYSTEM MASTER DISK.
- 2 When the program has finished and the] prompt returns, insert some paper in the printer and switch it on.
- 3 Type **PR #1** and press **RETURN**. This is the command to direct output to the printer. If the printer has been switched on, and is on-line, it will respond with a movement of the carriage and the cursor will return. If the printer is switched off or the ON LINE light is out, the computer will 'hang' with no cursor displayed, while it waits for the printer to acknowledge that it is ready to receive data.
When the printer is ready to receive data, i.e. both switched on and on-line, the cursor will return. If this does not happen, SWITCH OFF THE APPLE AND THE PRINTER BEFORE ATTEMPTING TO CHECK THE CARD. Make sure that you have put the card in the slot you are calling, as the computer will also hang if you attempt to call a slot which does not contain a card.
- 4 Press **RETURN** a few times. The paper will advance a line each time.
- 5 Type the word **LIST** on the keyboard and press **RETURN**. The letters you type will not be displayed on the screen, but as soon as you

press the **RETURN** key, they will appear on the printer. The HELLO program which is in memory will then be listed on the printer. You can stop the listing by pressing the **CTRL** and **C** keys together. Further details on listing BASIC programs are given on page 53.

- 6 Output to the printer is cancelled by typing **PR #0**.

EVERYDAY PRINTING

There are many ways to use an EPSON printer with the #8133 interface card.

- If you are using an applications package such as AppleWorks, or a wordprocessor or spreadsheet, consult the manual which came with the package to find out how to print. The software will probably control the printer completely.
- If you are programming and are attempting to use the features of the printer to the full with the #8133 card, read the rest of the manual. In particular, there are tips on using some applications programs and CP/M as well as using the commands.

GIVING COMMANDS

The Epson #8133 interface uses the **<CTRL>-I** character to mark the beginning of a command that is to be sent to the printer. This is consistent with other Apple interface cards and with most applications packages.

Under DOS 3.3 or ProDOS, the **<CTRL>-I** character is obtained by holding down the **<CTRL>** key while typing the letter **I**.

If you are using APPLESOFT BASIC, the command **PRINT CHR\$(9)** can be included in a program; this is equivalent to typing **<CTRL>-I**. If **<CTRL>-I** is typed from the keyboard while you are using APPLESOFT a Syntax Error will result. This is because the command **<CTRL>-I** does not start any BASIC or DOS command. However, the command will be sent to the printer and will function correctly.

Important: CP/M and Pascal use the **<CTRL>-I** character for their own purposes. Therefore, the **<CTRL>-Y** character must be used instead of **<CTRL>-I** with Pascal and CP/M to control the printer interface.

Some of the **<CTRL>-I** commands have a fixed format, such as **<CTRL>-I W**, which sets double width printing. Other commands control variable features of the printer, for example, the width of the left and right-hand margins. The variables you include in these commands are shown as a small letter *n* or *m* in the descriptions in this manual. An example of this kind of command is **<CTRL>-I nR**, which sets the right-hand margin. The letter *n* does not mean that you type a letter *n*: instead, you should substitute for *n* the number that you wish to use. In this case, to set the right-hand margin to 75 characters, use the command:

<CTRL>-I 75R

You would enter this command with the following series of keys:

<CTRL>-I

Here, the letter *n* has been replaced by 75.

As well as the #8133 interface commands themselves, you can also use printer control codes known as ESC/P codes. These form a standard laid down by Epson for the control of printers. It is rapidly becoming the universal standard and is often used by applications programs and programs not originally written for the Apple.

In fact, the interface commands use the ESC/P code sequences to control the printer. In most cases you will find it easier to use the <CTRL>-I commands because one <CTRL>-I command sometimes uses several ESC/P codes, but some effects can only be achieved by using the ESC/P codes directly. If you want to find out exactly which ESC/P commands are used by the interface, you should put your printer into HEX DUMP mode, as described in the printer manual, then send the command from the interface. By comparing the codes which are printed with the table of ASCII characters in your printer manual, you should then be able to identify each command.

ESC/P commands usually begin with the <ESC> (ESCAPE) character, which has a decimal ASCII code of 27. The <ESC> character is then followed by one or more ASCII characters which make up the command. For example, <ESC> G sets the printer to double-strike mode.

From APPLESOFT, the <ESC> G code can be sent using the command:

PRINT CHR\$(27);"G"

Remember to turn on the printer first, with the **PR #1** command.

CP/M and DOS both allow the use of <ESC> codes. The form that the commands take depends on the program being used. For example, with MBASIC and GBASIC, use **LPRINT CHR\$(27);"G"** to send the <ESC> G code to the printer.

Specific examples on the use of the #8133 interface with BASIC, DOS, Pascal and CP/M are covered elsewhere in this manual.

INTERFACE AND PRINTER CONTROL COMMANDS

There are a number of commands to control the printer and set the defaults — the command settings used if you do not make any changes. These are:

command	what it does
PR #1	DOS command to direct output to the printer if the card is installed in slot 1.
PR #0	DOS command to disable the interface
<CTRL>-I Y	Control command to disable the interface
<CTRL>-I @	Control command to reset the printer defaults
<CTRL>-I Z	Control command to set the interface defaults
<CTRL>-I V	Control command to restore normal printing
<CTRL>-I I	Control command to enable screen echo
<CTRL>-I J	Control command to disable screen echo

SWITCHING THE INTERFACE ON AND OFF

It is normally only necessary to switch the interface on and off using the **PR #1** and **PR #0** commands when writing APPLESOFT or INTEGER BASIC programs. Machine code programming, PASCAL and MBASIC or GBASIC (supplied with CP/M) have ways of directing output to the printer. Applications programs have special commands for printing. The use of **PR #1**, **PR #0** and <CTRL>-I Y is thus covered in the section on using the interface with BASIC.

SETTING DEFAULTS

It is possible to set a number of parameters on an Epson printer using the DIP switches. For example, if you are going to use condensed printing for wide spreadsheets, you may be able to set the printer to default to condensed mode in this way. The command <CTRL>-I @, restores the printer to these default settings without the need to switch the printer on and off. Note, however, that where the

print mode is changed by means of a Selectype feature, i.e. by means of the control panel rather than a software command, the command setting will not be restored. It is equivalent to the ESC/P sequence <ESC> @.

In the same way, the interface has a number of default settings. For example, output of a carriage return is also accompanied by a line feed when the interface is switched on. The command <CTRL> -I Z resets the board to its default state. The commands affected by <CTRL> -I Z, and the settings made are:

feature	action	command
automatic linefeed	set ON	<CTRL>-I A
bell code	set ON	<CTRL>-I B
screen echo	set OFF	<CTRL>-I J
high bit	set to 0	<CTRL>-I X

The use of <CTRL>-I Z will only affect these commands; it is equivalent to giving all the commands in the right-hand column at one time. If you have used another command, such as the one to select enlarged or double-strike printing, you will have to use <CTRL>-I @ to reset these in the printer. If the printer does not give the correct output, try giving both the <CTRL>-I Z and <CTRL>-I @ commands and try printing again. The <CTRL>-I V command can be used to cancel double-strike, bold (emphasized) and double width printing in a single command.

SCREEN ECHO

The interface defaults to the state of not echoing printer output to the screen as well. Echoing can be switched on and off using the <CTRL>-I I and <CTRL>-I J commands.

<CTRL>-I I enables screen echo
 <CTRL>-I J disables screen echo

CONTROLLING LINE FEEDS

In its normal mode of operation, whenever the #8133 interface receives a carriage return character (ASCII 13) from the APPLE, it sends it to the printer followed by a line feed command (ASCII 10). If, for some reason, it is only necessary to return the print head to the beginning of a line and print on that same line, the line feeds can be suppressed by the command:

<CTRL>-I K

The following program shows the effect of removing the line feeds in this way:

```

10 D$ = CHR$(13) + CHR$(4)
20 PRINT D$;"PR#1"
30 REM PRINT THE CHARACTERS WITH A LINEFEED
40 GOSUB 500
50 REM KILL THE LINEFEED
60 PRINT CHR$(9);"K";
70 REM PRINT THE CHARACTERS WITH NO LINEFEED
80 GOSUB 500
90 REM RESTORE THE LINEFEED
100 PRINT CHR$(9);"A";
110 GOSUB 500
120 PRINT D$;"PR#0"
130 END
500 PRINT
510 FOR J = 1 TO 5 STEP 2
520 PRINT TAB(J);"AB"
530 NEXT J
540 RETURN
  
```


This would print:

AB
AB
AB
ABABAB
AB
AB
AB

To re-enable line feeds when they have previously been cancelled, give the command:

<CTRL>-I A

In APPLESOFT you would do this with the following line:

PRINT CHR\$(9) ; CHR\$(65)

Once the automatic line feed has been cancelled, the printer will not advance the paper unless either its own automatic line feed function has been selected with a DIP switch, or you send a line feed on its own. (Your printer manual will give details of controlling line feeds with a DIP switch.) In APPLESOFT you would use the command:

PRINT CHR\$(10)

You should not send line feeds directly in this way if you have used the **<CTRL>-I nL** command to set the left margin to any value other than zero.

CHARACTER CONTROL COMMANDS

The commands in this section control the use of international characters, alternative currency symbols, italics and user defined characters.

