



80 COLUMN DOT MATRIX PRINTER

JRT

Programmer's Manual



Hi-G CO., INC.

Printer Products

580 Spring Street
Windsor Locks, Connecticut 06096
(203) 623-3363

DESIGNED TO SURVIVE.

PROGRAMMER'S MANUAL
MODEL 9/80 PRINTER

HI-G, INCORPORATED

580 Spring Street
Windsor Locks, CT 06096
Service Tel. No.: (203) 623-2481

Date: July 1982

PROGRAMMER'S MANUAL MODEL 9/80

TABLE OF CONTENTS

	<u>Page No.</u>
I. CONTROL CODES	
Software Downloadable Codes	P80-01
Logical Sequencing of Codes and Data	P80-01
Elongated Characters (CNTL N)	P80-01
Note to TRS-80 users	P80-01
Superscript and subscript characters (ESC B, ESC C)	P80-02
8 or 6 Vertical Lines per Inch (ESC 5, ESC 4)	P80-02
10 CPI (ESC 6)	P80-02
10 CPI Double Density (ESC 9)	P80-02
12 CPI (ESC 8)	P80-02
16.5 CPI (ESC 7)	P80-03
Optional Character Set (ESC A)	P80-03
Standard Character Set (ESC @)	P80-03
Downloaded Character Set (ESC D)	P80-03
Terminate Line (CNTL M)	P80-03
Underlining	P80-04
Paper Advance (CNTL J)	P80-04
Reverse Paper Advance (CNTL A, CNTL -)	P80-04
Reset to All Default Option Selections (ESC R)	P80-05
Printer Select/Deselect (CNTL Q, CNTL S)	P80-05
II. VERTICAL FORMS UNIT	
Defining a VFU	P80-06
Default VFU	P80-09
III. CHARACTER SET DOWNLOAD	
Coding Sequence	P80-10
Data to Printwire Relationship	P80-11
Illegal Definitions	P80-13

Programmer's Manual Model 9/80 Table of Contents (cont'd.)

	<u>Page No.</u>
IV. GRAPHICS	
Graphics Programming Sequence	P80-14
Data to Print Relationship	P80-14
A. Graphics Segment	
B. Graphics Code	
C. Graphics Block	
D. Graphics Line	
Graphics Line Terminators	P80-17
Graphics Errors	P80-17
A. APPENDIX	
Switch Settings	A1-A3
Control Codes	A4
ASCII Character Set	A5

I. CONTROL CODES

Software Downloadable

In addition to recognizing the 96 character ASCII set, the 9/80 printer will also respond to 33 ASCII control codes.

During normal printer operation, the programmer sends the appropriate control code that will select the option desired. The default operating parameters can always be returned to by sending an ESC R control code, or by resetting the printer.

Software downloadable control codes will override the Dip Switch selectable options. After RESET or TEST modes are used, then the control codes should be reloaded.

The table labeled Control Codes in the Appendix lists the possible control codes. An ASCII character set is also included.

Codes not recognized by the printer are ignored.

Logical Sequencing of Codes and Data

It is necessary that your control codes and data follow a logical sequence. This becomes especially important when using the superscript and subscript printing modes, underlining, Vertical Forms Unit, character set download and graphics.

Elongated Characters

Use the CNTL N to print elongated characters (double wide characters). Use the CNTL O or CNTL M (carriage return) to terminate the elongated characters. An example in BASIC that prints elongated characters follows:

```
PRINT CHR$(14); "WIDE CHARACTERS"; CHR$(15)
```

With ten CPI selected, only 40 elongated characters can be printed on each line.

Note to TRS-80 Users:

Due to the fact that some of the lowest 31 ASCII codes (1 through 1F Hexadecimal) are interpreted internally by the TRS-80 as keyboard and video display control codes and are not transmitted, it is advisable to add +128 to all control codes you use in this range (1 thru 31 Decimal).

The example shown above using BASIC must take a different form when using the TRS-80:

```
PRINT CHR$(14 + 128); "WIDE CHARACTERS"; CHR$(15 + 128)
```

Superscript and Subscript Characters

Use the ESC B control code to print in the superscript position and the ESC C control code for the subscript printing position. An example in BASIC utilizing the superscript and subscript options follows:

```
PRINT CHR$(27); CHR$(66); "SUPERSCRIPT"; CHR$(10);  
PRINT "          AND          CHARACTERS ARE HERE";  
PRINT CHR$(27); CHR$(67); "          SUBSCRIPTED"; CHR$(10)
```

Follow each of the superscript or subscript strings with one CNTL J (line feed).

