TRS-80®

DMP-110
Operation Manual
Catalog Number 26-1271

Radio Shack®
TRS-80
COMPUTER PRODUCTS

CUSTOM MANUFACTURED FOR RADIO SHACK, A DIVISION OF TANDY CORPORATION

Contents

Introduction

Congratulations for selecting this Radio Shack computer product! The DMP-110 is a high-density dot-matrix printer with a unique two-hammer system which can perform a variety of different printing operations. For instance, it can print:

- Proportionally spaced characters
- Monospaced characters (Standard, Condensed and Elite)
- Correspondence Quality characters
- Italic Cursive characters
- Super-/Subscript
- Microfont
- Graphics – standard and high-resolution

The DMP-110 operates in three modes:

- Data Processing Mode – for fastest output of program listings or data.
- Word Processing Mode – for letter writing or the creation of any text documentation.
- Graphics Mode – for drawing pictures, figures or graphs.

For word processing, you'll find the DMP-110's Proportionally Spaced Characters (created on a variable $n \times 16$ dot-matrix) can produce letter-quality results.

If, however, you need a printout that is produced faster, monospaced characters (created on an 9×8 dot-matrix) are just the thing for you!

In Graphics Mode, you can use graphic data to draw just about any type of graphic configuration you desire.

You can use two types of paper with the DMP-110.

- Standard (4"-10" wide) computer fanfold forms with guide holes (Radio Shack Catalog Number 26-1423, 26-1427, 26-1403, 26-1456). The Printer can also print one original plus one copy.
- Standard, single-sheet typewriter paper for use as in an ordinary typewriter.

Other software-controlled features include:

- Full or half-line feed and 3/4 line feed.
- Software controlled Form Feed.
- Underline capability.

And much more!

1/ Description of the DMP-110

Carefully unpack the DMP-110, being sure to locate the ribbon. Keep the empty box and packing material just in case you ever need to transport the Printer.

Be sure to remove the protective black plastic tube from the Carriage Guide before applying power.

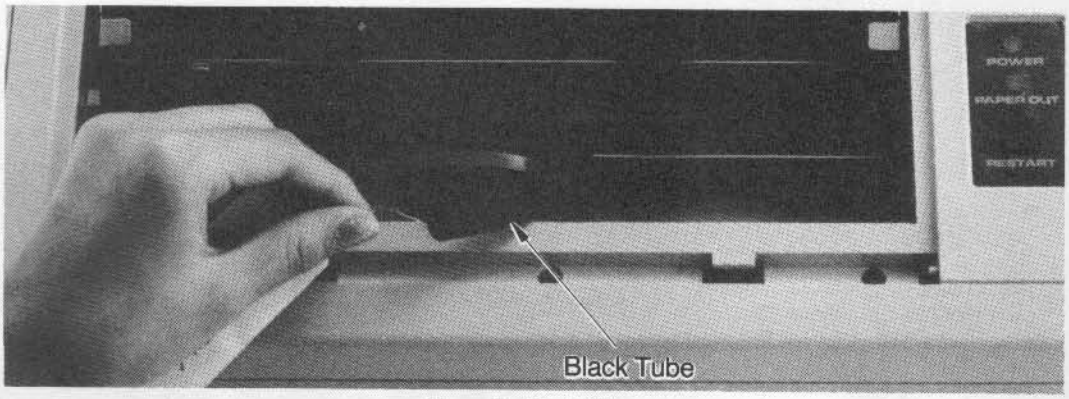


Figure 1. Black Tube

It's important to become familiar with the DMP-110 before you set it up and begin using it.

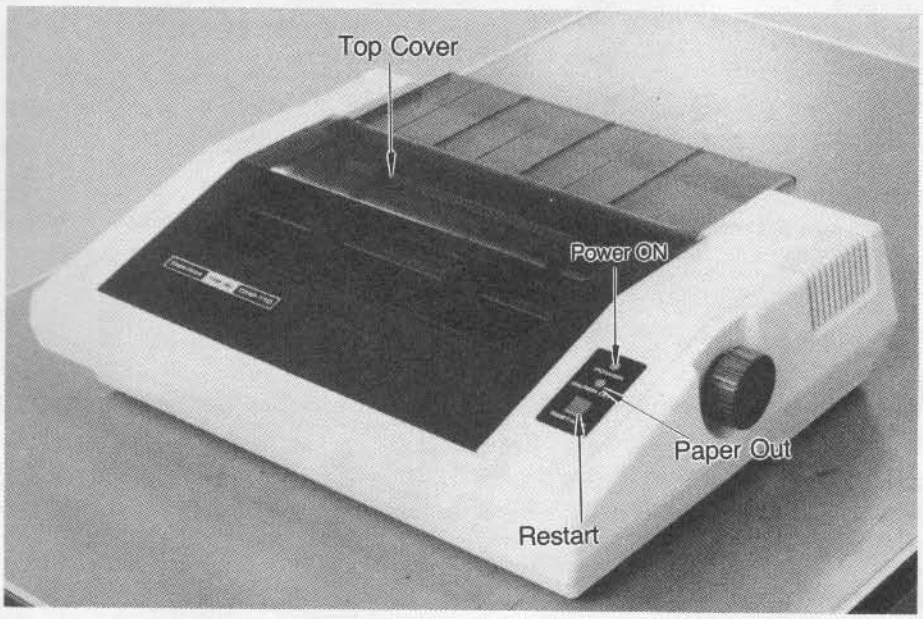


Figure 2. DMP-110 (Front View)

Front Panel

(1) PAPER OUT Indicator.
This lamp will come on when the Printer is out of paper.

(2) POWER ON Indicator.
This Indicator will illuminate when the DMP-110 is properly connected and the Power ON/OFF switch is set to ON. It flickers when there is a carriage fault, or when there is some sort of electrical problem.

(3) RESTART Switch.
When the Printer runs out of paper, load more paper, then press this switch to return the Printer to its status before the out-of-paper condition occurred.

When the Printer stops because it is out of paper, the PAPER OUT lamp will illuminate. To continue printing, insert more paper and press RESTART. The DMP-110 will automatically continue printing without loss of data in the print buffer.

Model II users: If a BASIC program stops execution because of a Printer error, typing CONT (ENTER) will cause printing to resume.

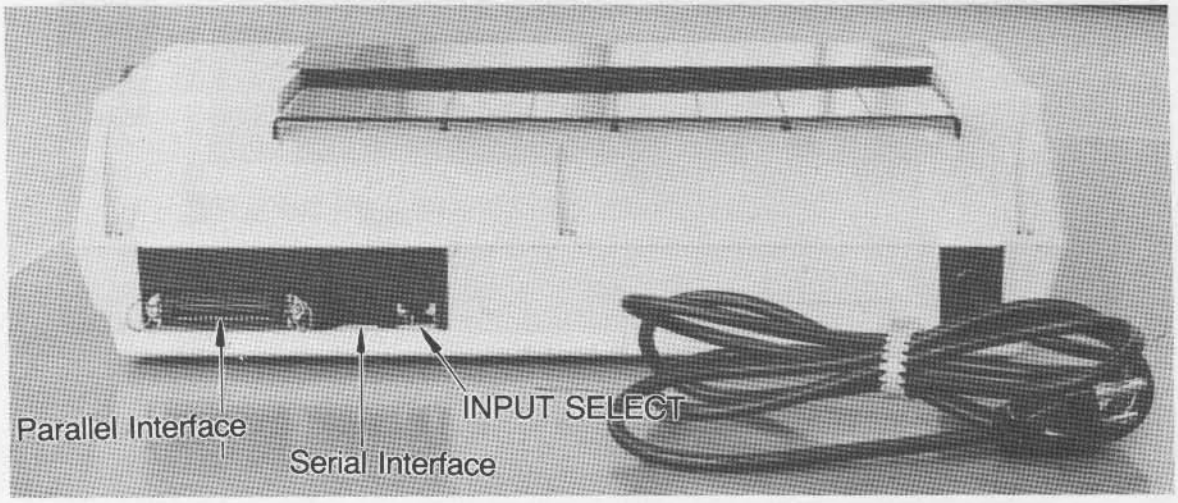


Figure 3. DMP-110 (Rear View)

Rear Panel

(1) Power ON/OFF Switch.
Press the red bar to turn the power OFF. Press the other way to turn power ON. Note that turning the power OFF and ON during operation may cause loss of the current program.

(2) Power Cord.
Plug the power cord into a wall-outlet or approved power strip.

(3) Parallel Interface Connector.
If your TRS-80 has parallel interface capabilities, connect the cable here. See "Setting Up the DMP-110" for the right cable for your TRS-80.

(4) Serial Interface Connector.
If your TRS-80 has serial interface capabilities, connect the cable here. See "Setting Up the DMP-110" for the right cable for your TRS-80".

(5) INPUT SELECT Switch.
The setting of this Switch will determine whether you're using the serial or parallel interface. For serial interface, baud rate (600 or 1200 baud) must also be set by this Switch.