INTERNATIONAL CHARACTER FONTS

EPSON printers have a range of international character sets which can be selected with the command:

<CTRL>-I nF

where *n* corresponds to the number of the character font (*n* must be less than 32). On printers such as the FX series, where it is possible to have user-defined characters, this also means that the built-in characters are automatically reselected in preference to the user-defined set. For example, the command:

<CTRL>-I 3F

selects the third set — UK characters on an FX-80 — and:

<CTRL>-I 10F

would select the tenth set — Denmark II characters on some printers. The actual set selected should be determined by looking in your printer manual. It will be described in conjunction with the **<ESC> R** command, or it may be in an appendix. The value of *n* corresponds to the value given in the Epson printer manual. If you use a value of *n* which is greater than the highest value given in your manual, the command will be ignored.

WARNING: This command cannot be used to select an international character set if you have copied the character set from the character generator ROM in order to use the downloaded set. It automatically reselects the built-in character generator ROM characters.

SELECTING A DOWNLOADED CHARACTER SET

The downloaded character set can also be selected using the `<CTRL>-I nF` command, with *n* set to 32. The command would be:

`<CTRL>-I 32F`

To switch back to the standard built-in character set use the `<CTRL>-I nF` command with *n* set to the code for the country you want to use.

SELECTING ITALIC CHARACTERS

Italic characters can be selected and cancelled by using the following commands:

`<CTRL>-I H` selects italic characters
`<CTRL>-I X` cancels italic characters

Italic characters are stored by the printer as ASCII characters with codes in the range 160 to 255. This means that the `<CTRL>-I H` command can be used to select italic characters. The `<CTRL>-I H` command adds 128 onto the character codes sent to the printer. For example, where the ASCII code 65 is sent to the interface to print the character 'A', if the `<CTRL>-I H` command has been sent first, the code 193 (128 + 65) would be sent to the printer instead and the 'A' would be printed in italic mode.

PRINTING #, \$, £ AND R

A command is provided to substitute other symbols for the \$ character which is displayed in much American software. This is extremely useful if the \$ symbol is used by a spreadsheet program and the currency required is (£) sterling. The effect of the commands varies slightly depending on the international character set in use.

The commands to choose between the different symbols are:

command	character set	£ signs are printed as
<code><CTRL>-I \$</code>	all	\$ (dollar sign)
<code><CTRL>-I #</code>	UK	£ (sterling symbol)
<code><CTRL>-I #</code>	Spanish	P (peseta symbol)
<code><CTRL>-I #</code>	all others	# (hash sign)

THE BELL CHARACTER

The printer will emit a beep sound if the character with ASCII code 9 is printed. This is the 'bell' character, `<CTRL>-G`. On some printers you can turn off the sound of the bell by means of a DIP switch. The following commands can also be used to turn it on and off:

`<CTRL>-I B` bell sounds when `<CTRL>-G` received
`<CTRL>-I C` bell is silent

PAGE FORMATTING COMMANDS

Some of the control commands available with the Epson #8133 Interface Board are similar to those found in word processing programs, in that they allow you to control the format of the printed page by sending the instructions to the printer.

HORIZONTAL FORMATTING COMMANDS

The commands which control the horizontal format of the page are:

<CTRL>-I nL	set left margin
<CTRL>-I nN	set line length
<CTRL>-I nR	set right margin (with word wrap)

In each case *n* is the number of character widths. The word wrap feature means that only complete words are printed on a line; words are never broken between the end of one line and the beginning of the next.

You would normally set the left margin and line length only, and allow them to control the right margin. However, the **<CTRL>-I nR** command is useful if you want to make a printed BASIC or PASCAL listing more legible with word wrapping, or if the computer keyboard is being used as a typewriter. This is the only use for the word wrap feature: it should never be used with a word processor, because it is likely to conflict with commands issued by the software program.

It is useful to note that in order to obtain tidy listings **<CTRL>-I nR** should be set for 8 characters less than the actual limit of the line length required. Also, when **<CTRL>-I nL** is used, the new left margin setting takes effect from the beginning of the next new line. This command is implemented by the interface and not via a printer **<ESC>** sequence.

These commands have been built into the #8133 command set for compatibility with other cards. The left margin can be set more effectively with the ESC/P command **<ESC>Ln**. For example in BASIC:

PRINT CHR\$(27) ; "L" ; CHR\$(10) ;

sets the left margin at the 10th column.

VERTICAL FORMATTING

<CTRL>-I *n*P set page length

In this case *n* is the total number of lines on a page; if you set *n* to 0, form feeds are disabled, and printing is continuous.

USING TABS WITH BASIC

The TAB command in BASIC was designed to work with the 40 column APPLE screen. It does not work as expected if a command is given to tab to a column greater than column 40. The Epson #8133 Interface Board has a command which does allow tabulation beyond 40 columns without difficulty. The command is:

<CTRL>-I *n*?

where *n* is equal to the total number of columns within which the TAB command will function. If no value is specified for *n*, or if the value is less than 48, normal APPLE tabbing is restored.

The following program illustrates how the command is used:

```
10 D$ = CHR$(13) + CHR$(4)
20 PRINT D$;"PRE1"
30 PRINT CHR$(9);"50N"
35 REM LINE 30 IS ESSENTIAL TO SET PAGE WIDTH
40 PRINT "APPLESOFT TABS"
50 GOSUB 250
60 GOSUB 190
70 PRINT : PRINT : PRINT
80 PRINT "CORRECTED TABS"
90 GOSUB 250
100 GOSUB 130
110 PRINT D$;"PRE0"
120 END
```

```
130 PRINT CHR$(9);"50?"
140 FOR J = 5 TO 45 STEP 5
150 PRINT TAB(J)"ABCD";
160 NEXT J
170 PRINT
180 RETURN
190 FOR J = 5 TO 45 STEP 5
200 PRINT TAB(J)"ABCD";
210 NEXT J
220 PRINT
230 RETURN
240 :
250 FOR J = 1 TO 5
260 FOR K = 0 TO 9
270 PRINT K;
280 NEXT K,J
290 RETURN
```

The output of the program is like this:

APPLESOFT TABS

```
0123456789012345678901234567890123456789
      ABCD          ABCD          ABCD
              ABCD                      ABCD
                        ABCD
                ABCD
        ABCD
ABCD
CD
```

AB

CORRECTED TABS

01234567890123456789012345678901234567890123456789

ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD

The printer also has its own method of setting TAB stops. This method sets up a number of fixed tab positions and is therefore more suitable for fixed tables, whereas the BASIC TAB function, used in conjunction with the <CTRL>-I n? command, is more suitable for variable tabbing. In order to use printer tabs, you first need to use the following printer escape sequence to set the tab positions:

<ESC> D n1 n2 nk

In BASIC you would send this sequence with the command:

```
PRINT CHR$(27); "D"; CHR$(n1); CHR$(n2); .....
CHR$(nk); CHR$(0)
```

after first turning on the printer with PR #1.

n1, n2, ... nk are the tab stop positions, and must be in the range $1 \leq n \leq 137$. You can set up to 32 tab positions across the page. To print strings at successive tab positions, print CHR\$(9) or send <CTRL>-I before each string. To avoid conflict with the <CTRL>-I interface commands the TAB character must be sent by means of the <CTRL>-I n? command of the #8133 interface. This is a way of sending a single character straight to the printer without the interface card interpreting it first. (For a further discussion of this command see page 31.)

On the RX-80 series printers, the <ESC> D command is not available, and fixed tabs have to be set with the <ESC> e command.

The following program illustrates how the <ESC> D command sets up fixed tabs, and then how <CTRL>-I 9< can be used to print at successive tab positions.

```
10 D$ = CHR$(13) + CHR$(4)
```

```
20 PRINT D$;"PR#1"
```

```
30 FOR Y = 1 TO 5
```

```
40 FOR X = 0 TO 9
```

```
50 PRINT X;
```

```
60 NEXT X
```

```
70 NEXT Y
```

```
80 REM SET UP TABS AT
```

```
90 REM POSITIONS 12, 20 AND 30
```

```
100 PRINT CHR$(27); "D";
```

```
110 PRINT CHR$(12); CHR$(20); CHR$(30);
    CHR$(0)
```

```
115 REM PRINT AT TAB POSITIONS
```

```
120 FOR J = 1 TO 3
```

```
130 PRINT CHR$(9); "9<"; "ABCD";
```

```
140 NEXT J
```

```
150 PRINT D$;"PR#0"
```

01234567890123456789012345678901234567890123456789

ABCD ABCD ABCD

CONTROLLING THE PRINTING

The commands in this section let you change the style and size of what is printed, including selecting letter-quality printing.

The command to dump text screens on the printer is also described.

PRINT ENHANCEMENT COMMANDS

There are three commands to provide enhancement to the printed text. The functions of these commands are:

command	produces
<CTRL>-I D	double strike printing
<CTRL>-I E	emphasized printing
<CTRL>-I W	enlarged printing

In double-strike mode the characters are printed twice with a double pass of the print head; on the second pass the dots are printed slightly lower than on the first. In emphasized mode the characters are again printed twice, but this time slightly shifted horizontally, and in one pass of the print head.

Enlarged characters are twice as wide as normal characters. Care should be taken when you set up text to print out in enlarged mode, because a word processor will not know that it needs to print half as many characters per line as normal to fit the page. It is also important to cancel enlarged characters at the end of a line and not at the beginning. This is because word processors frequently send spaces to set the left margin, and if the enlarged characters are still set when the spaces are printed for the margin, they will be twice the size you expect. This means that the left margin on that line will be displaced to the right.

The following examples show text printed in the three styles, and in combinations of styles, contrasted with the normal style:

pica text
double strike text
emphasized text
enlarged text
all combined

In order to cancel these commands, use **<CTRL>-I V**; this turns off all three settings at once.