8 or 6 LPI

To enable 8 lines per vertical inch, send an ESC 5 control code.

For example:

```
PRINT CHR$(27); CHR$(53);  
PRINT "THESE LINES WILL PRINT AT 8 LPI"  
PRINT "THESE LINES WILL PRINT AT 8 LPI"  
PRINT "THESE LINES WILL PRINT AT 8 LPI"  
PRINT "THESE LINES WILL PRINT AT 8 LPI"
```

Use the ESC 4 to enable six lines per vertical inch.

10 CPI*

Use the ESC 6 control code to print at 10 characters per inch (CPI). Eighty characters per line can be printed using this density. For example:

```
PRINT CHR$(27); CHR$(54); "10 CHARACTERS PER INCH"
```

10 CPI Double Density*

Use the ESC 9 control code to print 10 CPI Double Density printing. For example:

```
PRINT CHR$(27); CHR$(57); "LETTER QUALITY"
```

12 CPI*

Use the ESC 8 control code to print at 12 CPI. Ninety-six characters per line can be printed using this density. For example:

```
PRINT CHR(27); CHR$(56); "12 CHARACTERS PER INCH"
```

16.5 CPI*

Use the ESC 7 code to print at 16.5 CPI. One hundred thirty two characters per line can be printed using this density. For example:

```
PRINT CHR$(27); CHR$(55); "***** 16.5 CHARACTERS PER INCH*****"
```

Optional Character Set

Use the ESC A control code to select the optional character set. For example:

```
PRINT CHR$(27); CHR$(65); "0123456789 ALTERNATE SET"
```

If upon calling the optional character set, blanks are printed, use the standard character set (see next example).

Standard Character Set

Use the ESC @ control code to select the standard character set. For example:

```
PRINT CHR$(27); CHR$(64); "0123456789 STANDARD SET"
```

Downloaded Character Set

Use the ESC D control code to select the downloaded character set. For example:

```
PRINT CHR$(27); CHR$(68); "DOWNLOADED SET"
```

Before attempting to use this character set, please read Section III of this text, "Character Set Download".

Terminate Line

Use the CNTL M (Carriage Return) control code to terminate a line. The printer can be configured to insert a line feed upon receiving a carriage return. Refer to the Appendix or the Operator's Manual for the appropriate Dip Switch settings.

*Please note that for each line to be printed, only one character density is allowed (10 CPI, 10 CPI Double Density, 12 CPI, or 16.5 CPI), although Elongated Characters (double width characters) and normal width characters can be printed on the same line.

Underlining

The proper sequence to follow when underlining is this:

- (1) Transmit the first data line which includes the word or words to be underlined.
- (2) Transmit CNTL M (Carriage Return)
- (3) Transmit a second data line consisting of blanks and underlines with the underlines placed in such a position between the blanks (if any) so that they exactly overlay the word or words in the first data line that need underlining. For example:

```
PRINT "UNDERLINE EACH WORD"; CHR$(13); " _____ _ _ _"
```

It is imperative when underlining that:

- (1) No paper advance commands be transmitted between the first and second data lines.
- (2) The Automatic Line Feed or Carriage Return option must be OFF. Refer to "Switch Settings" in the Appendix or in the 9/80 Operator's Manual.

Paper Advance

Use the CNTL J (line feed) control code to advance the paper one line increment. The actual distance the paper will advance will be 1/6 inch (six lines per inch) or 1/8 inch (eight lines per inch), depending upon the current operating mode of the printer. Six or eight lines per inch operation is operator selected via Dip Switches (see Operator's Manual) yet can also be selected via control codes (see 8 or 6 LPI).

Reverse Paper Movement

Use the CNTL A control code to move the paper in a reverse direction one line increment. For example:

```
PRINT "THIS IS ON THE BOTTOM"; CHR$(1); "WHILE THIS IS ON TOP"
```

Use the CNTL __ (Hexadecimal 1F) control code to move the paper in a reverse direction in increments of 1/72 inch.

Reset to All Default Option Selections

Use the ESC R control code to reset all of the options back to the switch selected options. All options are affected including character density, vertical LPI density, super or subscript positions, elongated characters, character set, and VFU.

This control code will not work, however, if the printer has been Deselected (see next paragraph).

Printer Select/Deselect

Use the CNTL Q control code to Select the printer to receive data for output, and use the CNTL S code to Deselect the printer. Once the 9/80 printer has been Deselected, all data and control codes it receives will be ignored. If Deselected, you must send the CNTL Q control code to re-Select the printer or manually RESET the printer.