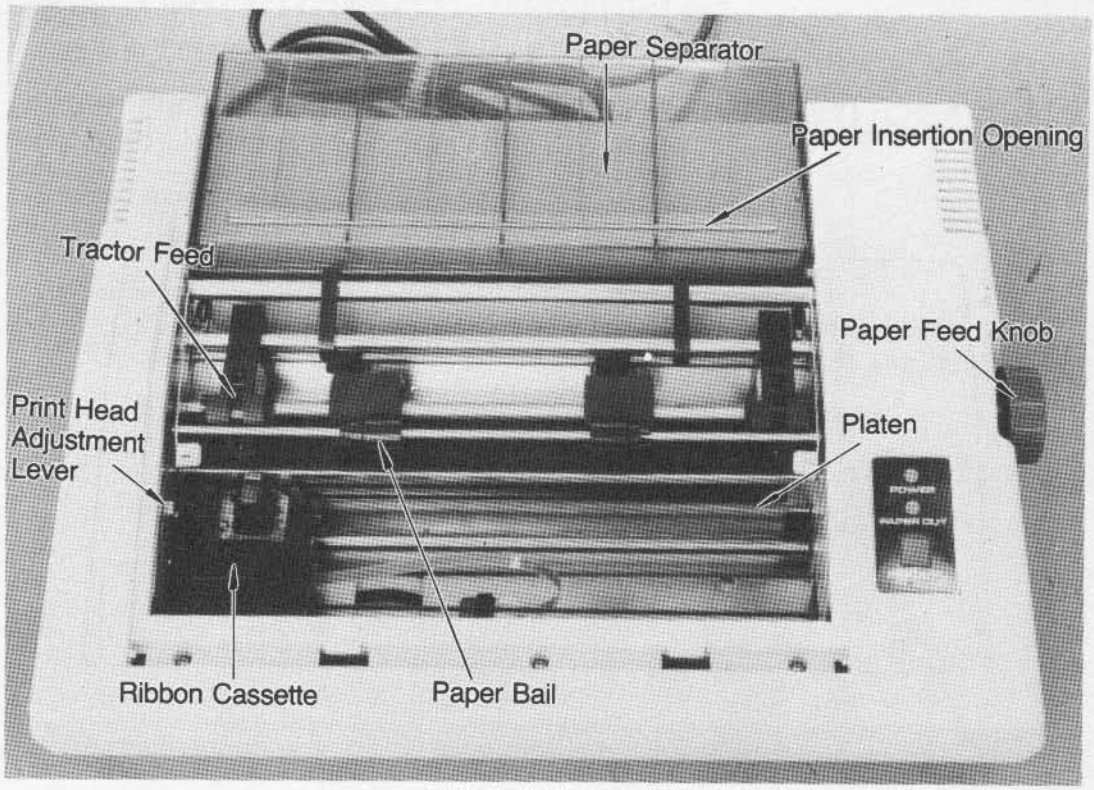


Figure 4. DMP-110 (Inside View)

Inside

(1) **Ribbon Cassette.**
Be sure to replace the ribbon when printing becomes faint.

(2) **Print Head Adjustment Lever.** Move this Lever towards you (e.g., move the Print Head away from the paper) when changing ribbons. If printing is faint, move the Lever away from you (e.g., the Print Head towards the paper). If smudging occurs during printing, move the Print Head one or two notches away from the paper.

(3) **Paper Bail.**
For optimum print quality, keep the Bail down on the paper.

(4) **Tractor Feed.**
See "Setting Up the DMP-110" for details on using the tractor feed.

(5) **Paper Feed Knob.**
Turn this Knob to manually advance the paper.

(6) **Paper Insertion Opening.**
Be sure the single sheet paper enters the DMP-110 here.

(7) **Paper Separator.**
This separates the incoming paper from the outgoing paper.

(8) **Platen.**

2/ Setting Up the DMP-110

This section will show you how to set up the DMP-110 so you can begin using it as quickly as possible. This includes:

- Loading paper.
- Replacing a ribbon.
- Connecting the DMP-110 to a TRS-80

and more!

The following Start-Up Checklist is a summary of how to set up your Printer and should be followed every time you start-up the Printer – not just the first time.

[ ] Find a good spot for your Printer. Be sure to:
  - Place the Printer on a sturdy work surface.
  - Consider the length of the printer cable, which will determine how far from the TRS-80 you can place the Printer.
  - Leave enough room for smooth paper flow.
  - Keep the Printer away from noise generators such as refrigerators and industrial equipment.

[ ] Be sure the POWER switch (on the left rear side of the Printer) is OFF.

[ ] Remove the Top Cover and the black tube.

[ ] Install continuous form fanfold paper or single-sheet paper.

[ ] Check the Ribbon Cassette. If it has not been installed, see Ribbon Installation/Replacement.

[ ] Connect AC power plug to a 3-wire, 120 volt, 60 Hz grounded AC outlet (220/240v, 50 Hz where the unit is so marked).

[ ] Connect the interface cable from the TRS-80 to the printer interface connector.

[ ] Set the Input Select switch.

[ ] Turn the Power ON and check that the Power On Indicator (on the front Panel) is illuminated.

[ ] Push the RESTART switch.

How Does the DMP-110 Handle Paper?

The DMP-110 provides both tractor feed for continuous forms and friction feed for single-sheet printing. The Printer is supplied with the Tractor unit installed. Both tractor feed and friction feed paper can by used with the Tractor installed.

Paper Loading

Once the paper is loaded and power is ON, check the PAPER OUT Indicator. If the lamp is illuminated, press the RESTART Switch. If the lamp remains lit, the paper is probably loaded incorrectly.

If the lamp is not illuminated after the paper is loaded, you may begin printing (if the power is ON).

Single-Sheet Paper Loading

1. Open the Top Cover by inserting your hand under the cover from the rear and lifting up.
2. Move the Print Head Adjustment Lever away from the paper.
3. Lift the Paper Bail Lever up away from the Roller.
4. Insert the paper into the Paper Insertion Opening (see Figure 5) as far as it will go. Use the Paper Feed Knob to pull the paper right around until it appears between the Platen and the Print Head.

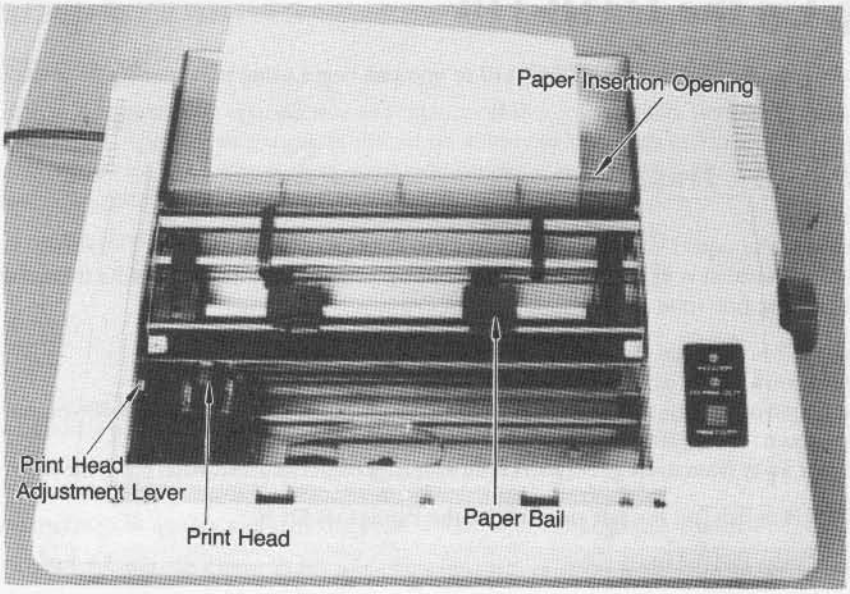


Figure 5

5. Set the Paper Bail Roller on top of the rubber roller on the Tractor Shaft.
6. Set the Print Head Adjustment Lever to the appropriate position.

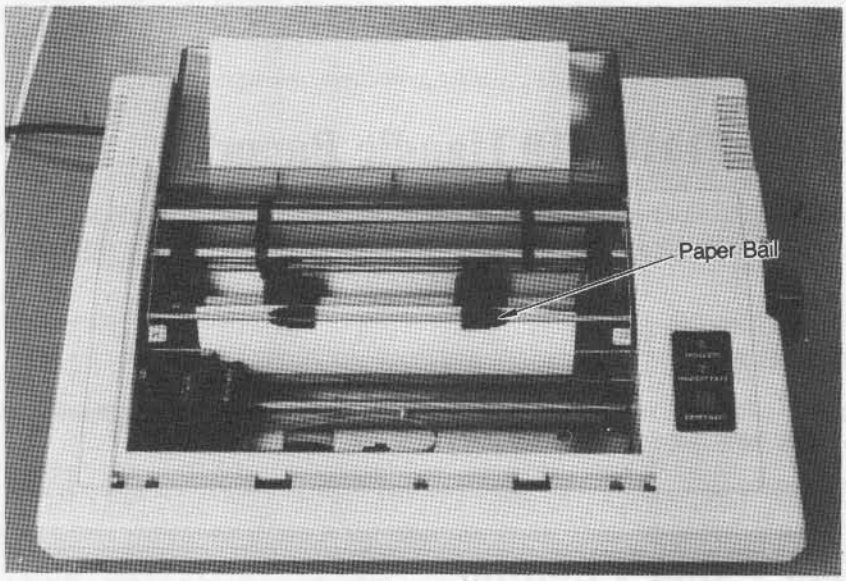


Figure 6

7. Close the Top Cover.
8. Press RESTART.

Hints and Tips On Single-Sheet Paper Loading...

- With the paper properly installed, printing will continue until the paper passes the Paper Empty Sensor. The Printer will then go OFF-LINE. Insert another piece of paper and turn the Paper Feed Knob to advance the paper. When the paper is in place, press the RESTART switch and the DMP-110 will continue printing from where it left off.
- If you want to print another few lines after the Paper Empty Sensor detects the paper end, press RESTART once for each additional line you want to print. Be careful not to exceed the bottom edge of the paper.

Fanfold Paper Loading

The DMP-110 will accept standard fanfold paper that is from 4" to 10" wide. The paper may contain one original and one copy.