CHANGING THE PRINT QUALITY

Some Epson printers can produce Near Letter Quality (NLQ) print. This is a slower way of printing but produces output which is close in quality to that of a daisy-wheel printer. If your printer has this feature, either built-in or as an optional board, you can turn it on using the command:

<CTRL>-I 33F

This is similar to the command for selecting international character sets, which is described elsewhere. However, to cancel NLQ printing you have to use the **<CTRL>-I nQ** command, as described below. There may be certain limitations on which other print modes can be combined with NLQ: for instance, it is not possible to combine NLQ with condensed printing. You should consult your printer or interface manual for details.

CHANGING THE PRINT SIZE

The #8133 card has a command which allows you to alter the density of a graphic screen dump. The same command also allows the character size (pitch) to be set. Remember that if you use this command to alter the density before carrying out a screen dump, the text size will be set differently when the screen dump is over. Density

is set by the command:

<CTRL>-I nQ

where *n* is a number between 0 and 7.

The table below shows the progressive effect of the available density settings on Epson printers, but note that some printers such as the MX and RX series do not have a proportional space mode.

The examples at the right of the table show the style of print which is produced by each command. Pica characters have a pitch of 10 characters per inch, and are the default draft mode characters on the printer; Elite characters have a pitch of 12 characters per inch. Proportional spacing means that narrow characters such as the letter *i* are allowed less space than wide characters such as *m* or *w*. The examples in the table cover a selection of wide and narrow characters to make clear the effect of the various commands.

control command	description	example
<CTRL>-I 0Q	Pica	MISwi y
<CTRL>-I 1Q	proportional Elite	MISwi y
<CTRL>-I 2Q	proportional Pica	MISwi y
<CTRL>-I 3Q	condensed Pica	MISwi y
<CTRL>-I 4Q	Elite	MISwi y
<CTRL>-I 5Q	Pica	MISwi y
<CTRL>-I 6Q	Pica	MISwi y
<CTRL>-I 7Q	Pica	MISwi y

This command does not control the way NLQ characters are printed. If you use the **<CTRL>-I nQ** command after setting NLQ mode with **<CTRL>-I 33F**, NLQ printing will be cancelled and the style given in the **<CTRL>-I nQ** command will be set up. This means that you can use **<CTRL>-I 0Q** to cancel NLQ printing, and reselect the default draft Pica style.

Proportional characters are not compatible with condensed characters.

PRODUCING TEXT SCREEN DUMPS

The currently active text screen can be printed out by giving the command:

<CTRL>-I *n*S

The *n* is an optional parameter controlling which of the two text screens is dumped on an APPLE IIe: if you have an APPLE II or an APPLE II+, only 40-column screens can be dumped and the *n* can be left out. On the APPLE IIe, no matter which screen is currently active, you can give *n* a value greater than 127 to print out the 80-column screen, or less than 128 to print out the 40-column screen.

The following program illustrates how the command works on an APPLE IIe:

```
5 REM PRINT CURRENT TEXT SCREEN
10 PRINT CHR$(9);"S"
15 REM PRINT 80-COL SCREEN APPLE IIe ONLY
20 PRINT CHR$(9);"128S"
25 REM PRINT 40-COL SCREEN
30 PRINT CHR$(9);"1S"
```

SENDING CHARACTERS DIRECT TO THE PRINTER

Because of the way the APPLE system software has been written, and the fact that some characters are used as control characters by the computer monitor, BASIC and DOS, it is not normally possible to send all the ASCII codes directly to the printer. This is an example of the many problems which occur as a result of the APPLE II being one of the first generation of microcomputers. Like all difficulties of this sort, there are ways around it. In this case, the Epson #8133 Interface provides three commands for different occasions:

command	purpose
<CTRL>-I <i>n</i> <	allows you to send one character with ASCII code <i>n</i> directly to the printer
<CTRL>-I <i>n</i> >	allows you to send a series of <i>n</i> characters represented by ASCII equivalents of hexadecimal bytes
<CTRL>-I <i>n</i> T	allows <i>n</i> characters to be sent directly to the printer as data with no interception by the #8133 interface
<CTRL>-I H	converts data with ASCII code <i>n</i> , where <i>n</i> <128, to <i>n</i> +128
<CTRL>-I X	converts data with ASCII code <i>n</i> , where <i>n</i> >127, to <i>n</i> -128

<CTRL>-I *n*< sends the character whose ASCII code is *n* as a single 8 bit byte. You would give the character as the decimal equivalent of its code. For example, the command:

<CTRL>-I 27<

will send the character whose ASCII code is 27 (decimal). This is useful where you know the code for the character which is one which might cause a problem and therefore cannot be input directly from the keyboard.

<CTRL>-I *n*> allows you to give a string of characters which will be interpreted as a series of hexadecimal codes to be sent to the printer. In this case, *n* is the number of characters to be sent. The character string which then follows the command will consist of $2n$ characters — a pair to represent each hexadecimal number.

For example, the printer escape code sequence <ESC> 3 *m* sets the line spacing in steps of $m/216$ of an inch. To set the line spacing to $160/216$ inch, the ASCII code 160 (decimal) or A0 (hexadecimal) is the code used for *m*. The full sequence you would use in this case is:

<CTRL>-I 3> 1B 33 A0

or in BASIC:

CHRS(9); "3> 1B 33 A0"

The pairs of characters can be separated by a space to make them easier to read, but a large number of spaces will reduce the speed at which the program will run. Note that even if the first character of a pair is a zero, both digits must be given.

This command is particularly useful for sending bit image data from word processors.

<CTRL>-I *n* T allows the next *n* characters to be sent to the printer without any interpretation by the interface. For example the command <CTRL>-I 75 T would send the next 75 characters to the printer irrespective of whether they are control characters used by the interface card or DOS. This mode of operation is termed 'transparent mode'.

If *n* is given as 0, using the command <CTRL>-I 0 T, transparent mode is set for an infinite number of characters. This means that if you do wish to use the <CTRL>-I commands again, you first have to switch the card off and on again. It also means that a line feed is not added to a carriage return by the interface, and your software must give line feed commands where they are needed.

This command is useful for sending a string of characters for bit imaging or downloading user-defined characters, since no extra characters are added by the interface and also none are lost by being interpreted. An example is shown in the section on bit imaging.

The <CTRL>-I H and <CTRL>-I X commands can be used to control the high bit of all data passed to the printer. This can be useful for

getting round the problem of the way the APPLE handles the high bit of data sent to the printer. Normally, it is set to zero by the APPLE system software. The <CTRL>-I H command allows you to force the high bit to be set to 1. This is the only way of sending characters with codes greater than 127 using the CHRS function. Otherwise transparent mode has to be used.

BIT IMAGES AND USER-DEFINED CHARACTERS

Epson printers have the ability to allow the individual needles to be fired under software control. This is known as bit image printing. Some printers have the added ability to redefine characters, by allowing the definitions for the needle sequences, which build up the characters, to be sent and stored in the printer. This process is known as downloading the characters. The method of defining downloadable characters is similar to the methods used for bit imaging and full details can be found in the relevant printer manual.

A BIT IMAGE EXAMPLE

The program which follows illustrates both the `<CTRL>-I n<` and `<CTRL>-I n>` interface board commands. Remember that `<CTRL>-I n>` uses two digit hexadecimal bytes and that `<CTRL>-I n<` employs decimal numbers. The value of n must be in the range $1 \leq n \leq 255$, otherwise only the first $(n \text{ MOD } 256)$ values will be interpreted, and the remainder will be printed out normally as though they were not part of the command sequence.

```
10 D$ = CHR$(13) + CHR$(4)
20 PRINT D$;"PR£1"
30 I$ = CHR$(9)
40 PRINT I$;"12>1B4B0B0022528A8F8A522200"
50 REM BIT IMAGE USING <CTRL>-I N>
60 PRINT I$;"50N";
70 PRINT I$;"27<";I$;"83<";I$;"48<";
80 REM PRINT IN SUPERScript ESC S 0
90 PRINT "SUPERScript";
100 PRINT I$;"27<";I$;"83<";I$;"49<";
110 REM PRINT IN SUBScript ESC S 1
```



```

120 PRINT "SUBSCRIPT";
130 PRINT I$;"27<";I$;"84<";
140 REM TURN OFF SUBSCRIPT ESC T
150 PRINT "NORMAL"
160 PRINT D$;"PRE0"

```



SUPERSCRIPT SUBSCRIPT NORMAL

Line 20 turns the printer on.

Line 50 issues the <CTRL>I n> command followed by the bit image data. In this case n/12 because there are 12 hexadecimal bytes following it. The first two of these bytes are <ESC> and K which set the normal bit image mode on the printer. All the remaining bytes are used to fire the printer head pins to obtain the astrological symbol for Venus.

Line 60 sets the line width.

Line 80 sends a series of single 8 bit decimal bytes, as described for <CTRL>I n<. In this case they form the sequence <ESC> S 0 which puts the printer in superscript mode.

Line 100 is similar, but selects subscript mode.

Line 130 turns off superscript and subscript modes, using <CTRL>I n<.

PROBLEMS WITH APPLESOFT

There are a number of bit image modes on Epson printers. The only two which are standard on all models are normal and double density. Normal density bit imaging is enabled using <ESC> K, and double density by <ESC> L. Double density means the dots overlap and so give a sharper image, very much like condensed printing in text mode. In each case the number of columns of dots must be sent as a sixteen bit number with the MSB (most significant byte) followed by the LSB (least significant byte). In practice this means carrying out a calculation as follows:

Suppose the number of columns to be sent is n .