II. VERTICAL FORMS UNIT (VFU)

Defining a VFU

The VFU offers a means by which the printer can keep track of the number of lines of data it has printed. By remembering the number of lines printed, it is possible for the printer to maintain an image of a fixed page length and then move the printhead to any line on that page. In physical terms, the printer is able to position the printhead on any desired line of any paper or form that passes through it.

For example, use the 1.5 inch address labels that come on tractor type paper. The distance from the top of one label to the top of the next label is 1.5 inches. At six printed lines per inch, this is equivalent to nine printed lines. If the printhead were positioned at the top line of one label and the printer was commanded to advance nine lines, the printhead would then be at the top line of the second label. From this position, advancing nine more lines would now place the printhead at the top line of the third label and so on. This task could be accomplished by sending nine sequential line-feed commands to the printer. The VFU feature facilitates this action by using only one command. This is how it would be accomplished:

First, the printer is set up to run at six lines per inch. The control code used for this is ESC 4. Next, the VFU load sequence is started and nine line positions are defined. CNTL ^ (Hexadecimal 1E) starts the load sequence. The top most line position is called the "Top of Form" position. The printer must understand that this position and this position alone is the "Top of Form" position. To do this, CNTL T assigns the first-line position in the VFU. The next eight-line positions in the printer's memory image of the nine-line form must also be assigned a name. CNTL U names each of these next eight positions. These eight-line positions must have a different name from the "Top of Form" position so that the printer will know that the "Top of Form" position is unique and also that eight more line positions in this form do indeed exist. Every line in the page must be defined regardless of page length. For example, an eleven-inch form would be 66 lines long (six lines per inch times eleven inches). To accomplish the nine-line form definition, the following sequence of control codes must be received by the printer:

ESC 4, CNTL ^ , CNTL T, CNTL U, CNTL U, CNTL U, CNTL U, CNTL U,
CNTL U, CNTL U, CNTL U, CR

ESC 4 sets the printer to six lines per inch vertical feed.

CNTL ^ starts the VFU loading sequence.

CNTL T defines the "Top of Form" line position #1.

CNTL U defines each of the other line positions #2 through #9.

CR ends the VFU loading sequence. Any non-VFU code will end the loading sequence.

Upon receiving this data, the printer has within its memory an image of this nine-line form, with the current position of the printhead now resting at line position #1. To advance to the next form, transmit a CNTL T, or in BASIC: PRINT CHR\$(20). In general, once a VFU form has been defined, the same control codes are used to advance to line positions within that form.

The program sequence at this point could transmit a name and address, advance to the next form, transmit another name and address, advance to the next form, etc. Regardless of whether the address is two, three or four lines long, advancing to the "Top of Form" line position #1 always places the address labels in the correct position.

This sequence works well if printing always begins at the "Top of Form" line. Suppose that a return address was desired in line #1 and #2, and a delivery address was to be placed in the center of the form starting at line position #5;

Line position #1	Return Address	
Line position #2	Return Address	
Line position #3		
Line position #4		
Line position #5		Delivery Address
Line position #6		Delivery Address
Line position #7		Delivery Address
Line position #8		
Line position #9		

Here, if the VFU definition for line position #5 were unique, for example CNTL X, then regardless of whether a one, two or three-line return address was printed, CNTL X would always place the printhead in the correct position on line position #5.

The control code sequence used in this case would be as follows:
ESC 4, CNTL ^ , CNTL T, CNTL U, CNTL U, CNTL U, CNTL X, CNTL U, CNTL
U, CNTL U, CNTL U, CR

ESC 4 sets the printer at six lines per inch vertical feed.

CNTL ^ starts the VFU loading sequence.

CNTL T defines the "Top of Form" line position #1.

CNTL U defines line position #2, #3 and #4.

CNTL X defines line position #5.

CNTL U also defines line positions #6, #7, #8 and #9.

CR ends the VFU loading sequence.

To use the form that has been set up, the data transmission sequence would be as follows:

- (1) Advance to line position #1 (CNTL T).
 - (2) Transmit return address.
 - (3) Advance to line position #5 (CNTL X).
 - (4) Transmit first delivery address.
 - (5) Advance to line position #1 (CNTL T).
 - (6) Transmit return address.
 - (7) Advance to line position #5 (CNTL X).
 - (8) Transmit second delivery address.
 - (9) Advance to line position #1 (CNTL T).
- etc.

If, however, the printhead is positioned at or past line position #5 (for instance, if a six-line return address was used), transmitting a CNTL X results in advancing the address labels to the top (line position #1) of the next form. Any VFU command code which cannot be found in the remainder of the form results in movement to the top of the next form. This also applies to all undefined VFU command codes. When the printer receives a VFU command code that is not included in the form that has been defined, the resulting movement will be an advance of the paper to the top of the next form.