To load fanfold paper into the DMP-110:

1. Set Power ON/OFF Switch to OFF.
2. Raise Top Cover by inserting your hand under the cover from the rear and lifting up.
3. Gently move the Print Head Adjustment Lever away from the paper.
4. Lift the Paper Bail Lever up away from the Roller.
5. Turn the Paper Separator upright and pull it up to remove it.

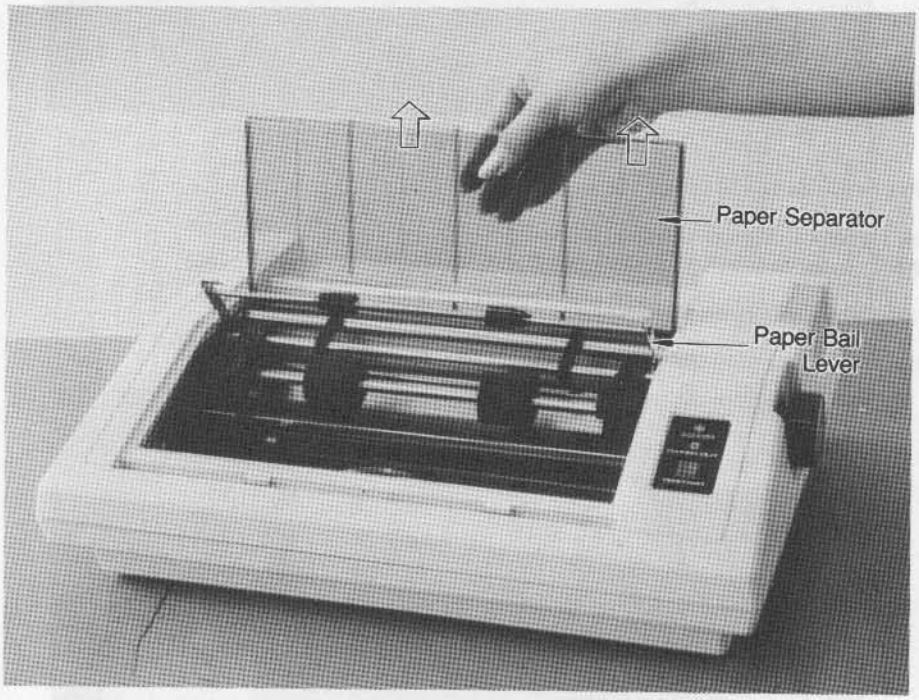


Figure 7

6. Raise the Pin Feed Clamps to the side.
7. Insert the paper into the printer from the rear. Be sure the paper lines up straight so that the holes will line up with the pin feed sprockets. Use the Paper Feed Knob to pull the paper around until it appears between the Platen and the Print Head.

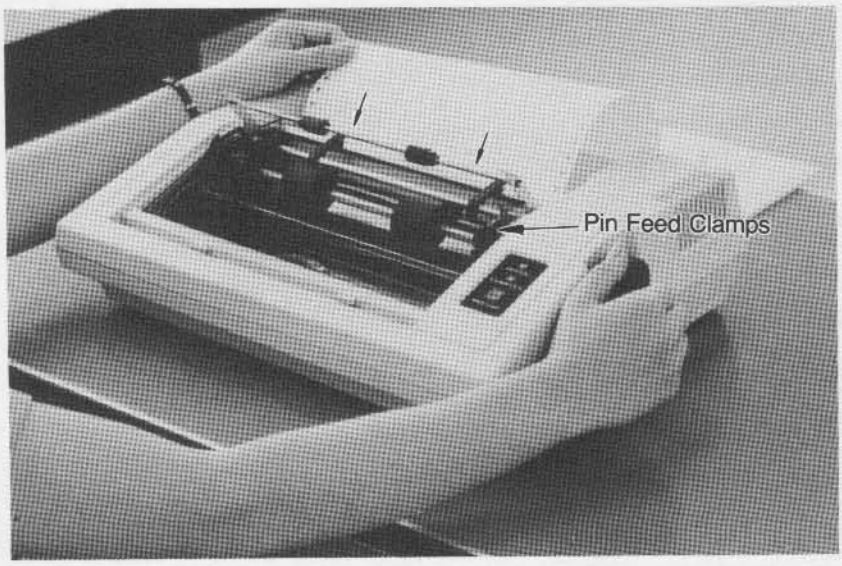


Figure 8

8. Close the Pin Feed Clamps to secure the paper.
9. Set the Print Head Adjustment Lever as follows:
   Move the Lever as far as it will go toward the Platen without smudging the paper.

   Check for smudging by performing the printing at each of the Lever settings.
10. Put the Paper Bail Roller onto the Feed Roller.

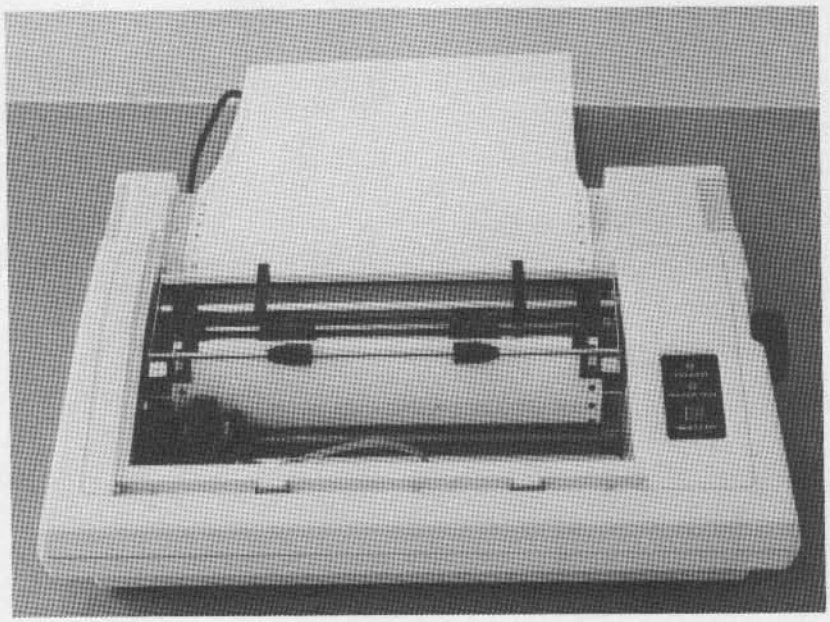


Figure 9

11. Replace the Paper Separator and the Top Cover.

Hints and Tips On Fanfold Paper Loading...

- Do not let paper pile up on top of unprinted paper or printed paper may be pulled back into the Printer. This could jam the paper feed or damage the Printer.
- As much as possible, place the paper on the same height as the Printer.

Ribbon Installation/Replacement

If the ribbon is already installed, simply check to see that it is properly threaded between the paper and Print Head.

If the Ribbon Cassette is not installed, or if it must be replaced due to excessive wear, faint printing, etc., follow this procedure:

1. Set Power Switch to OFF. (Note: When you turn the power OFF, any information stored in the Printer's buffer will automatically be lost.)
2. Raise the Top Cover and gently move the Print Head Adjustment Lever toward the front of the Printer as far as it will go.
3. Gently push the Ribbon Cassette supporters on both sides outward, using your thumbs, and remove the Cassette by lifting it upward, bottom end first.

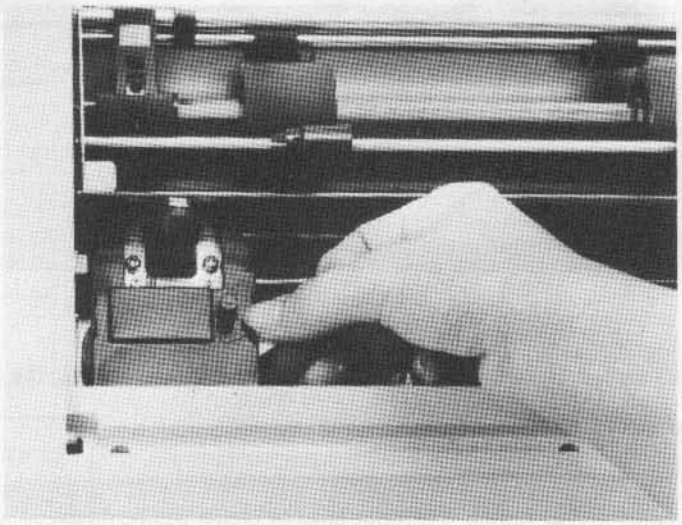


Figure 10-1

4. Unwrap the new Cassette.
   Before inserting the new Cassette, tighten the ribbon by turning the knob in the direction indicated by the arrow.
5. Gently slide the ribbon in between the paper and the Print Head. Gently press the left side of the Cassette down until you hear a click. Then, while rotating the cassette knob in the direction indicated by the arrow, press the right side of the Cassette.

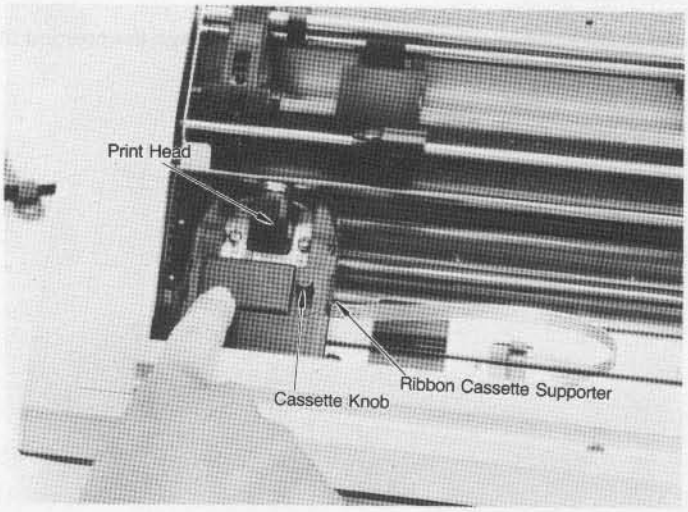


Figure 10-2

Do not force the Cassette into place! If the Cassette is not properly fitted, the cassette knob will not match up with the shaft from the Carriage. Do not force the Cassette down but fit it in gradually while turning the cassette knob in the indicated direction.