- 1 Divide n by 256, and call the remainder $n1$.
- 2 Divide n by 256 and take the integral part of the number. Call this $n2$.
- 3 The sequence to include in a PRINT statement is:

PRINT CHR\$(27); "K"; CHR\$(n1); CHR\$(n2);

For example, suppose you wish to print 70 of the characters defined above. This would require $70 \times 5 = 350$ columns. Following the calculations as described above, you would find that $n1 = 94$ and $n2 = 1$.

The following program uses bit image mode to attempt to print 35 of these characters. In this case $n1 = 175$ and $n2 = 0$. The program has been written to illustrate problems and how to overcome them.

```

10 D$ = CHR$ (13) + CHR$ (4)
20 PRINT D$;"PRE 1"
30 PRINT CHR$ (9);"80N"
40 PRINT CHR$ (27);"K"; CHR$ (9)"175<"; CHR$ (0);
50 FOR J = 1 TO 35
60 PRINT CHR$ (12); CHR$ (44);
70 PRINT CHR$ (127); CHR$ (44); CHR$ (12);
80 NEXT J
90 PRINT D$;"PRE0"

```

+++++|

If you examine the printout, you will see that there is an error after the 26th character. You will also notice that the last character is not printed correctly and there is a comma at the end of the line. These are caused by two related problems.

Line 30 sets a line length for printing 80 characters. This means that the carriage return and line feed sequence is added by the interface after 80 characters have been received. They are then interpreted as bit image characters affecting the image which is printed. Since the printer has received two extra characters the last two characters which were intended as bit image data are no longer seen as being part of the bit image sequence since they come after the allocated number. The first is a **CHRS(44)** which is a comma. The last is a **CHRS(12)** which is a form feed. If you run the program you will see that the paper is fed through the printer at the end of printing.

This problem can be overcome by removing line 30 altogether, or by setting the width of the line to 255 characters while the bit imaging is carried out. You can do this using **<CTRL>-I 255N** instead of **<CTRL>-I 80N**. Note also that, in line 40, the LSB has of necessity been sent using the command **<CTRL>-I 175<**. This is because the Apple normally sets the high bit of characters which you print to zero: transparent mode is provided to stop this from happening. If **CHRS(175)** had been used as part of a **PRINT** statement, it would have been sent to the printer as ASCII code 47, i.e. 175-128. This would mean that only 47 characters would have been printed as bit image data, and from then on the remaining bit image data would have been printed as a series of commas and form feeds.

This type of problem, in which data is printed as normal characters when you still expect bit image characters, and the reverse one in which bit imaging continues when text should be printed, is not normally the fault of the APPLE or the interface. It is usually due to miscalculation when the number of data bytes for the bit image data are worked out.

BIT IMAGING WITH WORD PROCESSORS.

Programs which will accept control commands, like Zardax and AppleWriter II or Ile are able to print bit image characters via the #8133 interface. For instance, in the case of Zardax, to print the 'Venus' character used in the BASIC program above, simply enter the ordinary edit mode then press **<CTRL>- * I** and immediately follow this with the sequence of characters **12>1B4B080022528A8F8A522200**, as in the BASIC example. In a similar way, AppleWriter II is able to accept control commands via its **<CTRL>-V** option. In this case, enter

<CTRL>-V <CTRL>-I <CTRL>-V and follow it immediately with the sequence given above. Of course, it is possible to create your own sequence of bit images in this way too and you could enter your bit image data as items in the word processor's glossary, so that they are always readily available.

PRINTING THE HI-RES SCREENS

You can print either of the APPLE's high resolution pages in various ways using the **<CTRL>-I G** command, followed by a sequence of letters specifying the options you want to use. Both pages can also be combined in a number of ways.

The options available are:

option	purpose
2	select page 2 for printing
D	print double size
E	print emphasised
I	print inverse
J	shade white areas
K	shade black areas
O	OR pages 1 and 2
P	AND pages 1 and 2
Q	EX-OR pages 1 and 2
R	rotate page by 90° clockwise
S	scale X axis x 2
T	scale X axis x 3
U	scale X axis x 4
V	scale X axis x 5
W	scale Y axis x 2
X	scale Y axis x 3
Y	scale Y axis x 4
Z	scale Y axis x 8

When the commands are typed in immediate mode the graphics page is printed, but the Apple will give a 'syntax error'. This is because APPLESOFT does not recognize the commands. In order to overcome this, you can include the relevant statements in a short BASIC program. This should include **<CTRL>-I G** and any valid combination of the options listed in the table above. For example:

PRINT CHR\$(9) ; "G2"

would give a copy of page 2. Similarly:

PRINT CHR\$(9) ; "GI2"

would give an inverse copy of page 2.

Hi-res page 1 (HGR) will always be printed for a single page command, unless the character 2 is included to specify HGR2.

COMMANDS AFFECTING IMAGE SIZE

<CTRL>-I GD

This option prints an image double the size of that produced by the <CTRL>-I G command. For example in APPLESOFT:

PRINT CHR\$(9); "G2D"

will instruct the interface to print a double sized image of graphics page 2. If this image is printed on an 80 column printer, the right hand part of the image will be ignored. It is possible to obtain the complete screen by using the rotation command.

<CTRL>-I GS <CTRL>-I GT <CTRL>-I GU <CTRL>-I GV

These commands cause the width of the printed image — the X axis on the screen — to be multiplied by 2, 3, 4 and 5 times, respectively. The depth (Y axis) of the image is not affected.

<CTRL>-I GW <CTRL>-I GX <CTRL>-I GY <CTRL>-I GZ

These commands all affect the depth of the image — the Y axis on the screen. Taken in the order above they cause the Y axis to be scaled by 2, 3, 4 and 8 times.

Obviously, you would not use two different instructions affecting one axis at the same time, but the commands affecting different axes can be used together. For example, the following line:

PRINT CHR\$(9); "GSY"

would give a graphic print of twice the normal width and four times the normal depth. These facilities for enlarging the axes of the image can be used in connection with the <CTRL>-I nQ command to restore normal symmetry. This is described below.

SUMMARY OF COMMANDS USED FOR HORIZONTAL AND VERTICAL SCALING

X axis (horizontal)	scaling factor	Y axis (vertical)	scaling factor
<CTRL>-I GS	2	<CTRL>-I GW	2
<CTRL>-I GT	3	<CTRL>-I GX	3
<CTRL>-I GU	4	<CTRL>-I GY	4
<CTRL>-I GV	5	<CTRL>-I GZ	8

Note that the size of printed text is regulated by the printer and cannot be changed with these commands.

ROTATING THE IMAGE

<CTRL>-I GR

This command rotates the printed pages by 90° anticlockwise. Normally, the image is printed with its long axis across the width of the paper, so using the R option you can print an oversize image along the length of the paper.

COMMANDS TO MIX HGR AND HGR2

The #8133 interface makes it possible to print both the high resolution graphics screens together in various combinations. The commands available are:

command	purpose
<CTRL>-I GO	OR pages 1 and 2
<CTRL>-I GP	AND pages 1 and 2
<CTRL>-I GQ	EX-OR pages 1 and 2.

In the case of <CTRL>-I GO, if a dot appears on either page a dot is printed.

When <CTRL>-I GP is used, the positions of the dots on pages 1 and 2 are compared and a dot is printed only if it appears in the same position on both pages.

The **<CTRL>-I GQ** command causes the positions of the dots to be compared and only prints those dots which do not occur in the same position on both pages. A dot will only be printed, therefore, if it is unique to either hi-res page 1 OR hi-res page 2.

COMMANDS TO PRODUCE SPECIAL EFFECTS

<CTRL>-I GI

Normally the page will be printed with the plotted (i.e. white) dots of the screen printed as black dots on the printer. Using this command changes the areas of the screen which are black to be printed instead.

A group of commands are available which allow you to affect the shading of the printed graphics. Although the degree of shading will depend upon the print density which is set (see **<CTRL>-I nQ** below), two specific commands will influence large areas of black or white. They are **<CTRL>-I GJ** and **<CTRL>-I GK**. The higher the print density, the darker will be the shading effects of these two commands.

<CTRL>-I GJ shades areas of white. This is termed post-shading.

<CTRL>-I GK shades areas of black. This is termed pre-shading.

Whether an area which would otherwise be printed as black or an area which would be printed as white is the one that will be shaded depends on whether or not inverse is set. The concept is best illustrated by looking at the examples and comparing them against the table.

combinations in examples:	A	B	C	D
<CTRL>-I G followed by:	nothing	K	J	IK
normal/inverse set to:	normal	normal	normal	inverse
shading option set to:	no shade	pre-shade	post-shade	pre-shade
black area prints as:	black	black	shaded	white
White area prints as:	white	shaded	white	shaded

It should be noted that fine detail may be lost when using the shading option, if the vertical scale is not set to a value greater than 1.

COMMANDS WHICH AFFECT THE PRINT DENSITY

<CTRL>-I GF

This is an overstrike mode, and has the effect of removing the pin stripe horizontal lines which may occur during normal graphic printing of pictures. When combined with other commands it can give a superior graphic reproduction. For example, if **<CTRL>-I GEF** is used, extremely good positive prints of digitised photographs can be obtained.

<CTRL>-I GE

This command affects the print density and works in the same way as the **<CTRL>-I E** command for text printing. It gives a darker print or picture by using the 'emphasized' printer code. If a **<CTRL>-I nQ** instruction is used in a preceding BASIC line, this can also affect print density.

<CTRL>-I nQ

The **<CTRL>-I nQ** options can be most conveniently used from BASIC, in the form of a line preceeding the graphics commands themselves. For example:

```
10 PR #1: PRINT CHR$(9); "1Q"
20 PRINT CHR$(9); "G2I"
```

prints a normal sized image of hi-res graphics page 2 using **1Q** density, which is 240 dots per inch.