Default VFU

The 9/80 printer features a default VFU that is automatically loaded when the printer is powered on or is reset. The number of lines in this default VFU is determined by the form length selected by the operator. Refer to the Operator's Manual or this Appendix for the appropriate form length settings.

For example, if an 11-inch form were selected along with six lines per vertical inch, then the VFU would consist of 66 lines. Each "Top of Form" position would be 66 lines apart. Line position #1 is defined as CNTL T. Line positions #7, 13, 19, 25, 31, 37, 43, 49, 55 and 61 are defined as CNTL Y. All other line positions are defined as CNTL Z.

The resultant form has CNTL Y VFU codes at one-inch intervals.

Other examples of default VFU definitions are as follows:

- (a) Twelve-inch form with six lines per inch:

72 line positions

CNTL T is "Top of Form", line position #1

CNTL Y defines line positions #7, 13, 19, 25, 31, 37, 43, 49, 55, 61 and 67

CNTL Z defines all other positions.

The resultant form defined has CNTL Y VFU codes at one-inch intervals.

- (b) Three-inch form with eight lines per inch:

24 line positions

CNTL T is "Top of Form", line position #1

CNTL Y defines line positions #7, 13 and 19

CNTL Z defines all other positions

- (c) Eleven-inch form with eight lines per inch:

88 line positions

CNTL T is "Top of Form", line position #1

CNTL Y defines line positions #7, 13, 19, 25, 31, 37, 43, 49, 55, 61, 67, 73, 79 and 85

CNTL Z defines all other positions

In general, the default VFU form will have the "Top of Form", line position #1 defined as CNTL T. Every sixth line position will be a CNTL Y and each one of the other line positions will be a CNTL Z.

III. CHARACTER SET DOWN-LOAD

Coding Sequence

With Switch 5 of U11 ON, the downloadable character set option is enabled. The printer will set aside 1K of RAM (Random Access Memory) to serve as storage for a character set. The switch selected character set (standard or alternate) is then automatically copied to this RAM. This RAM character set can then be modified by using the "ESC L" code.

Referring to the ASCII character set in the Appendix, the 96 printable characters in the set are comprised of six columns of 16 characters per column. Each printable character image is defined by a 9x9 dot matrix array, each element indicating which dots are to be printed. With nine columns of printable data to be defined for each character, nine data column definitions are required for each character.

It is required that 16 sequential ASCII character images be redefined as one down-loaded set. Redefinitions are only allowed to start with characters that have a zero as the second hexadecimal digit in their respective hexadecimal representations. Specifically, these characters are "space", "0", "@", "P", "A" and "p". Their corresponding hexadecimal representations are 20, 30, 40, 50, 60 and 70 respectively. The sequence of code used to redefine 16 character images is as follows:

ESC L, X,...288 codes

where;

ESC L initiates the character set download

X determines which of the ASCII character set columns is to be redefined. X can be space, 0, @, P, A, or p.

288 Codes= (2 codes/Column)(9 Columns/printed character)(16 characters)

For example, if X were an @, this implies that the ASCII characters @, A, B, C, D, E, F, G, H, I, J, K, L, M, N, O would be redefined by the 288 codes that immediately followed.

The sequence is automatically terminated by the last character and 289 characters are always expected to follow the ESC L. Transmitting less than 289 characters following the ESC L will have erroneous results. Also, the equipment used to transmit this data must not insert a carriage return or other line terminator prematurely.

Data to Printwire Relationship

The printhead has nine wires which requires that two codes be presented for each column. The nine print wires correspond to nine printed dots per column. The five least significant bits of the first code define the upper five dots, and the four least significant bits of the second code define the lower four dots:

<u>Dot No.</u>	<u>1st Code</u>	<u>2nd Code</u>
1	Bit 0	
2	Bit 1	
3	Bit 2	
4	Bit 3	
5	Bit 4	
6		Bit 0
7		Bit 1
8		Bit 2
9		Bit 3

The two most significant bits of the first code and the three most significant bits of the second code are ignored. Nine printhead wire positions are defined, however, only the upper seven or lower seven may print in any given print column. Therefore it is necessary that only the upper seven or lower seven print wire positions be defined. Since some codes are used in other ways by the printer, it is important to restrict the range of the first and second codes to hexadecimal 20 to 3F.

On the following page, the letter "P" is defined.