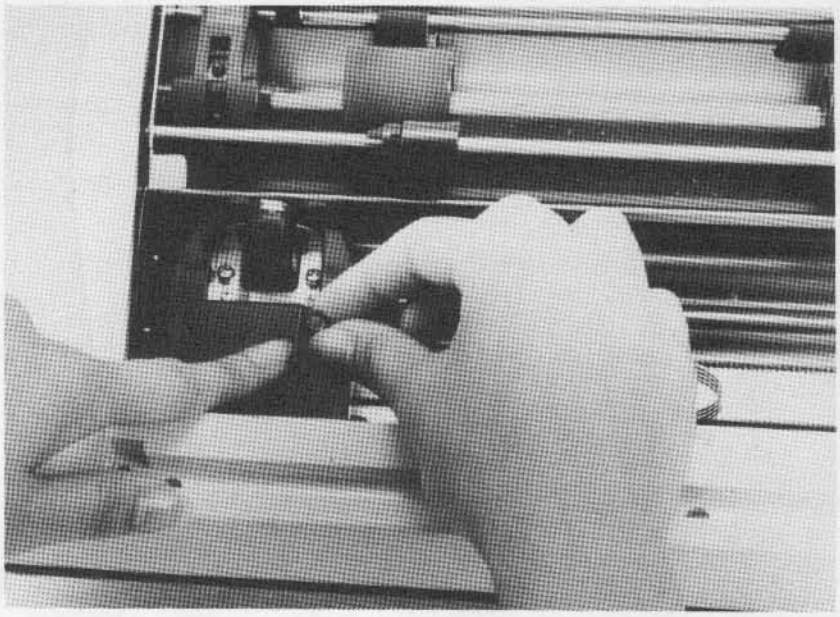


Figure 10-3

6. Once the new Cassette is installed, tighten the ribbon by turning the cassette knob in the indicated direction.
7. Set the Print Head Adjustment Lever (see "Paper Loading" section).
8. Replace the Top Cover.

Note: Do not print without paper and/or ribbon. The print head or platen will be damaged.

Setting Input Select Switch

There is a switch located at the right rear side of the Printer. This switch selects the input to the DMP-110.

If you use the DMP-110 with a Computer which has serial printer output (such as the Color Computer), the switch must be set to either 1200 baud or 600 baud position, depending on the characteristic of your Computer. If your Computer has parallel printer output, set it to Parallel.

It is important to note that the Printer power must be OFF before you change the position of the Switch.

Figure 11 Input Select Switch

Connecting the DMP-110 to a Power Source

Before plugging the power cord into an AC power outlet, check the following:

[ ] Is Printer Power ON/OFF switch set to OFF?
[ ] Have you removed the black plastic protective tube from the Carriage guide?
[ ] Don't connect the Printer to the Computer yet.

Connect the AC power plug to a 3-wire, 120 volt, 60 Hz grounded AC outlet (220/240v, 50 Hz where the unit is so marked) or an approved power strip such as the Radio Shack Plug-In Power Strip (61-2619).

Adjustment of Print Head Adjustment Lever

You will have to adjust the Print Head Adjustment Lever on the inside left of the printer according to the thickness of the paper you are going to use.

Push the lever outward a little and then move it inward to increase the darkness of the print. If smudging occurs, move the lever outward. Always set the lever to one of the eight click holes. Do not set it "in-between".

Connecting the DMP-110 to the TRS-80

Before making any connections between the Printer and TRS-80, be sure all units are off!

You must also be sure you have the correct cable for your TRS-80 if the DMP-110 is to operate properly. Table 1 describes the printer cables Radio Shack provides. Table 2 provides quick instructions for printer connection locations.

TRS-80 to DMP-110 Cables	
TRS-80	Cable Number
Model I (Keyboard only)	26-1411
Model I (Exp. Interface)	26-1401
Model II/16/DT-1	26-4401
Model III	26-1401
Model 4	26-1401
Color Computer	26-3020
Model 100	26-1409

Table 1

TRS-80 to DMP-110 Cables	
TRS-80	Connector
Model I (Keyboard only)	Rear of Keyboard
Model I (Exp. Interface)	Left side of E.I
Model II/16	Rear Panel of Computer
Model III/DT-1	Bottom Panel
Model 4	Bottom Panel
Color Computer	Rear Panel of Computer
Model 100	Rear Panel of Computer

Table 2

1. Attach the molded male end of the cable to the connector at the left rear of the Printer. Do not force the plug. If it doesn't fit one way, turn it over and try again.
2. Connect the other end of the cable to the Printer Jack of your Computer. See your TRS-80 owner's manual for specific instructions.

Power-Up Sequence

The specific power-up sequence will depend upon your Computer. We suggest you consult your TRS-80 owner's manual on powering up your TRS-80 with peripheral devices (such as printers) for details.

In any event, the Power Lamp will remain lit while the Printer in ON.

It is essential that the Printer remain ON when connected to the Computer. If you turn the power ON or OFF, or a Printer is connected but not turned on, erratic operation of the entire system may occur.

3/ Using the DMP-110 (General Printer Operation)

The DMP-110 is designed for three distinct applications:

- Data Processing
- Word Processing
- Graphics Printing

The Printer has three different ways it responds to software codes from the TRS-80, one for each application. The three response patterns, or modes, have many similarities, but each has its own unique features.

Data and Word Processing Modes are used for printing characters. The only difference between these two modes is the way they handle Line Feed commands (commands that decide how far the paper is fed).

- In the Word Processing Mode, each Line Feed command causes immediate paper advancement. Word Processing programs (such as SCRIPSIT) can use immediate line feeds for superscripts, subscripts, and the like.
- In the Data Processing Mode, Line Feed Commands do not cause immediate printing. Instead, they are stored in the Printer's memory along with the other data. When the current line is printed, the Line Feed Commands stored in memory determine the pitch of the paper feed.

Both Data and Word Processing can print two different print styles. One style is the proportionally spaced character set and the other is the monospaced character set.

- Proportionally spaced characters have variable widths: an M takes up more space than an I. Proportionally spaced characters are used to create professional looking documents.
- Monospaced characters are so named because each character takes up the same width. This uniformity makes it preferable for tables and charts that require vertical alignment.

In Graphics Mode, you have complete control of the Print Head. This Mode can be used to create a custom letterhead, designs, special type fonts, etc.
However, with Graphics operation, many control codes (which can be used with Data and Word Processing) cannot be used. The DMP-110 doesn't return an error when you send such a code – it simply ignores the code. This includes codes that change line feed pitch and direction. Graphics Mode has restricted numbers of line feed to insure full coverage of the paper.

Control Codes

Before investigating the various print modes, let's consider how the TRS-80 communicates with the Printer.

All information is sent to the Printer as numbers between 0 and 255 decimal (00 – FF for you Hexadecimal fans). The Printer interprets these numbers according to the American Standard Code for Information Interchange, commonly referred to as the ASCII numbers (or codes) which are printed as letters, numbers, or symbols. However, the numbers 0 – 31, as well as some special sequences of code numbers, are used to "control" various functions of the Printer. These "Control Codes" allow you to change character sets, select print modes, underline, superscript, subscript, etc.

The Control Codes have different meanings depending on the current print mode. If a Code is not recognized by the Printer, it is printed as "⧖". The next few sections demonstrate how some of the Control Codes activate various Printer functions. Read these sections carefully.

Sending Control Codes from BASIC

Some Printer features are activated by a single code, but many functions require a sequence of two or more codes. Most multiple code sequences begin with decimal 27 (referred to as the "ESCape" code). The ESC code notifies the Printer that a special sequence is on its way. The next code(s) sent determines which Printer feature is selected. In BASIC, use CHR$ ( ) to send these codes to the Printer.

Note: This section will use the command LPRINT in examples that send codes to the Printer. If you're using a TRS-80 Color Computer, substitute PRINT #-2, for LPRINT.

For instance, set up the DMP-110 as described earlier and enter BASIC in the normal way. Then type the following program:

```
10 REM
20 LPRINT "DATA ";CHR$(27);CHR$(56);"PROCESSING"
30 LPRINT "MODE"
```

and RUN it.

Roll the paper forward and look at the results. The word MODE printed just below the word DATA. Why? The codes CHR$ (27) and CHR$ (56) are the guilty parties. Take a quick look at Appendix A. This chart shows the various code sequences understood by the DMP-110. The Control Code sequence CHR$ (27); CHR$ (56) means "change the forward line feed to three quarter of its normal distance".

Data Processing Mode

How can you tell which mode the DMP-110 uses when it's first turned on? A little reflection on the above program tells you all you need to know.

Line Feed commands are executed immediately in Word Processing (WP) Mode, but not in Data Processing (DP) Mode. The (27, 56) sequence didn't cause a 3/4 forward line feed until after the first line was printed. Thus, the Printer must be in DP Mode. And this new Line Feed stays in effect until further notice (another characteristic of the DP Mode).

Type: `LLIST` (ENTER)

Sure enough. You still have that short Line Feed.

Word Processing Mode

If the same program were executed in WP Mode, the Line Feed would have occurred immediately after the word DATA. Go into WP Mode and try it. To enter WP Mode, change line 10 to:

```
10 LPRINT CHR$(20):REM CHR$(20) SELECTS WP MODE
```

and RUN the program.