This provides you with a means of telling the printer how close to each other you want it to print the dots which form the images it creates. The higher the density, the closer together the dots will be printed and the darker the resulting picture. The progressive closing of the gap between each dot will gradually reduce the size of a graphics print-out; expanding the horizontal and vertical scales will compensate for this. (See **<CTRL>-I GS** to **<CTRL>-I GZ**.)

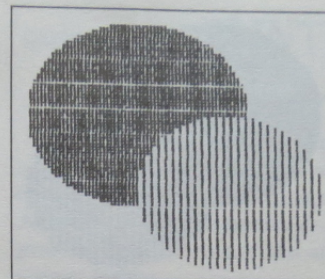
The density is set by entering **<CTRL>-I nQ**, where *n* is a number between 0 and 7. The table below shows the progressive effect of the available density settings on Epson FX series printers. Some printers cannot use this command at all, and some, like the RX series, cannot use all of the settings. You should look in your printer manual for the command **<ESC> ***. The control command table number corresponds to the value of the mode number given in that manual.

Where the mode number does not exist in the printer manual, that command cannot be used with **<CTRL>-I nQ**.

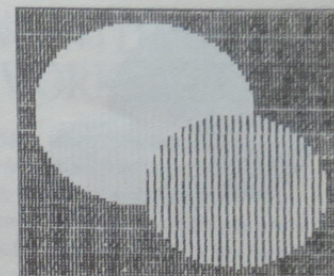
control command	maximum dots per inch/line	description
0	60/480	normal single density
1	240/1920	quad density
2	120/960	proportional Pica/double density
3	90/720	CRT graphics II
4	80/640	CRT graphics I
5	72/576	plotter graphics (1:1 ratio)
6	60/480	normal
7	120/960	double speed double density

Examples of different screen dumps are shown on pages 47 and 48.

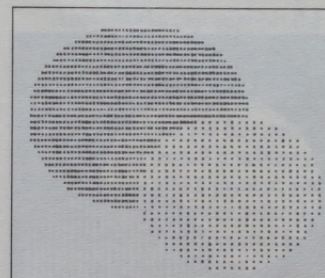
Warning: The **<CTRL>-I nQ** sequence also sets some text modes (see page 28). If it is used to set the screen dump size, the text size should be reset afterwards with the **<CTRL>-I @** command or preferably the **<ESC> @** printer control command if it exists in the commands on the printer. Consult the printer manual.



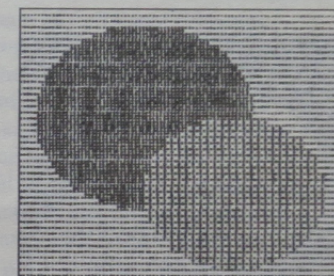
Standard dump using **<CTRL>-I G**
(A in table — page 44)



Inverse Dump using **<CTRL>-I G I**



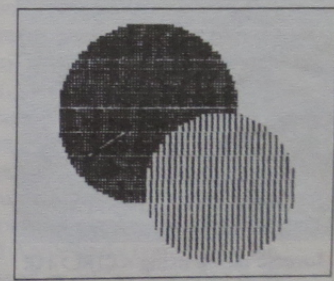
Shaded dump using **<CTRL>-I GK**
(B in table — page 44)



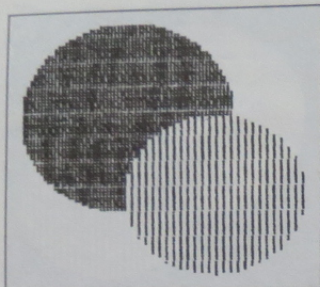
Shaded dump using **<CTRL>-I GJ**
(C in table — page 44)



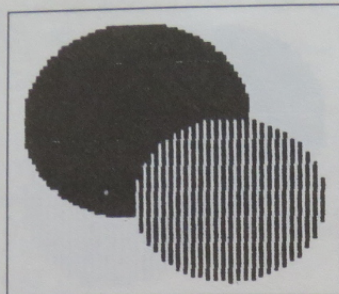
Shaded dump using **<CTRL>-I G IK**
(D in table — page 44)



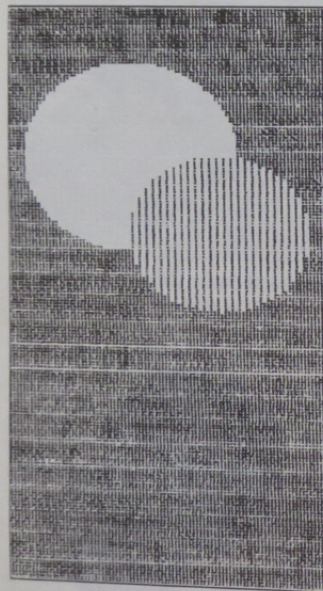
Correct aspect ratio on FX-80
using **<CTRL>-I 5Q <CTRL>-I G**



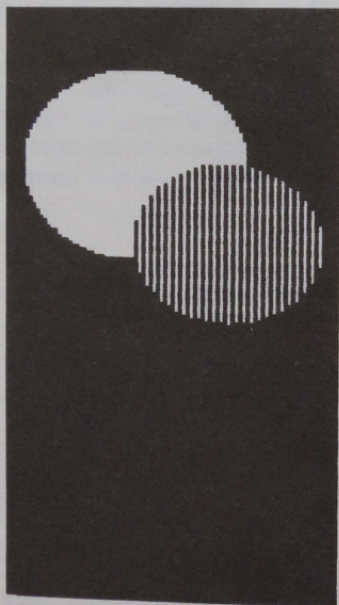
Standard dump using <CTRL>-I G



Intense dump using <CTRL>-I IQ
<CTRL>-I GU
(quad density x 4 expansion)



Inverse dump using <CTRL>-I GI



Inverse overstrike mode using
<CTRL>-I GIF

PRINTING WITH APPLEWORKS

The AppleWorks integrated package allows documents, spreadsheets and databases to be printed either on a printer, or to a disk file. Even if you intend to print to disk, you must first set up AppleWorks for your particular printer. Otherwise, when you come to print the disk file on a printer at a later date, the file will not be in the correct format.

SETTING UP FOR YOUR PRINTER

AppleWorks can support the Epson MX, RX and FX series printers. To set up AppleWorks for one of these printers, select **Other Activities** from the **Main Menu** and then **Specify Information About Your Printer** from the **Other Activities Menu**. Refer to the AppleWorks reference manual for full details of adding and removing printers. You can always re-install a printer at a later date if you wish.

When you add a printer, you will be asked which slot the printer interface is in. Answer **1** for the printer in slot 1. You can then set some of the printer options from a menu. The #8133 sends out a line feed with every carriage return, so you should set the **Line Feed After Each Return** option to **NO**.

AppleWorks does not allow control commands to be inserted directly into a file. This means you cannot use most of the commands described in this manual, or do bit image printing within a document, without first setting up a custom printer and making one of the AppleWorks control codes (superscript or subscript, for example) into a <CTRL>-I character. If you do this, you can then use the interface commands by inserting the appropriate AppleWorks control command, and then typing the part of the command which should follow the <CTRL>-I in normal characters as part of the file.

If you do not want to do anything more than print using the facilities provided by AppleWorks, you need only install the printer you are using. You can then use the standard AppleWorks commands, for example <CTRL>-B to turn bold type on or off, as described in the AppleWorks manual, and you need not bother with the commands described in this manual.

Full details of using printers with AppleWorks, including printing to disk or to the screen, and printing database and spreadsheet reports, are given in the AppleWorks reference manual starting on page 255.

PRINTING WIDE SPREADSHEETS

It is possible to print spreadsheets up to a width of 136 characters, even on an Epson 80-column printer, by using condensed printing. However, the printer itself automatically adds a carriage return after every 132 characters it receives. To print 136-column spreadsheets on an 80-column printer, use the **Special Character** option as follows:

- 1 With your spreadsheet on the screen, press **<open-apple>-O** for printer options.
- 2 To select the number of characters per inch, type **CI** and press **RETURN**. Answer **17** and press **RETURN** again.
- 3 Type **SC** and press **RETURN** to select the special character codes to disable the carriage return character which the FX-80 normally adds after 132 characters.
- 4 Press the following keys:
ESCAPE **>** **ESCAPE** **Q** **<CTRL>-H** **ESCAPE** **=**
After typing these 7 keys, type a * character to end the sequence. Now press **ESCAPE** to return to the spreadsheet, and press **<open apple>-P** to print.

PRINTING WITH APPLEWRITER II

Using APPLEWRITER II with a printer requires no special setting up. In order to use the special features of the #8133 interface, you will need to use the **<CTRL>-V** method to insert control characters. To use a control character in the middle of text, first press **<CTRL>-V** then press the appropriate keys for the control characters you require. Finally press **<CTRL>-V** to turn the control mode off. In many cases the **<CTRL>-I** command will need a number of extra text characters. In calculating the line length when formatting the text, APPLEWRITER will take these characters into account, whereas it will ignore the control characters for this purpose. Make sure you make allowances for this when you write the text. For this reason, it is best to make changes on a new line, rather than in the middle of text.

The version of APPLEWRITER for the APPLE II+ and the version for the APPLE IIe are similar except in one respect; with APPLEWRITER IIe it is not possible to send the **<NUL>** character (ASCII code 0) using the **<CTRL>-V** method. Instead you should send the **<NUL>** character by using the #8133 interface **<CTRL>-I 0<** command. First type **<CTRL>-V** to go into control character mode. Then type **<CTRL>-I** followed by **<CTRL>-V** to go into normal text mode. Then simply type **0<** as the next characters.