The letter "P" is defined as follows:

	Col. #	1	2	3	4	5	6	7	8	9	
Dot #1		0	+	0	+	0	+	0	+	0	BIT-0
2		0	+	+	+	+	+	+	+	0	-1
3		0	+	+	+	+	+	+	+	0	-2
4		0	+	0	+	0	+	0	+	0	-3
5		0	+	+	+	+	+	+	+	0	-4
6		0	+	+	+	+	+	+	+	0	BIT-0
7		0	+	+	+	+	+	+	+	0	-1
8		+	+	+	+	+	+	+	+	+	-2
9		+	+	+	+	+	+	+	+	+	-3

BINARY DATA:

1st	1 0 1 0 1 0 1 0 0	BIT-0
	1 0 0 0 0 0 0 0 1	-1
	1 0 0 0 0 0 0 0 1	-2
	1 0 1 0 1 0 1 0 0	-3
	1 0 0 0 0 0 0 0 0	-4

2nd	1 0 0 0 0 0 0 0 0	BIT-0
	1 0 0 0 0 0 0 0 0	-1
	0 0 0 0 0 0 0 0 0	-2
	0 0 0 0 0 0 0 0 0	-3

<u>1st HEX</u>	<u>2nd HEX</u>	
3F	23: : : : : : : :
20	20: : : : : : : :
29	20: : : : : : : :
20	20: : : : : : : :
29	20: : : : : : : :
20	20: : : : : : : :
26	20: : : : : : : :
20	20: : : : : : : :
20	20: : : : : : : :

1B 4C 50 3F23 2020 2920 2020 2920 2020 2920 2020 2620 (HEX INTERPRETATION)

Referring to the ASCII character set in the Appendix, hexadecimal codes 20 through 3F can be represented by ASCII codes space through ?. The hexadecimal codes on the previous page can be represented by the following sequence:

ESC L P ? # spsp) sp spsp) sp spsp) sp spsp & sp (ASCII from host)

Illegal Definitions

(1) It is illegal to print the same dot in two consecutive columns, for example:

<u>Col. #</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>
Dot X	-	+	+	+	+	-	-	+	+
Y	-	+	+	+	+	-	+	+	+

ILLEGAL double firing of Dot X in columns 6 and 7 above.

X	-	+	+	+	+	-	+	-	+
Y	-	+	+	+	+	-	+	+	+

VALID use of wire X in columns 6 and 8 above.

(2) It is illegal to define dots 1 or 2 and 8 or 9 in the same column. Erroneous results will occur with this definition:

<u>Col. #</u>	<u>1</u>	<u>2</u>	<u>3</u>	...
Dot 1	-	+	-	
2	-	+	+	+
3	-	+	-	
4	-	+	+	+
5	-	+	+	+
6	-	+	+	+
7	-	+	-	
8	-	+	+	+
9	-	+	-	

In this example, in columns 1 and 3, dots 1 and 9 are simultaneously defined. This is an illegal multiple definition.

IV. GRAPHICS

The graphics mode is entered with CNTL M and ESC G control codes. The CNTL M (carriage return) terminates the data transmitted prior to it. The CNTL J may be used in place of the CNTL M. ESC G then places the printer in the graphics mode.

Absolutely no data or control codes may follow the ESC G except as described below.

Graphics Programming Sequence

After entering the graphics mode, the programming sequence consists of the following:

- (1) Graphics Line (consisting of up to 575 graphics codes)*
- (2) Graphics Terminator (only one of these)

*A maximum of 590 can be achieved with modified software.

Data to Print Relationship

Definition of terms:

(A) Graphics Segment

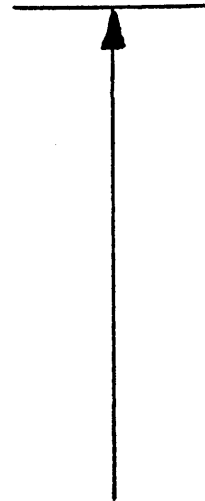
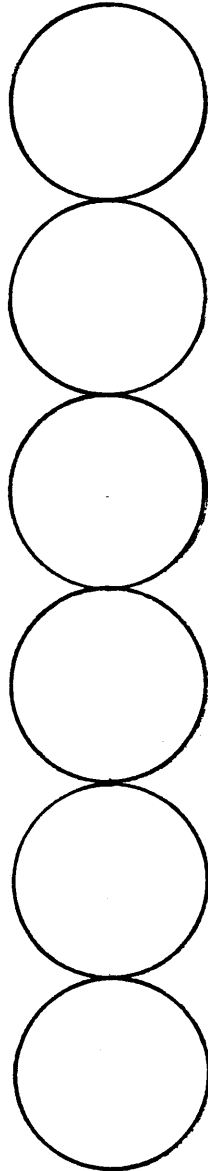
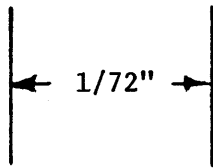
Actual visual output that is printed on the paper consisting of six vertical dots. Each dot is 1/72 inch in diameter. The overall dimension of each graphics segment is 1/12 inch high by 1/72 inch long. See Figure IV.1.