Just as you suspected, the Line Feed is immediately executed.

Note that in WP Mode, the new Line Feed is only temporary.
Type: `LLIST` (ENTER) to prove that the half forward Line Feed occurs only once, then returns to normal.

Graphics Mode

Graphics Mode is very different from the other two printer modes. For one thing, code CHR$ (10) in Graphics Mode feeds paper 7/60" against ordinary 1/6" pitch in WP and DP Modes. Furthermore, only a few of the WP and DP features are available in Graphics Mode. Standard letters and symbols, for example, are ingored by the Printer when it is in Graphics Mode. Instead, numeric data from 128 to 255 is translated into dot patterns for the Print Head. This lets you produce print-outs of high-resolution graphics of charts, logos, etc.

For a quick look at this Mode in action, change our test program to:

```
10 LPRINT CHR$(18)
20 FOR I=128 TO 255
30 LPRINT CHR$(I);
40 NEXT
```

and RUN the program.

CHR$ (18) puts the DMP-110 into Graphics Mode. The numbers 128 through 255 are interpreted as dot patterns.

Type: `LPRINT CHR$(30)`**ENTER** to return the Printer to WP Mode. Try LLISTing the program to make sure you're not stuck in Graphics land.

Selecting a Print Mode

Table 3 summarizes the Control Codes required to move from one mode to another.

If you're in:	and want to	Send a CHR$ ( ):
DP	WP	20 (14) Hex
	Graphics	18 (12) Hex
WP	DP	19 (13) Hex
	Graphics	18 (12) Hex
Graphics	DP	30* (1E) Hex
	WP	30* (1E) Hex

* Returns to last Mode (WP or DP) used.

Table 3

Hints and Tips About Print Modes...

Data Processing Mode

- All commands which decide Line Feed pitch are stored in the Printer's memory. They are not executed until a LF code (10 Dec.) is received. Then, the paper advances according to the pitch codes stored in the Printer's memory.
- Line Feed commands stay in effect until replaced by a new command.
- All printable characters (except user defined Graphics) can be printed in this mode.

Word Processing Mode

- Line Feed codes that determine pitch are executed immediately.
- Line Feed pitch changes affect only the current print line.
- All printable characters (except user defined Graphics) can be printd in this mode.

Graphics Mode

- This mode is very different from the other two modes. In Graphics Mode, only three Line Feed codes are acceptable. The LF code causes the paper to move 7/60" forward. The other Line Feed codes are (27, 49) for 1/120" forward, (27, 71) for 2/15" forward.
- Decimal numbers 128 – 255 sent via CHR$ in BASIC are interpreted as pin firing patterns for the Print Head.
- Only a few control code sequences are recognized in Graphics Mode.

4/ Print Font Styles and Character Widths

The DMP-110 has six distinct print (character) font styles:

- Standard (Draft quality)
- Condensed
- Correspondence Quality
- Proportionally Spaced
- Italic Cursive Script
- Microfont

Each style is created with a unique dot pattern laid out in a grid or matrix.

PRINT CHAR. SET	CODES IN DECIMAL (HEX)	PRINT HEAD PASS	DOT MATRIX (H×V+SP)	NO. OF CHAR.	NO. OF COLUMNS	PRINT SPEED (CPS)	CHAR. SPACING (CPI)
• STANDARD							
{ NORMAL	27·19 (1B·13)	1	9×8+3	95	80	50	10
{ ELITE	27·23 (1B·17)	1	9×8+1	95	96	60	12
• CONDENSED	27·20 (1B·14)	1	5×8+2	95	136	86	17
• CORRESPONDENCE QUALITY							
{ NORMAL	27·18 (1B·12)	2	9×16+3	159*	80	25	10
{ ELITE	27·29 (1B·1D)	2	9×16+1	159*	96	30	12
• PROPORTIONALLY SPACED	27·17 (1B·11)	2	(3~11)×16	159*	–	–	–
• ITALIC CURSIVE	27·66 (1B·42)	2	12×16	95	80	25	10
• SUPERSCRIPT • SUBSCRIPT • MICROFONT	27·30 (1B·1E) 27·28 (1B·1C) 27·77 (1B·4D)	2	5×8+2	95	136	43	17

Note 1: Elongation (27·14) and bold (27·31) printing functions are independently effective in every character set.

2: * mark indicates that these three character sets include 64 kinds of special and European characters.

Table 4

Standard Characters

The Standard characters are printed in a 9×8 dot-matrix (9 dots wide by 8 dots high).

Figure 12 Aj

Each of the Standard characters can be printed in two main character widths:

- Normal 10 Characters Per Inch (CPI)
- Elite 12 CPI

Each of these widths can be elongated (double-width) which gives half as many characters per inch and a total of 4 different print widths.

Condensed Characters

The Condensed characters are printed in a 5×8 dot-matrix for 17 CPI. This also can be elongated to double width.

Correspondence Quality Characters

The Correspondence Quality Characters are printed in a 9×16 dot-matrix for 10 CPI. The characters have the same total width as Normal width characters, but they are printed with the Condensed character density (16 dots high fits in the same space as 8 dots high). Correspondence Quality print also has 12 CPI and can be elongated to 5 CPI/6 CPI.

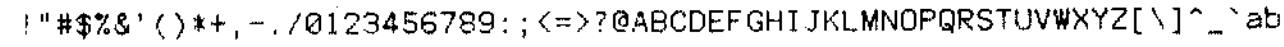


Figure 13

Proportionally Spaced Characters

The Proportionally Spaced Characters are the same as Correspondence Quality, but the character matrix width varies from character to character. The characters are 16 dots high; the widths vary from 3 dots to 11 dots (including 2 columns of blank dots to allow space between the characters).

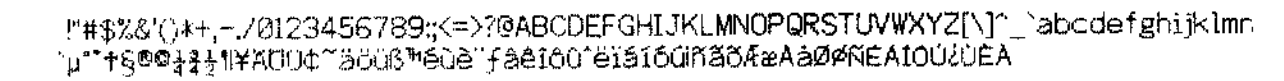


Figure 14

Proportionally Spaced Characters add a quality look to word processing documents by eliminating wide gaps between characters. These characters can also be elongated to double their normal width.

Italic Cursive Characters

The Italic Cursive Characters are printed on a slant. This is a unique font not usually found on printers. You can use it to give special accent or stress to a portion of your document. The character matrix is 12 × 16.

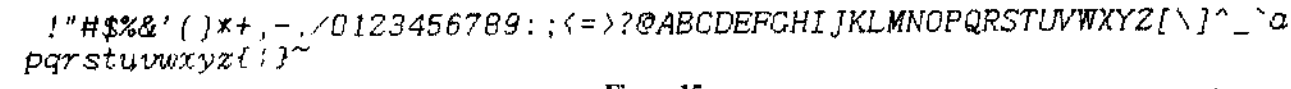


Figure 15

Microfont

The Microfont Characters are printed in a 5×8 dot-matrix, but density is the same as Correspondence Quality: that is, the character height is half that of the Correspondence Quality (or any other characters) and the width is 5/9 of ordinary characters. This is quite convenient for printing super- or subscript.

Figure 16

Theory of Operation

Your DMP-110 uses a newly developed dual uni-hammer print head. The printing system with the uni-hammer is quite different from ordinary impact dot printing systems. The dot is printed when the hammer strikes a raised ridge on the platen.

The timing for the hammer to strike depends on the dot signals generated by the revolution of a rotation detector which is installed at the motor shaft. The strike of the hammer, left-to-right movement of the hammer, and the revolution of the platen are minutely synchronized.

As the platen rotates, for each ridge, eight dot signals are sent to the CPU (on the printed circuit board). The CPU then selects whether or not to activate the print head hammer for the given dot according to the character pattern being printed.

The hammer can be activated eight separate times as one ridge passes by the hammer head. The hammer head is slanted to compensate for the constant movement from left to right of the hammer. Each pass of a ridge causes one dot column to be printed. There are 18 ridges on the platen, so 18 dot columns are printed for each revolution of the platen. Each head strikes every other column alternately. When column one is stricken by head no.1, column two is stricken by head no. 2, and so forth.

For the standard quality fonts, the heads pass once for every printed line. For correspondence quality and others, the heads pass twice per line. Between the two passes, a 1/120" line feed is done, so the dots printed by the second pass are 1/120" lower than the first – thus creating 16 dots vertically (8 dots in half height for Microfont).

Character Widths and Densities		
Style	Matrix Size	Width and Density
Standard	9×8	Normal 10 CPI / Elongated 5 CPI Elite 12 CPI / Elongated 6 CPI
Condensed	5×8	Normal 17 CPI / Elongated 8.5 CPI
Correspondence Quality	9×16	Normal 10 CPI / Elongated 5 CPI Eite 12 CPI / Elongated 6 CPI
Proportionally Spaced	n×16	Variable character width
Italic Cursive	12×16	Normal 10 CPI / Elongated 5 CPI
Microfont	5×8	Normal 17 CPI / Elongated 8.5 CPI

Table 5

Selecting Character Styles

Character styles can be selected by Control Codes from the TRS-80.

Character styles stay in effect until another character style is selected. Even entering Graphics Mode does not change the character set. The DMP-110 returns to the last active set on leaving Graphics Mode.