PRINTING FROM BASIC

Unlike many other forms of BASIC, neither APPLESOFT nor INTEGER BASIC has any special command to print exclusively on the printer. The two most commonly used commands to send data to the printer instead of the screen are **LPRINT** and **PRINT # file or device number**. Similarly, the command **LLIST** is often used to list programs on the printer. The examples in Epson manuals are written in standard MICROSOFT BASIC, which uses the commands **LPRINT** and **LLIST**. Because these commands are not available in either APPLESOFT or INTEGER BASIC, other methods have to be used to get the same effect.

The interface card is a means of sending characters to a device other than the screen, and you can use it just like any other card which processes data. The card is made active by giving the command **PR #** followed by the slot number of the card, and deactivated with **PR #0**. For example, initialising the card using **PR #1** simply tells the APPLE to route information through the card in slot 1.

LISTING TO THE PRINTER

If you have typed **PR #1** at the prompt, anything more that you type on the keyboard will be sent to the printer, but, because of the way printers work, it will only be printed out when you press the **RETURN** key. The cursor will appear at the beginning of the line on which the **PR #1** was typed and you will have to type without seeing anything happen.

The interface lets you overcome this by using the **<CTRL>-I** command to echo all characters to the screen. For example, giving the **<CTRL>-I** command then typing **HOME** will clear the screen as normal, and the word 'HOME' will also appear on the printer when the **RETURN** key is pressed. Similarly, if you use the **LIST** command, not only will the printer list the program, but it will also print the word 'LIST' above the listing just as it would appear on the screen.

Listings made in this way appear on the screen at the same time as they are being printed. The printer gives a listing which will have the program lines printed on separate lines of the paper rather than split as

they are on a 40 column screen. When you have finished printing a listing, use the **PR #0** command to switch the output from the printer back to the screen. Unfortunately this also prints the letters 'PR#0' after the listing. This can be overcome by pressing the <CTRL> and I keys together, and then the Y key without holding down the control key. A syntax error message will be displayed on the screen because APPLESOFT does not understand the characters as a command; this will not appear on the printer.

You can also catalog disks onto the printer to have a permanent record. Simply type **PR #1** and press **RETURN**, then type **CATALOG**, with the drive number if necessary and press **RETURN** again; this is the same as displaying a catalog on the screen, but the catalog of the disk will only appear on the printer. In the case of a long directory, it will be necessary to press a key, in order to display another 'screenful', and so for the remainder of the catalog to be printed.

USING THE PRINTER WITH BASIC PROGRAMS

Apart from producing listings and disk catalogs, the printer has many other applications. The process of printing on the printer is very similar to printing on the screen, and this makes printing a straightforward programming task.

There are many occasions when only a few lines are needed on the printer, while the main program prints the instructions on the screen. In order to do this, insert the **PR #1** command in your program at the appropriate point to direct output to the printer. When you want output to cease being printed by the printer, include the **PR #0** command.

If the program is running under DOS, then there may be times when the printer does not always become active in response to **PR #1**. It is as well to heed the advice of the APPLE DOS MANUAL and precede the command with a <CTRL>-D character or **CHR\$(4)**. Since <CTRL>-D is only active if it is preceded by a carriage return, the sequence can be added as part of a **PRINT** statement (or as the actual ASCII codes for the characters), as illustrated in the following program. If you are using ProDOS you should NOT use the carriage return as well as the <CTRL>-D. If you do, you will turn the **TRACE** command on.

```
10 D$ = CHR$(13) + CHR$(4)
20 PRINT "TO THE SCREEN ONLY"
30 PRINT D$;"CATALOG"
40 PRINT D$;"PR#1"
50 PRINT CHR$(9); CHR$(73)
55 REM <CTRL>-I I TURNS ON SCREEN ECHO
60 PRINT "TO THE SCREEN AND PRINTER"
70 PRINT D$;"CATALOG"
80 PRINT CHR$(9); CHR$(74)
85 REM <CTRL>-I J TURNS OFF SCREEN ECHO
90 PRINT "TO THE PRINTER ONLY"
100 PRINT D$;"CATALOG"
110 PRINT D$;"PR#0"
```

Line 10 sets up a string (**D\$**) which will be used to print a carriage return followed by <CTRL>-D in later lines. Line 20 prints the message that output is to go to the screen only, and the logged in disk is then catalogued to the screen. Line 40 switches on the printer, then line 50 issues the command <CTRL>-I I to switch on the screen echo. This time the catalog is printed both on the screen and on the printer. The screen echo is switched off again by entering <CTRL>-I J, as in line 80; this ensures that output goes only to the printer. Remember that if your catalog is more than one screen in length, you will have to press the space bar as usual to get the rest of it displayed.

When using INTEGER BASIC, it is necessary to type the <CTRL>-D directly inside the string. However, unless you use a special routine or utility which makes control characters visible, you will not see the <CTRL>-D in the program listing. In this case you should be especially careful if there is a need to edit the lines using the APPLE editor, as copying over the line removes any control characters.

The example program used the <CTRL>-I I and <CTRL>-I J commands to echo characters to the screen. There are a number of other commands which control the printer. Details are given elsewhere in the manual, with listings wherever necessary.

BREAKING A PROGRAM

Frequently it is necessary to break a program when it gets stuck in an endless loop, or when you realise that it is not running correctly. It is possible to use either **<CTRL>-C** or the RESET key. If you use the RESET key then not only will the program be stopped, but the printer will be switched off and output will be directed to the screen only. However, if **<CTRL>-C** is used, then the printer will not be switched off and the error message will be printed on both the printer and the screen. If you now try to re-run the program, all printing will go to the printer as well as the screen from the beginning of the program.

PRINTING MONITOR LISTINGS

You can also use the printer to dump areas of memory or disassemble machine code, instead of printing just to the screen. If you are in the monitor (the prompt will be a *) you can switch the printer on by typing the number of the slot of the printer followed by **<CTRL>-P**. However, if you are using DOS, the output will only go to the screen and not the printer. This can be overcome by turning the printer on in BASIC using **PR #1** for slot 1, before entering the monitor using **CALL -151** or **CALL -155**.

USE OF THE PRINTER WITH LOGO

Using the printer with the LOGO language is very similar to using it with BASIC. The interface card has to be enabled, and the PRINT commands then cause data to be printed on the printer rather than on the screen. There are some peculiarities which require the control codes to be sent in a specific way: these are described by means of examples below. It is also possible to copy the screen to the printer.

Different versions of LOGO use slightly different commands to control the printer. Examples are therefore given for APPLE LOGO and MIT LOGO.

LISTING LOGO PROGRAMS

The method of listing a program is the same as for BASIC. To print out all the procedures in workspace:

- the printer is enabled
- the **PRINTOUT ALL** or **POALL** command is typed in MIT and APPLE LOGO respectively
- the listing is printed on the printer rather than on the screen.

The commands to control the printer are:

MIT LOGO	APPLE LOGO	action
OUTDEV 1	.PRINTER 1	switch to printer - the '1' denotes slot 1
OUTDEV 0	.PRINTER 0	switch printer off

The way you handle the computer after you have given these commands at the prompt is slightly different with the two versions of LOGO.

With MIT LOGO, everything LOGO would normally send to the screen is sent to the printer instead but everything you type on the keyboard goes only to the screen. This means that you can see what you are typing by looking at the screen, but you have to look at the printer to see LOGO's replies.

With APPLE LOGO the screen simply shows a flashing cursor: everything you type will come out on the printer when you press the RETURN key. You have to type without making mistakes or the result will look confusing! LOGO's responses are also sent to the printer, so that you have a complete printed record of the dialogue. Thus the commands for enabling and disabling the printer behave in a similar way to the **PR #1** and **PR #0** commands in BASIC; they just have different names.

PRINTING TEXT AND USING THE CONTROL CODES

Controlling the printer is similar to printing on the screen. You have to be careful in giving commands to the printer, particularly with the ESC/P sequences. The following program, used as an example to list to the printer, was chosen not only to encompass the different print commands, but also to illustrate the reason for using particular command sequences.

MIT LOGO

```
TO PRT
OUTDEV 1
PRINT [AN EXAMPLE OF TEXT]
(PRINT CHAR 65 CHAR 66)
PRINT1 CHAR 65
PRINT1 CHAR 66
PRINT [ ]
PRINT [CD]
OUTDEV 0
END
```

APPLE LOGO

```
TO PRT
.PRINTER 1
PRINT [AN EXAMPLE OF TEXT]
(PRINT CHAR 65 CHAR 66)
TYPE CHAR 65
TYPE CHAR 66
PRINT [ ]
PRINT [CD]
.PRINTER 0
END
```

The output from the program be:

AN EXAMPLE OF TEXT

```
A B
AB
CD
```

As well as demonstrating **PRINT**, the program shows how the **CHAR** command is used. The third line prints the characters **A** and **B** using

the **CHAR** command twice in one **PRINT** statement. The same characters are then printed using the commands **PRINT1** and **TYPE** — the equivalent commands in the two versions of LOGO: these print text without a carriage return. Note that if **CHAR** is used more than once in a single statement, the characters are printed with a space in between them. If they are printed separately, using **TYPE** or **PRINT1**, then the characters are placed together just like printing them as a block of text.