(B) Graphics Code

A seven bit data word. The highest order, or the most significant of these seven bits must be a binary "1". The lower six bits determine which combination of the six vertical dots in the corresponding graphics segment is to be printed.

<u>Graphics Segment</u>	<u>Graphics Code</u>
uppermost dot 1	1 least significant bit
2	2
3	3
4	4
5	5
lowermost dot 6	6
	7 most significant bit

A solid vertical line 1/12 inch high by 1/72 inch long would consist of a graphics segment with every one of the six dots printed. The graphics code that would represent this is:



1/12"

GRAPHICS SEGMENT

FIGURE IV.1

P80-15

Binary: 1111111
 Hexadecimal: 7F
 Decimal: 127

Since each of the six data bits is "1", then each corresponding dot will be printed. A blank vertical line of the same dimensions would consist of a graphics segment with none of the six dots printed. The graphics code that would represent this is:

Binary: 100000
 Hexadecimal: 40
 Decimal: 64

Since each of the six data bits is "0", then none of the dots will be printed. Referring to the ASCII character set in the Appendix, the characters which can be used as graphics codes lie in the range:

Binary: 1000000 to 1111111
 Hexadecimal: 40 to 7F
 Decimal: 64 to 127
 ASCII: @ to DEL

(C) Graphics Block

Any combination of graphics segments.

The graphics block sample illustrated in the upper Figure IV.2 would consist of these six graphics codes:

Binary: 1111111, 1111110, 1111100, 1111000, 1110000, 1100000
 Hexadecimal: 7F, 5F, 4F, 47, 43, 41
 Decimal: 127, 95, 79, 71, 67, 65
 ASCII: DEL, __, O, G, C, A

Combinations of graphics segments result in in graphics blocks. An ascending diagonal line of overall dimension 1/12 inch high by 1/12 inch wide would consist of the six following graphics codes (see Figure IV.2):

Binary: 1100000, 1010000, 1001000, 1000100, 1000010, 1000001
 Hexadecimal: 60, 50, 58, 44, 42, 41
 Decimal: 96, 80, 72, 68, 66, 65
 ASCII: ,, P, H, D, B, A

(D) Graphics Line

One horizontal line of graphics consisting of a maximum of 575 graphics codes.

Graphics Line Terminators

Each graphics coding sequence must be properly terminated for the graphics line to print. Three different ways of terminating a graphics line are available:

- (1) Exit graphics mode but do not advance the paper.
- (2) Exit graphics mode and advance the paper 1/12 inch vertically.
- (3) Stay in graphics mode and advance paper 1/12 inch vertically.

By staying in the graphics mode, an "ESC G" is not needed to initiate the next line of graphics and must not be transmitted. Referring to the ASCII character set in the Appendix, the terminator used to produce the action described in (1) is Hexadecimal 2B which is Decimal 43 and is also the ASCII "+" character. The terminator used to produce the action described in (2) is Hexadecimal 2D which is Decimal 45 and is also the ASCII "-" character. The terminator used to produce the action described in (3) is Hexadecimal 2F which is Decimal 47 and is also the ASCII "/" symbol. Note that every terminator used has the seventh data bit set to "0" while the graphics codes have this bit set to "1".