Table 6 is a summary of the Character Style change commands:

Control Code DEC. (HEX)	New Character Style/Width
27 19 (1B 13)	Normal } Standard
27 23 (1B 17)	Elite } Standard
27 20 (1B 14)	Condensed
27 17 (1B 11)	Proportionally Spaced
27 18 (1B 12)	Normal } Correspondence
27 29 (1B 1D)	Elite } Correspondence
27 66 (1B 42)	Italic Cursive
27 28 (1B 1C)	Subscript
27 30 (1B 1E)	Superscript
27 77 (1B 4D)	Microfont
27 14 (1B 0E)	Start Elongation
27 15 (1B 0F)	End Elongation
27 31 (1B 1F)	Start Bold
27 32 (1B 20)	End Bold

Table 6

Standard Characters and Condensed Characters

You can get a better feel for the different available print widths by printing a few sample lines. Type in this program:

```
NEW (ENTER)
120 F$="STANDARD":N=19:W$=" 10 CPI":GOSUB 240
130 F$="ELITE":N=23:W$=" 12 CPI":GOSUB 240
140 F$="CONDENSED":N=20:W$=" 17 CPI":GOSUB 240
230 LPRINT CHR$(27) CHR$(19):STOP
240 LPRINT CHR$(27) CHR$(N);F$;" CHARACTERS ";W$
250 RETURN
```

and RUN it.

The subroutine in line 240 sends the required Control Codes to the DMP-110. Line 230 returns to Normal character width and stops program execution.

Correspondence Quality Characters

Correspondence Quality characters appear to be the same as Standard characters in Normal width, but they are an entirely unique character style. Add these lines to the program, then compare the two styles.

```
150 F$="CORRESPONDENCE "
160 N=18:W$=" 10 CPI":GOSUB 240
170 N=29:W$=" 12 CPI":GOSUB 240
```

and RUN the program.

The difference between some characters is very slight, but the O and W are quite different. This is a good style to use with word processing programs that do not support proportionally spaced characters.

Proportionally Spaced Characters

Proportionally Spaced Characters use the same style and density as Correspondence Quality Characters. The only difference is that Correspondence Characters are fixed in width, whereas the Proportionally Spaced Characters vary. Add these lines to see the Proportionally Spaced Characters:

```
180 F$="PROPORTIONAL "
190 N=17:W$="":GOSUB 240
```

and RUN.

Italic Cursive Characters

The Italic Cursive Characters use a 12×16 matrix. This is a quite unique font, usually not found on other dot-matrix printers.

To see what this character set looks like, add:

```
200 N=66:W$="":F$="ITALIC ":GOSUB 240
```

and RUN.

Microfont Characters

The microfont is a 5×8 dot matrix. The number of dots are the same as for condensed characters, the vertical dot density is twice as great, and the height of character is half that of condensed characters.

It is most convenient when you want to use super- or subscript, but you will soon find this is quite useful for some applications.

Add these to the current program and RUN.

```
210 N=77:W$="":F$="MICROFONT ":GOSUB 240
```

Right Justification

Proportionally Spaced characters are designed to be used with word processing programs. They don't carry around all the wasted space between words that monospaced print styles do. As a result, you can sneak in little slivers of space between characters to line up the right margin of text on a page without destroying the nice character spacing. This process, called "Right Justification," is usually handled by word processing software. The DMP-110 provides codes to allow you to insert spaces between characters ranging from 1 dot to 9 dots wide. These codes are summarized below.

Send CHR$ ( ):			To Insert This much
27	01	(1B 01) Hex	1 dot space
27	02	(1B 02) Hex	2 dot space
27	03	(1B 03) Hex	3 dot space
27	04	(1B 04) Hex	4 dot space
27	05	(1B 05) Hex	5 dot space
27	06	(1B 06) Hex	6 dot space
27	07	(1B 07) Hex	7 dot space
27	08	(1B 08) Hex	8 dot space
27	09	(1B 09) Hex	9 dot space

Table 7

You can demonstrate the way these codes work by modifying the current program. When you add the following two lines, the DMP-110 will print two lines of Proportionally Spaced Characters, then insert enough space to line up the right margins.

```
70 DATA "THE PROPORTIONAL CHARACTER SET OF THE"
80 DATA "DMP-110 PRINTER CAN BE RIGHT JUSTIFIED"
```

The lines will be read in as a string of characters with the MID$ function. Enter:

```
10 LPRINT CHR$(27) CHR$(17)
20 FOR I=1 TO 2:READ A$
30 FOR J=1 TO LEN(A$)
40 LPRINT MID$(A$,J,1);
50 REM
60 NEXT J:LPRINT:NEXT I
90 LPRINT CHR$(27) CHR$(19):END
```

Now RUN the program.

To line up the right edge, insert a single blank dot column between the first 8 letters in the second print line. Add:

```
50 IF I=2 AND J<8 THEN LPRINT CHR$(27) CHR$(1);
```

then RUN the program.

If a proportional spacing command is used at the end of the text (exceeding a line length), it generates line-full condition. Printing will start and proportional spacing command will begin at the start of the next line. If several kinds of proportional spacing commands in succession at the end of text are used, and if the row of proportional spacing commands causes a line-full condition, only the last proportional spacing command is set at the head of the next line.

Delete lines 10 through 90 of your sample program before going on.

Wrap-Around

The DMP-110 is a dot-addressable printer. Therefore, line length is not determined by the number of characters, but by the number of dots per line. The number of addressable dots-per-line in Data Processing or Word Processing Mode are 960.

If the length of text the Printer receives exceeds the limit of dots-per-line, a Line Feed is inserted and the last character is printed from the start of the next line. This is called "wrap-around".

Elongated Characters

Any of the character styles can be elongated to twice their normal width. To start elongation, use CHR$ (27); CHR$ (14); to end elongation, use CHR$ (27); CHR$ (15).

The start (27 14) and end (27 15) codes for Elongated characters may be entered any number of times within a line and can be used in every mode.

You can easily elongate the characters in the current program. Change:

```
100 LPRINT CHR$(27) CHR$(14)
230 LPRINT CHR$(27) CHR$(19) CHR$(27) CHR$(15):STOP
```

and RUN the program.

Bold Characters

Bold characters are implemented in much the same way as Elongated characters.

Bold printing is started by sending a CHR$ (27); CHR$ (31) to the DMP-110 and ends when you send a CHR$ (27); CHR$ (32).

When a (27 31) code sequence is received, the DMP-110 prints the current buffer contents, then resumes Bold character printing from next character received.

Bold characters can be added to the current program by changing lines:

```
100 LPRINT CHR$(27) CHR$(31)
230 LPRINT CHR$(27) CHR$(19) CHR$(27) CHR$(32):STOP
```

and RUNning it.

Mixing Bold and Elongated Characters

Bold and Elongated characters can be active at the same time.

5/ General Control Codes

Line Feed Codes

When Line Feed code (ASCII 10) is received by the DMP-110, all data in the Printer buffer is printed followed by a Line Feed. Unless you tell it otherwise, the DMP-110 uses 1/6" forward Line Feed when advancing paper.

Other Line Feed codes control the pitch of the Line Feed. In DP Mode, these codes may be stored in the buffer. In WP Mode, they cause immediate printing.

Pitch setting is sent to the DMP-110 in a two code sequence. First, a Control Code 27 is sent (CHR$ (27)). This tells the DMP-110 that a special code sequence will follow. The next number determines the specific pitch. These Control Codes are listed in Table 8.

Line Feed Control Codes	
Operation	Code in decimal (hex)
Half Forward Line Feed (1/12")	27 28* (1B 1C)
Full Forward Line Feed (1/6")	27 54** (1B 36)
Three-quarter Forward Line Feed (1/8")	27 56 (1B 38)

* Only in DP Mode. In WP Mode this code sequence is to select subscript character.
** Ignored in WP Mode

Table 8

Hints and Tips On Line Feed...

- In Data Processing Mode, codes are stored in the Printer buffer. They are not activated until a LF code is sent. In the Word Processing Mode, these sequences cause the Printer to print the information in its buffer, then execute a Line Feed with the specified pitch.
- CHR$ (10) will not work from some BASIC with the CHR$ function. The LF code (10) is intercepted by BASIC and sent to the printer as a 13.
- CHR$ (27); CHR$ (54) is ignored in Word Processing Mode since it duplicates the LF code.
- CHR$ (27); CHR$ (28), CHR$ (27); CHR$ (54), and CHR$ (27); CHR$ (56) are ignored in Graphics Mode.

Special Line Feed Codes

There are two special forward Line Feed Codes that operate the same regardless of the current print mode.

Special Line Feed Control Codes	
Operation	Code in decimal (hex)
1/20 Forward Line Feed (1/120")	27 49 (1B 31)
4/5 Forward Line Feed (8/60")	27 71 (1B 47)

Table 9

They are unique since they cause an immediate dump of the Printer buffer, followed by a Line Feed, regardless of the print mode.

These special Line Feed Codes are useful for adjusting a print line or printing a dot-matrix picture.

Carriage Return (CR)

A SUB (26) Code tells the printer to print the current buffer contents, and then perform a Carriage Return. The printing will start at the beginning of the same line.

Note: In case of two-pass printing, 1/120" line feed will take place between the first and second passes.

Backspace (BS)

The DMP-110 can be backspaced from one to 255 dot-columns when you send a two code sequence, of which the first code is CHR$ (8). The second code is in the form of CHR$ (*n*), where *n* is a value from 1 to 255 and specifies how many dot-columns to backspace from the current printing position. For example:

```
LPRINT CHR$(8);CHR$(150)
```

would backspace 150 dot-columns from the current position.

In general, backspacing should be done in multiples of the current character size. That is, backspacing for the Standard character set should be 12 dots per character (9 dots plus 3 for spacing between characters). For instance, `LPRINT CHR$(8);CHR$(24)` would backspace two characters.