This is important if the characters are control characters, so these have to be printed using the **CHAR** function. The printer must see the control characters as a complete string, without spaces. For example, to select enlarged characters permanently, the sequence the printer needs is **<ESC> W** then ASCII code 1: the ASCII code sequence is 27, 87, 1. The following program uses this sequence to print in enlarged characters:

MIT LOGO

```
TO ENLARGE
OUTDEV 1
PRINT1 CHAR 27
PRINT1 CHAR 87
PRINT1 CHAR 1
PRINT [SOME ENLARGED TEXT]
OUTDEV 0
END
```

APPLE LOGO

```
TO ENLARGE
.PRINTER 1
TYPE CHAR 27
TYPE CHAR 87
TYPE CHAR 1
PRINT [SOME ENLARGED TEXT]
.PRINTER 0
END
```

If the line:

```
(PRINT CHAR 27 CHAR 87 CHAR 1)
```

is used (which would be the same in both versions of LOGO) then the printer will receive the ASCII code sequence 27, 32, 87, 32, 1, instead of 27, 87, 1. (Note the ASCII code for a space is 32.) This sequence is meaningless as far as the printer is concerned, since **<ESC>** followed by ASCII code 32 is not an instruction. This means that the next character will be seen as a printable character, and a letter **W** will be printed. It would also be possible in this case to use the alternative method of using **<ESC> W 1** where the actual character 1 is sent as part of the sequence, instead of ASCII code 1. The program would then be:


```
MIT LOGO
TO ENLARGE
OUTDEV 1
PRINT1 CHAR 27
PRINT1 [W1]
PRINT [SOME ENLARGED TEXT]
OUTDEV 0
END
```

```
APPLE LOGO
TO ENLARGE
.PRINTER 1
TYPE CHAR 27
TYPE [W1]
PRINT [SOME ENLARGED TEXT]
.PRINTER 0
END
```

PRINTING COPIES OF THE GRAPHICS SCREEN

The majority of programs written in LOGO involve graphics. It is possible to copy the graphics screen by the same methods as with BASIC, namely using the sequence <CTRL>I G and the additional codes for double height, etc. The following procedure illustrates the method of printing the graphics page to produce a double size screen:

```
MIT LOGO
TO PRINTPIC
OUTDEV 1
PRINT1 CHAR 9
PRINT1 [GD]
OUTDEV 0
END
```

```
APPLE LOGO
TO PRINTPIC
.PRINTER 1
TYPE CHAR 9
TYPE [GD]
.PRINTER 0
END
```

OVERCOMING ASPECT RATIO PROBLEMS

The aspect ratio problem can also be solved. There is a command to set the screen height in LOGO called **.ASPECT** (MIT) or **SETSCRUNCH** (APPLE). Experiment with different values depending on the printer you have and whether or not you are rotating the screen image.

USING THE PRINTER WITH PASCAL

Since PASCAL is a compiled language, the way you use the printer is slightly different from when you are using an interpreted language like LOGO or BASIC. Data can be transferred to the printer using the **Transfer ?** option in the **Filer**., or the printer can be treated as a file inside a program. You should install the interface card in slot 1. PASCAL then assigns **VOLUME #6:** to the **PRINTER**., as you will see if you look at the volumes which are on-line with the **V** option in the **Filer**..

DIRECTORIES AND PROGRAM LISTINGS

If you want to print a directory, you would normally send the data only to the screen, but it is possible to send it to the printer, either by specifying the volume number or **PRINTER**.. The following examples give a directory of the **APPLE1:** disk in drive 4.

Typing **L** whilst in the **Filer**: will give the prompt:

Dir Listing of ?

You can then respond with any of the following combinations:

```
# 4:, # 6:
APPLE1:, # 6:
# 4:, PRINTER:
APPLE1:, PRINTER:
```

An extended directory can be obtained in a similar way by pressing **E** in the **Filer**..

In order to print listings or text files, you can treat the printer as the device to which they are transferred. For example, to print a file named **PRTOUT.TEXT**, you would simply type **T** from the **Filer**., and at the **Transfer ?** prompt, reply with **PRTOUT.TEXT**, adding the volume name if necessary. Then, when the prompt **To where ?** is given, reply with **# 6:**, or **PRINTER**., and the text file will be listed on the printer.

USING THE PRINTER AS A PASCAL FILE

The process of printing from a PASCAL program is different from BASIC: you have to direct each item of data to be sent to the printer specifically to that device. The printer then becomes an output file. First it is necessary to declare an internal identifier for the printer file, making its type either **TEXT** or **INTERACTIVE**. Open the file using **REWRITE**, supplying the name **PRINTER:**, and then either **WRITE** or **Writeln** statements can be used to carry out the printing. The following short program will accept input from the keyboard and print it on the printer:

PROGRAM PRTOU;

```
VAR  EPSON   : INTERACTIVE;  
     WORDS   : STRING;
```

BEGIN

```
  READLN(WORDS);  
  REWRITE(EPSON, 'PRINTER:');  
  Writeln(EPSON, WORDS, 'WAS THE TEXT YOU INPUT.');
```

END.

Since the printer is not a block-structured device, you cannot use **BLOCKWRITE**. You can, however, use **UNITWRITE** — consult the **APPLE PASCAL LANGUAGE REFERENCE MANUAL** for the full details of its use.

Remember that, if you are using **WRITE** instead of **Writeln**, no carriage return is sent to the printer. You will not see any text printed by the printer until either the printer's buffer is full or a carriage return is sent to empty it. Thus you should ensure at the end of your program that either a carriage return is sent as the last character, or that a **Writeln** statement is used.

INTERFACE COMMANDS IN PASCAL

Using the commands in PASCAL is the same as described in the rest of the manual, except that **<CTRL>Y** is used instead of **<CTRL>I**.

SCREEN DUMPS

Both text and graphics screen dumps can be performed in the usual way using the **<CTRL>Y nS** and **<CTRL>Y G** commands respectively.

USING THE PRINTER WITH CP/M

As with PASCAL, using the #8133 interface with CP/M is slightly different from using it with BASIC. The interface should go into slot #1. The normal way to direct output to the printer is to use **<CTRL>P** as a toggle. The CP/M documentation gives full details, as does the documentation for any applications programs.

If you are using MBASIC or GBASIC, the commands are used as described in the rest of the manual. You do not have to use the **PR #1** command to direct output to the printer. Use the **LPRINT** and **LLIST** commands instead.

Commands should start with **<CTRL>Y** instead of **<CTRL>I**, including those for dumping graphics screens.

CONNECTOR PIN ASSIGNMENT TABLES

1. INTERFACE BOARD SIDE

Pin No.	Signal	Wire Color
1	STROBE	Red
2	GND	Grey
3	DATA 1	Grey
4	GND	Grey
5	DATA 2	Green
6	GND	Grey
7	DATA 3	Grey
8	GND	Grey
9	DATA 4	Grey
10	GND	Green
11	DATA 5	Grey
12	GND	Grey
13	DATA 6	Grey
14	GND	Grey
15	DATA 7	Green
16	GND	Grey
17	DATA 8	Grey
18	GND	Grey
19	ACK	Grey
20	BUSY	Green

2. PRINTER SIDE

Pin No.	Signal	Pin No.	Signal
1	STROBE	8	DATA 7
2	DATA 1	9	DATA 8
3	DATA 2	10	ACK
4	DATA 3	11	BUSY
5	DATA 4	12-18	N/A
6	DATA 5	19-27	GND
7	DATA 6	28-36	N/A

EPSON OVERSEAS MARKETING LOCATIONS

EPSON AMERICA, INC.

2780 Lomita Blvd., Torrance,
Calif. 90505, U.S.A.
Phone: (213) 539-9140
Telex: 182412

EPSON DEUTSCHLAND GmbH

Zülpicher Straße 6,
4000 Düsseldorf 11,
F.R. Germany
Phone: (0211) 56030
Telex: 8584786

EPSON (UK) LTD.

Dorland House, 388 High Road,
Wembley, Middlesex, HA9 6UH, U.K.
Phone: (01) 902-8892
Telex: 8814169

EPSON FRANCE S. A.

55, Rue Deguingand, 92300, Levallois-
Perret, France
Phone: (1) 739-6770
Telex: 614202

EPSON AUSTRALIA PTY. LTD.

Unit 3, 17 Rodborough Road,
Frenchs Forest, NSW 2086, Australia
Phone: (02) 452-5222
Telex: 75052

EPSON ELECTRONICS (SINGAPORE) PTE. LTD.

No. 1 Maritime Square, #02-19,
World Trade Centre, Singapore 0409
Phone: 2786071/2
Telex: 39536

EPSON ELECTRONICS TRADING LTD.

30/F, Far East Finance Centre
Harcourt Road, Central, Hong Kong
Phone: 5-282555
Telex: 65542

EPSON ELECTRONICS TRADING LTD. (TAIWAN BRANCH)

1, 8F K.Y. Wealthy Bldg., 206, Nanking
E. Road, Sec. 2, Taipei, Taiwan R.O.C.
Phone: 536-4339; 536-3567
Telex: 24444

EPSON CORPORATION

80 Hirooka, Shiojiri-shi, Nagano
399-07 Japan
Phone: (0263) 52-2552
Telex: 3342-214

8133
Apple Interface
Command Summary

EPSON

Control Codes by Letter

General and Text Commands

* Default Settings

PR #0	DOS command to disable the interface.
PR #1	DOS command to activate the interface if installed in slot 1.
<CTRL>I #	Causes ASCII code 36 to be printed as £.
<CTRL>I \$	Causes ASCII code 36 to be printed as \$.
<CTRL>I n<	Sends the decimal number n directly to the printer.
<CTRL>I n>	This command must be followed by a string of 2n characters representing n bytes of hexadecimal data to be sent directly to the printer.
<CTRL>I n?	Allows Applesoft tab function to operate correctly up to column n. If $n \leq 48$ tabbing operates normally.
<CTRL>I @	Resets the printer.
<CTRL>I A	* Enables auto linefeed.
<CTRL>I B	* Enables "bell".
<CTRL>I C	Disables "bell".
<CTRL>I D	Selects double strike printing.
<CTRL>I E	Selects bold (emphasized) printing.
<CTRL>I nF	Selects international character sets, NLQ and downloaded character sets. ($0 \leq n \leq 10$ or $n=32$ or $n=33$)
<CTRL>I H	High bit of data passed to the printer.
<CTRL>I I	Enables screen echo.
<CTRL>I J	* Disables screen echo.
<CTRL>I K	Disables auto linefeed.
<CTRL>I nL	Sets the left margin to column n.
<CTRL>I nN	Sets the line length to n characters.