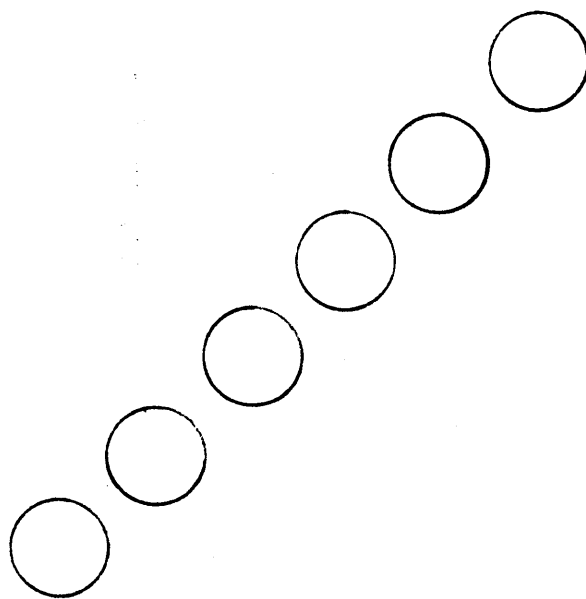
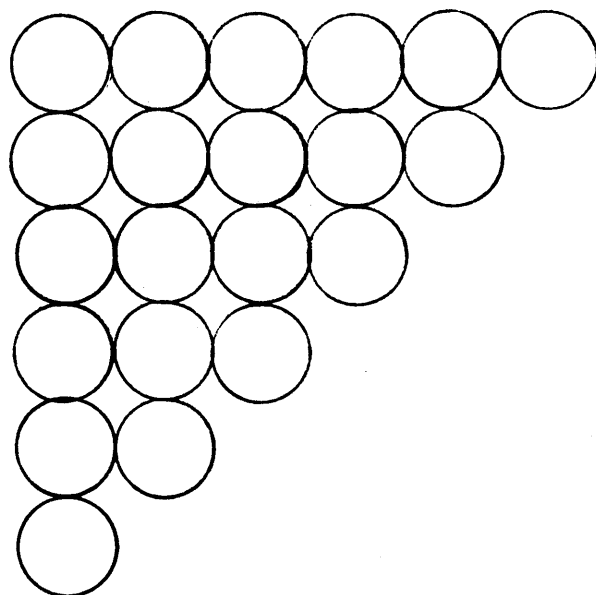
Graphics Errors

Errors encountered while using graphics will be indicated by flashing lights on the front panel of the 9/80 printer. When flashing lights are observed, the printer must be manually RESET.

Graphics programming errors may be caused by:

- (1) An ESC G was encountered following an improperly terminated line.
- (2) The maximum number of graphics codes on one graphics line has been exceeded.
- (3) An illegal graphics code has been encountered, that is, its seventh (highest order) data bit is not "1".

In the condition described in (3), the printer will treat the illegal graphics code not as a code, but as a graphics terminator. The graphics codes that preceded it will be printed as graphics segments but the graphics codes that follow may be treated as normal ASCII characters. The error lights will not flash, however, the output may consist of ASCII characters and not graphics.



GRAPHICS BLOCKS

FIGURE IV.2

P80-18

APPENDIX

9/80 SWITCH SETTINGS

Selectable Function	Switch Bank	Position	Status
Serial Interface	U10	1	On
Parallel Interface	U10	1	Off

10 CPI - Normal	U11	1	Off
		2	Off
10 CPI Double-Density	U11	1	On
		2	On
12 CPI	U11	1	Off
		2	On
16.5 CPI	U11	1	On
		2	Off

6 LPI	U11	7	Off
8 LPI	U11	7	ON

Skip 6 Lines at Bottom of Page	U11	8	On
No Skip at Bottom of Page	U11	8	Off

Auto LF on CR	U11	4	On
No LF on Cr	U11	4	Off

Standard Character Set	U11	6	Off
Use Alternate Character Set	U11	6	ON
Enable Download Character Set Feature	U11	5	On
Disable Download Character Set	U11	5	Off

Printer to Transmit XON/XOFF	U11	3	On
Disable XON/XOFF	U11	3	Off

Logic Controlled Busy on Pin 11	U9	3	On
Logic Controlled Busy on Pin 20	U9	4	ON
		5	Off

9/80 SWITCH SETTINGS

Selectable Function	Switch Bank	Position	Status
DTR on Pin 20	U9	4	Off
		5	On
Busy (Negative)	U9	1	On
		2	Off
Busy (Positive)	U9	1	Off
		2	On
Data Strobe Negative	U9	6	On
Data Strobe Positive	U9	6	Off
No Parity	U9	7	Off
Serial Parity	U9	7	On
1 Stop Bit	U9	8	On
2 Stop Bits	U9	8	Off
Odd Parity	U9	9	On
Even Parity	U9	9	Off
7 Data Bits/Char	U9	10	On
8 Data Bits/Char	U9	10	Off
300 BAUD	U10	6	Off
		7	On
		8	Off
600 BAUD	U10	6	On
		7	On
		8	Off
1200 BAUD	U10	6	Off
		7	Off
		8	On
2400 BAUD	U10	6	On
		7	Off
		8	On
4800 BAUD	U10	6	Off
		7	On
		8	On
9600 BAUD	U10	6	On
		7	On
		8	On