If *n* is 0, backspacing is not done. The repeat feature can be used to backspace more than 255 dot-spaces.
If *n* is greater than the current dot-position, printing starts at the beginning of the line.
In Graphics Mode, the backspace code is ignored and *n* is treated as an independent character. Backspace works in both Data and Word Processing Modes.

Type in this program:

```
10 LPRINT TAB(30);"D P 1 0";
20 LPRINT CHR$(8);CHR$(72);"M - 1"
```

and RUN the program.

To backspace over elongated characters, simply double the number of dots. Let's try it. Change the program to:

```
10 LPRINT TAB(30);CHR$(27);CHR$(14);"D P 1 0";
20 LPRINT CHR$(8);CHR$(144);"M - 1"
30 LPRINT CHR$(27);CHR$(15)
```

and RUN the program.

CHR$ (27); CHR$ (14) and CHR$ (27); CHR$ (15) get the DMP-110 in and out of Elongated Character width. Remember that you must compensate for the double-width characters by doubling the 72 in line 20 to 144.

The widths of the 10 available character sets are shown in Table 4. The Proportionally Spaced Character widths naturally vary from character to character.

Setting Top-of-Form and Form Length

The Control Code CHR$ (27); CHR$ (52) is used to set the Form Length in all three print modes. It resets the Line Feed count to zero and sets the current line as the Top-of-Form position. The line length per page is set to *n* (×1/6") to be used with the Form Feed code. If *n* is 0, it is changed to 256. Whenever any Line Feed operation is activated, Line Feed pitch is counted up and compared with *n* (×1/6").

On initial power-up, the DMP-110 sets the Top-of-Form at the current paper position and the Form Length is set to 66 lines per page. Be sure the paper is properly positioned before you turn on the Printer.

Form Feed (FF)

When CHR$ (12) command is received, the print buffer contents are printed out completely, paper is advanced to the next Top-of-Form position, and the Line Feed counter is reset to zero.

However, there is one slight problem for those of you who communicate to the Printer through BASIC. Most BASICs keep track of the Top-of-Form internally and intercept the Form Feed code on its way to the Printer and send out, instead, a series of line feeds. Since the FF code never makes it to the Printer, the CHR$ (12) is not activated. Some BASICs can use the POKE or OUT statement to send a FF directly to the printer and bypass the interpreter.

Ignored or Undefined Codes

Codes that are unusable or undefined in a given print mode are either ignored or printed with the symbol ⧖ which represents an invalid code.

There are several reasons a code may be unusable in a certain mode. Redundant codes that don't change the current printer status are usually ignored. For example, if the Printer is in DP Mode, sending a CHR$ (19) (used to enter DP Mode) is useless. And there are many ASCII control codes in the range 0 to 31 that the DMP-110 simply doesn't recognize. ASCII control code 0, for example, is not used in any of the three print modes.

The followng table summarizes the undefined print codes.

DMP-110 Ignored Control Codes
All Modes: • Out of range on repeat sequence. • Out of range on ESC POS sequence. • Redundant codes that don't change the current printer status. For example, if you send a CHR$ (15) when underline is already set.

DP: 0, 1, 19, 30, 127, 255

WP: 0, 1, 20, 30, 127, 255, 27 54

Graphics: All codes in the range 0 – 127 are ignored except

(10), (12), (13), (27 14), (27 15)
(27 16 *n*1 *n*2), (27 49), (27 52), (27 71),
(27 73), (28 *n*1 *n*2), and (30).

Unprintable repeat sequence data '*n*2' is also ignored.

Codes printed as ⧖
DP and WP: • All codes from 0–31 and 128–159, except the active function codes or the above ignored codes. • Unprintable repeat data 'n2'. • All codes from 128–159 and 224–254.

Table 10

****When a certain condition has been set, if a code or a sequence which is identical with the former one is received, it is ignored.**

DMP-110 Buffer Operation

The DMP-110's ability to temporarily store data is one of its main advantages over a typewriter. Codes sent to a typewriter (i.e., keys pressed) are transferred immediately to the paper. Codes sent to a Printer are not printed immediately. They are stored in a separate section of memory in the Printer called the buffer. When the buffer fills, or certain codes are received (e.g., LF or CR), the buffer is emptied and all data is printed on the paper. What happens after the buffer data is printed depends on the circumstances. In some cases, printing continues on the same line; in others, the Print Head is moved to a different position relative to the paper.

In the DP Mode, commands for changing print fonts, Line Feed, etc., can be stored in the buffer to take affect when the data is dumped to paper.

Understanding how the buffer works is important for those who wish to gain full control of the DMP-110.

Hints and Tips on the DMP-110 Buffer...

- The buffer allocates 960 horizontal dot positions by 16 vertical dots as printing image. In case character data is in DP or WP Mode, the data received is converted to the character matrix according to the character styles, elongation and/or bold face designation and stored in the buffer. In the Graphics Mode, the data is stored as pattern. The character style changes (elongation or boldface designation), therefore, do not cause printing.
- The micro space (27, *n*), backspace (8, *n*) and dot positoning (27, 16, *n*, *n*) changes the stored dot position information (add/subtract dot position counting). These also do not cause printing.
- If the last received character exceeds the 960th dot position, the buffer is printed without printing the last character, and the last character will be printed at the start of the next line, after automatic line feed and carriage return (this is called "wrap-around").
- The carriage return code (13) activates to print the buffer, and the subsequent data will be printed at the start of the next line.
- The line feed code (10) also activates the printing. The subsequent data will be printed on the next column of the next line. In WP Mode, the other line feed codes also cause printing of the buffer contents, and feed the line in the designated pitch.
- The carriage return only code (26) activates the printing, and the subsequent data will be printed over the current line.
- If buffer contains some data and the computer stops sending next data for a second, the buffer is printed, and printing will continue from the current position when data is received again.

Note 1: In the description, "next line" means the new line performed by Line Feed operation.

Note 2: **Repeat data can cause a buffer full or overflow condition as well as single characters.

Superscript and Subscript

In an earlier section, we told you that the half line feed pitch is available only in Data Processing Mode, and the same code in Word Processing Mode is interpreted as subscript. Your DMP-110 has Microfont character font, which is used for printing subscript or superscript.

Printing superscripts and subscripts can be done via the control codes (27 30) and (27 28). To terminate the super-/subscript mode, enter the code for opposite code (i.e. 27 28 to terminate superscript, 27 30 to terminate subscript). Type in this new program:

```
10 E$=CHR$(27)  :'ESC
20 D$=CHR$(28)  :'DOWN
30 U$=CHR$(30)  :'UP
40 LPRINT CHR$(20);CHR$(&HD);
50 REM
60 LPRINT "(X";
70 LPRINT E$;D$;"1";E$;U$;" + X";
80 LPRINT E$;D$;"2";E$;U$;")";
90 LPRINT E$;U$;"2";E$;D$
```

and RUN the program.

In this program, frequently used codes are stored in variables E$, D$, and U$. This shortens the program a bit. The directions in line 10 through 30 refer to the motion you would make drawing the script characters by hand. (Move down to do the subscripts "1" and "2", then back up to the output line. Then move up to do the superscript "2".)

Repeat Printing

The DMP-110 also provides a built-in repeat capability. You can use it to repeat a single character code up to 255 times. It's great for repeating graphics codes, underlining, etc. The Repeat feature uses a three code sequence:

- CHR$ (28)
- The number of repetitions.
- The code to be repeated.

```
LPRINT CHR$(28);CHR$(11);CHR$(65)
```

will print the capital A (the code 65) eleven times.

Positioning the Print Head

In any mode, you can position the Print Head to a specific dot position. There are 960 dot positions per line.

Elongated characters use the same dot columns although the characters are printed twice as wide.

To position the Print Head to a specific position, send a (27 16), then two numbers (we'll call them *n*1 and *n*2) that specify the desired position.

Format: `CHR$(27);CHR$(16);CHR$(n1);CHR$(n2)`

Why two numbers (*n*1 and *n*2)? The maximum value you can send to the DMP-110 with one number is 255, and clearly you have more than 255 dot positions available. The two-number approach is a way around this limitation. *n*1 is used to add multiples of 256 to *n*2. *n*1=1 adds 256, *n*1=2 adds 2×256 (=512), *n*1=3 adds 3×256 (=768), etc.

Table 11

N1=0 => 0 - 255
N1=1 => 256 - 511
N1=2 => 512 - 767
N1=3 => 768 - 1023 (Careful! 960 is a maximum)

Those of you who are fans of binary math will recognize that the DMP-110 is interpreting these two numbers as a single 10-bit (b (0) -b (9)) value. The two lower bits of *n*1 are used as b (8) and b (9).

Note: Use 9" wide paper for this next example.

See if you can print a character starting in position 792. Table 11 shows you that *n*1=3 gives 768 of those dots, and 792-768-1=23 is the difference to be sent as *n*2. Type:

```
10 LPRINT CHR$(27);CHR$(16);CHR$(3);CHR$(23);
20 LPRINT "*"
```

and RUN the program.

Whoops! The asterisk printed at the left edge of the paper. Hmmm? Maybe you need to leave enough room for the asterisk to fit on the end of the line. Try:

```
10 LPRINT CHR$(27);CHR$(16);CHR$(3);CHR$(18);
```

and RUN. That's better. It fits nicely at the end of the line. Try this program with the different character densities.

Position is a little like a TAB, but it gets right down to the dot level, giving you much finer control. Although it is available in all three print modes, its potential is greatest in Graphics Mode.

If you want to make a real mess on your paper, try:

```
10 LPRINT CHR$(27);CHR$(28);
20 FOR I=1 TO 100
30 LPRINT CHR$(27);CHR$(16);CHR$(1);CHR$(150+I*SIN(I));
40 LPRINT "*"
50 NEXT I
```

and RUN the program.