<CTRL>I nP	Sets the page length to n lines including 6 blank lines. If $n=0$ form feed is disabled.
<CTRL>I nQ	Sets combinations of elite, pica and condensed pitches. ($0 \leq n \leq 8$)
<CTRL>I nR	Sets the right margin for word-wrap to column n.
<CTRL>I nS	Dumps the current text screen to the printer. On an Apple IIe, set $n > 128$ to dump the 80 column screen.
<CTRL>I nT	Allows the next n characters to be sent directly to the printer, ie the character codes are treated as data. If $n=0$, transparent mode is switched on permanently.
<CTRL>I V	Cancels double width, bold, double strike.
<CTRL>I W	Selects double width printing.
<CTRL>I X	* High bit of data set to zero.
<CTRL>I Y	Control command to disable the interface.
<CTRL>I Z	Restores defaults settings (marked *).

Graphics Commands

<CTRL>I nQ	Selects print density and speed. Higher print densities also result in smaller screen dumps.
<CTRL>I G 2	Print Graphics Page 2.
<CTRL>I G D	Scale X and Y axes by 2, ie print double size.
<CTRL>I G E	Selects a combination of double size and double density.
<CTRL>I G F	Causes each row to be overprinted after a half dot linefeed, to produce a more even effect.
<CTRL>I G I	Prints an inverted screen dump.
<CTRL>I G J	Causes white areas of the dump to be shaded in grey.

<CTRL>I G K	Causes black areas of the dump to be shaded in grey.
<CTRL>I G O	The data sent to the printer is the logical OR of graphics screens 1 and 2.
<CTRL>I G P	The data sent to the printer is the logical AND of graphics screens 1 and 2.
<CTRL>I G Q	The data sent to the printer is the logical XOR of graphics screens 1 and 2.
<CTRL>I G R	Print dump rotated by 90° anticlockwise.
<CTRL>I G S	Scale X axis by 2.
<CTRL>I G T	Scale X axis by 3.
<CTRL>I G U	Scale X axis by 4.
<CTRL>I G V	Scale X axis by 5.
<CTRL>I G W	Scale Y axis by 2.
<CTRL>I G X	Scale Y axis by 3.
<CTRL>I G Y	Scale Y axis by 4.
<CTRL>I G Z	Scale Y axis by 8.

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EPSON AMERICA, INC. 2780 Lumis-Built, Torrance, Calif. 90505, U.S.A. Phone: (213) 539-9140 Telex: 182412	EPSON DEUTSCHLAND GmbH Zölzacher Strasse 8, 4000 Düsseldorf 11, F.R. Germany Phone: (0211) 56030 Telex: 8584786
EPSON (UK) LTD. Dartford House, 388 High Road, Wembley, Middlesex, HA9 6UH, U.K. Phone: (01) 902-8892 Telex: 8814169	EPSON FRANCE S.A. 55, Rue Deguingand, 92300, Levallois-Perret, France Phone: (1) 739-6770 Telex: 614202
EPSON AUSTRALIA PTY. LTD. Unit 3, 17 Rodborough Road, Frenchs Forest, NSW 2086, Australia Phone: (02) 452-5222 Telex: 75052	EPSON ELECTRONICS (SINGAPORE) PTE. LTD. No. 1 Maritime Square, #02-19, World Trade Centre, Singapore 0409 Phone: 2786071/2 Telex: 39536
EPSON ELECTRONICS TRADING LTD. 30/F, Far East Finance Centre Harcourt Road, Central, Hong Kong Phone: 5-282555 Telex: 65542	EPSON ELECTRONICS TRADING LTD (TAIWAN BRANCH) 1, 8F, K.Y. Wealthy Bldg., 206, Nanking E. Road, Sec. 2, Taipei, Taiwan R.O.C. Phone: 536-4339, 536-3567 Telex: 24444
EPSON CORPORATION 80 Hirooka, Shioyuri-shi, Nagano 399-07 Japan Phone: (0263) 52-2552 Telex: 3342-214	

Giving Commands to the #8133 Interface

To mark the beginning of a command addressed to the #8133 interface

- under DOS 3.3 or ProDOS, press <CTRL> and I simultaneously
- under APPLESOFT, PRINT CHR\$(9)
- under CP/M or PASCAL, press <CTRL> and Y simultaneously.

A syntax error will be generated if <CTRL>I is entered directly from the keyboard, rather than in a program, since it is not recognised as a command by APPLESOFT. However, the command will still function correctly. The remainder of the command is sent to the interface as a string, consisting of single letter commands, and in some cases a number, denoted by "n" in this summary. For instance, to set the number of lines per page to 60 requires a command of the form <CTRL>I nP. To achieve this in an Applesoft program use the following line.

```
10 PRINT CHR$(9); "60P"
```

Control Codes by Function

Interface and Printer Control Commands

PR #1	DOS command to activate the interface if installed in slot 1.
PR #0	DOS command to disable the interface.
<CTRL>I Y	Control command to disable the interface.
<CTRL>I @	Resets the printer.
<CTRL>I Z	Restores defaults used by the interface.
<CTRL>I V	Cancels double width, bold, double strike.

General Control Commands

<CTRL>I A	* Default settings
<CTRL>I K	* Enables auto linefeed.
<CTRL>I I	Disables auto linefeed.
<CTRL>I J	Enables screen echo.
<CTRL>I B	* Disables screen echo.
<CTRL>I C	* Enables "bell".
<CTRL>I H	Disables "bell".
<CTRL>I X	High bit of data passed to the printer.
<CTRL>I Z	* High bit of data set to zero.
	Restores all default settings.

Horizontal Print Size Commands

<CTRL>I nQ	Sets combinations of elite, pica and condensed pitches. ($0 \leq n \leq 8$)
------------	---

Print Enhancement Commands

<CTRL>I W	Selects double width printing.
<CTRL>I D	Selects double strike printing.
<CTRL>I E	Selects bold (emphasized) printing.

N.B. These commands can be used in combination.

<CTRL>I V	Cancels all print enhancement.
-----------	--------------------------------

Character Set Control Commands

<CTRL>I nF	Selects international character sets, NLQ and downloaded character sets. ($0 \leq n \leq 10$ or $n=32$ or $n=33$)
<CTRL>I #	Causes ASCII code 36 to be printed as £.
<CTRL>I \$	Causes ASCII code 36 to be printed as \$.

Page Formatting Commands

<CTRL>I nL	Sets the left margin to column n.
<CTRL>I nN	Sets the line length to n characters.
<CTRL>I nR	Sets the right margin for word-wrap to column n.
<CTRL>I nP	Sets the page length to n lines including 6 blank lines. If n=0 form feed is disabled.
<CTRL>I n?	Allows Applesoft tab function to operate correctly up to column n. If $n \leq 48$ tabbing operates normally.

Transparent Mode Commands

<CTRL>I nT	Allows the next n characters to be sent directly to the printer, ie the character codes are treated as data. If n=0, transparent mode is switched on permanently.
<CTRL>I n<	Sends the decimal number n directly to the printer.
<CTRL>I n>	This command must be followed by a string of 2n characters representing n bytes of hexadecimal data to be sent directly to the printer.

Text Screen Dump Command

<CTRL>I nS	Dumps the current text screen to the printer. On an Apple //e, set n>128 to dump the 80 column screen.
------------	--

Graphics Screen Dump Commands

<CTRL>I nQ	Selects print density and speed. Higher print densities also result in smaller screen dumps.
<CTRL>I G 2	Print Graphics Page 2.
<CTRL>I G S	Scale X axis by 2.
<CTRL>I G T	Scale X axis by 3.
<CTRL>I G U	Scale X axis by 4.
<CTRL>I G V	Scale X axis by 5.
<CTRL>I G W	Scale Y axis by 2.
<CTRL>I G X	Scale Y axis by 3.
<CTRL>I G Y	Scale Y axis by 4.
<CTRL>I G Z	Scale Y axis by 8.
<CTRL>I G D	Scale X and Y axes by 2, ie print double size.
<CTRL>I G R	Print dump rotated by 90° anticlockwise.
<CTRL>I G E	Selects a combination of double size and double density.
<CTRL>I G F	Causes each row to be overprinted after a half dot linefeed, to produce a more even effect.
<CTRL>I G I	Prints an inverted screen dump.
<CTRL>I G J	Causes white areas of the dump to be shaded in grey.
<CTRL>I G K	Causes black areas of the dump to be shaded in grey.
<CTRL>I G O	The data sent to the printer is the logical OR of graphics screens 1 and 2.
<CTRL>I G P	The data sent to the printer is the logical AND of graphics screens 1 and 2.
<CTRL>I G Q	The data sent to the printer is the logical XOR of graphics screens 1 and 2.

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QUANTITY

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PARTS NAME

APPLE II INTELLIGENT PARALLEL
I/F TYPE II
#8133W

PURCHASE ORDER NO.

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USER'S MANUAL

**NEW APPLE II
INTELLIGENT PARALLEL
INTERFACE**

8133

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