9/80 SWITCH SETTINGS

Selectable Function <u>Form Length</u>	Switch Bank	Position Status			
		<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
3	U10	ON	ON	ON	ON
3.5	U10	OFF	ON	ON	ON
4.0	U10	ON	OFF	ON	ON
4.5	U10	OFF	OFF	ON	ON
5.0	U10	ON	ON	OFF	ON
5.5	U10	OFF	ON	OFF	ON
6.0	U10	ON	OFF	OFF	ON
7.0	U10	OFF	OFF	OFF	ON
8.0	U10	ON	ON	ON	OFF
8.5	U10	OFF	ON	ON	OFF
9.0	U10	ON	OFF	ON	OFF
11.0	U10	OFF	OFF	ON	OFF
11.5	U10	ON	ON	OFF	ON
12.0	U10	OFF	ON	OFF	OFF
14.0	U10	ON	OFF	OFF	OFF
17.0	U10	OFF	OFF	OFF	OFF

Control Codes

The Model 9/80 Printer will recognize the following control codes:

		<u>HEX</u>	<u>DEC</u>	
ESC 4		1B, 34	27, 52	SET 6 LPI VERTICAL FOR LINE FEED
ESC 5		1B, 35	27, 53	SET 8 LPI VERTICAL FOR LINE FEED
ESC 6		1B, 36	27, 54	SET 10 CPI BASIC PRINT DENSITY
ESC 7		1B, 37	27, 55	SET 16.6 CPI BASIC PRINT DENSITY
ESC 8		1B, 38	27, 56	SET 12.0 CPI BASIC PRINT DENSITY
ESC 9		1B, 39	27, 57	SET 10 CPI DOUBLE PRINT DENSITY
ESC @		1B, 40	27, 64	SELECT STANDARD CHARACTER SET
ESC A		1B, 41	27, 65	SELECT OPTIONAL CHARACTER SET
ESC B		1B, 42	27, 66	ADVANCE PAPER TO SUPERSCRIPIT POSITION
ESC C		1B, 43	27, 67	ADVANCE PAPER TO SUBSCRIPT POSITION
ESC D		1B, 44	27, 68	DOWN LOADED CHARACTER SET SELECT
ESC G		1B, 47	27, 71	GRAPHICS MODE SELECT
ESC L		1B, 4C	27, 76	CHARACTER SET DOWNLOAD
ESC R		1B, 52	27, 82	RESET TO ALL DEFAULT OPTION SELECTIONS
CNTL G	BEL	07	7	SOUND AUDIBLE ALARM
CNTL M	CR	0D	13	CARRIAGE RETURN, TERMINATES LINE (See Note)
CNTL J	LF	0A	10	LINE FEED
CNTL N	SO	0E	14	ELONGATED CHARACTERS (DOUBLE WIDE)
CNTL O	SI	0F	15	END OF ELONGATED CHARACTERS
CNTL A	RS	1E	30	START VFU LOAD SEQUENCE
CNTL L	FF	0C	12	FORM FEED (SLEW TO CHANNEL 1)
CNTL K	VT	0B	11	VERTICAL TAB (SLEW TO VFU CHANNEL 6)
CNTL Q	DC1	11	17	SELECTS PRINTER
CNTL S	DC3	13	19	DESELECTS PRINTER
CNTL T	DC4	14	20	DEFINE LINE OR SLEW PAPER TO CHANNEL 1
CNTL U	NAK	15	21	DEFINE LINE OR SLEW PAPER TO CHANNEL 2
CNTL V	SYN	16	22	DEFINE LINE OR SLEW PAPER TO CHANNEL 3
CNTL W	ETB	17	23	DEFINE LINE OR SLEW PAPER TO CHANNEL 4
CNTL X	CAN	18	24	DEFINE LINE OR SLEW PAPER TO CHANNEL 5
CNTL Y	EM	19	25	DEFINE LINE OR SLEW PAPER TO CHANNEL 6
CNTL Z	SUB	1A	26	DEFINE LINE OR SLEW PAPER TO CHANNEL 7

Note: The function of CR is modified by U11-4 on the Main Board.
Undefined control codes are ignored.

ASCII CHARACTER SET

Bits					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1	
b ₄	b ₃	b ₂	b ₁	ROW	COLUMN	0	1	2	3	4	5	6	7
0	0	0	0	0	0	NUL	DLE	SP	0	•	P	`	p
0	0	0	1	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	4	EOT	DC4	\$	4	D	T	d	t
0	1	0	1	5	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	14	SO	RS	.	>	N	~	n	~
1	1	1	1	15	15	SI	US	/	?	O	—	o	DEL