But get out of double-width first!

6/ Graphics Mode

In Graphics Mode, you no longer have pre-defined characters at your disposal. You are responsible for the positioning and the action of the Print Head.

The DMP-110 allows you to have direct, programmable control over all of the available graphic dots.

How many "across the paper" addressable dots-columns are there? That's 960.

How many "up and down" (dot-columns) addressable dots are there? The answer is a flat 7 for normal graphics, 16 in high density graphics mode.

That means you can specify any one of up to 15,360 individual dots. (16×960=15,360)

Normal Graphics

How do you print just one (or two or three) of those dots in the dot-column you want? (For example, how can you print the 3rd dot from the top in the 400th dot-column?)

Simple. Just follow this general procedure:

1. Send a CHR$ (18) to put the DMP-110 into Graphics Mode.
2. Send a CHR$ (27); CHR$ (16) to tell the Printer you want to position the Print Head to print a specific dot and tell the Printer at which dot-column you want to print.

This is a little more complicated and will be explained shortly. For now, just understand that you simply tell the Printer which dot-column you want.

3. Tell the Printer what you want to print. You can do this a number of ways. Again, this will be explained in more detail shortly. For now, just keep this overall procedure in mind.

When you want to specify a dot-column for printing to begin, you must first use CHR$ to send the (27 16) code. Follow this with another two-code sequence which specifies the position. For instance:

```
LPRINT CHR$(27);CHR$(16);CHR$(n1);CHR$(n2)
```

Where *n*1 is a value between 0-3 and *n*2 is a value between 0-255

Graphic dot Positioning (condensed)		
If you wish to specify dot-column:	n1 bust be:	n2 must be:
1-256 (001-100) Hex	0	0-255 (0-FF) Hex
257-512 (101-200) Hex	1	0-255 (0-FF) Hex
513-768 (201-300) Hex	2	0-255 (0-FF) Hex
769-960 (301-3C0) Hex	3	0-191 (0-BF) Hex

Table 12

Even though dot-columns greater than 255 exist, you cannot send values greater than 255. That is, CHR$ (400) is not allowed – you must break it into a two-byte value.

```
10 LPRINT CHR$(18)
20 LPRINT CHR$(27);CHR$(16);CHR$(1);CHR$(143);CHR$(255)
```

(Don't worry, that last CHR$ (255) will be discussed shortly.)

In line 10, CHR$ (18) puts the Printer into Graphics Mode and CHR$ (27); CHR$ (16) (line 20) tells it to get ready to position the Print Head.

Try this line to print a vertical bar at the right-most available dot-column – 960

```
10 LPRINT CHR$(18);CHR$(27);CHR$(16);CHR$(3);CHR$(191);CHR$(255);
```

What happens is:

- CHR$ (18) puts the Printer into Graphics Mode.
- CHR$ (27); CHR$ (16) tells the DMP-110 to get ready to position the Print Head.
- CHR$ (3) tells the Printer that the position will be greater than 768.
- CHR$ (191) specifies the last available dot-column.

(**Note:** If you used CHR$ (192) in this line instead of CHR$ (191), the DMP-110 would "wrap-around" to the first dot-column in the next line.)

Printing Graphics Patterns

By now, you should be adept at positoning the Print Head. But you also need to be able to tell the DMP-110 what to print once the Head is positioned.

Remember that we said there were 7 vertical dots in a dot-column. You can print any or all of these dots in any combination you want.

Look back at the sample programs used when we talked about Print Head positioning. Do you remember the last part of the program line (CHR$ (255)) which always printed a vertical bar. That's an example of all 7 dots being printed at once.

To Print just the top dot of that last dot-column (960):

```
10 LPRINT CHR$(18);CHR$(27);CHR$(16);CHR$(3);CHR$(191);CHR$(129);
```

How does the CHR$ (129) print just the top dot?

Even though the 7 dots in a dot-column are in a vertical row, they are not numbered sequentially down from 1 to 7. Table 13 describes the numbering system you must use with the DMP-110 when specifying an individual dot:

DMP-110 Addressable Dot Numbering System

Dot #:	Dot:	Number You Must Use To Print the Dot:
1 (1) Hex	*	129 [128+1] (81) Hex
2 (2) Hex	*	130 [128+2] (82) Hex
4 (4) Hex	*	132 [128+4] (84) Hex
8 (8) Hex	*	136 [128+8] (88) Hex
16 (10) Hex	*	144 [128+6] (90) Hex
32 (20) Hex	*	160 [128+32] (A0) Hex
64 (40) Hex	*	192 [128+64] (C0) Hex

Table 13

For instance, you've already seen how to print the top dot in the column, but to print the bottom dot, change the program line to:

```
10 LPRINT CHR$(18);CHR$(27);CHR$(16);CHR$(3);CHR$(191);CHR$(192);
```

This is fine if you want to print an individual dot, but how do you print a combination of dots?

It's actually quite simple too.

1. Specify the Dot # (1-64, see Table 13) that represents the individual dots you want to print.
2. Add those individual Dot # 's together.
3. Add the sum of the combined Dot #'s to 128.

For example, if you want to print the first dot (Dot # 1) the fourth dot (Dot # 8), and the last dot (Dot #64), add them together: 1+8+64=73. Then add the sum (73) to 128: 73+128=201. Use 201 as the addressable dot pattern in the form CHR$ (201):

```
10 LPRINT CHR$(18);CHR$(27);CHR$(16);CHR$(3);CHR$(191);CHR$(201);
```

Remember how CHR$ (255) printed a solid (all dots printed) vertical bar. Try out the formula on that:

(1+2+4+8+16+32+64)=127+128=255

The following sample program line will print a box with a line through the middle:

```
10 LPRINT CHR$(18);CHR$(27);CHR$(16);CHR$(1);CHR$(30);CHR$(255);
CHR$(201);CHR$(201);CHR$(201);CHR$(201);CHR$(255);
```

Now to flex our muscles.

Type in this NEW program:

```
10 LPRINT CHR$(18)
20 S=1 :N=128
30 FOR I=1 TO 20:S=-S
40 FOR J=0 TO 6
80 IF S<0 THEN N=N+2^(6-J) ELSE N=N-2^J
90 LPRINT CHR$(N);
100 NEXT J:NEXT I
120 LPRINT CHR$(30)
```

and RUN. Be prepared for a pause; it takes time to fill the print buffer.

This program alternately adds and subtracts powers of two to the current code pattern stored in the variable N. The net effect is to add or remove a single dot from the preceding dot pattern.

Line Feed

In Graphics Mode, it is assumed that you want to print rows of graphics one right after another, each 7 dots high. Therefore, Graphics Mode provides only one line feed. A single line feed advances the paper 7 dots or approximately 0.1 inch. This small paper advance allows for continuous printing without unwanted space between lines.

Modify the current program to demonstrate this fixed line feed. Add or change:

```
20 FOR K=1 TO 2:S=1:N=128
50 IF K=1 THEN 80
60 IF S<0 THEN N=N+2^J ELSE N=N-2^(6-J)
70 GOTO 90
110 LPRINT :NEXT K
```

and RUN.

These lines infiltrate the current loop and produce a mirror image of the first pass of the Print Head. The LPRINT in line 110 causes the Line Feed between passes.

Repeat Printing

CHR$ (28) will tell the DMP-110 to repeat a graphic pattern a specified number of times.

The format for the Repeat Function is:

repeat code+number of times to repeat+what to repeat

For instance, LPRINT CHR$ (28); CHR$ (15); CHR$ (255); will print the solid vertical bar 15 times.

Change line 90 to:

```
90 LPRINT CHR$(28);CHR$(2);CHR$(N);
```

and RUN.

Or run this program:

```
10 LPRINT CHR$(18);:REM ENTERS GRAPHIC MODE
20 LPRINT CHR$(28);CHR$(50);CHR$(135);:REM 50 means repeat 50 times
```

Leaving Graphics Mode

CHR$ (30) is used to exit Graphics Mode. It places the DMP-110 in the same mode (DP or WP) the Printer was in when it entered Graphics Mode. In addition, all the previous conditions, such as underline and character style, are restored. Change the sample program to:

```
5 LPRINT CHR$(27);CHR$(20);
90 LPRINT CHR$(N);
130 LPRINT "STILL IN COMPRESSED MODE"
```

and RUN.

Sure enough, the condensed mode is still alive and well.

Mixing Modes on the Same Line

The fact that character density is unaffected as the DMP-110 moves in and out of Graphics Mode is a blessing when mixing Text and Graphics on the same line. It simplifies the calculation of the number of dots per line.

Freehand Drawing

Having high resolution graphics at your disposal is great, but you must realize that it requires plenty of data. The Computer can do most of the work in drawing figures that can be described by a mathematical function. Freehand drawings, on the other hand, require translating the figure into a matrix of dots, then calculating the dot printing combinations for each Print Head position. Since there are 7 dots available for graphics, separate the matrix into rows 7 dots high.

The numbers can be stored in DATA statements. To conserve memory and typing time, store the data as numbers from 0 to 127, then add 128 as you send them to the Printer. Enter these sample DATA lines:

```
NEW (ENTER)
140 DATA 999
160 DATA 120,116,116,124,122,122,77,77,71,71,70,66,67,67,3,1
200 DATA 12,4,4,12,112,999
260 DATA 24,24,24,4,5,6,999
300 DATA  5,5,3,3,3,3,2,2,1,1,1,1,1,1,999
```

The 999s will be used to signify the end of a line. The other number are between 0 and 127. Now for the program to read the numbers, add 128, then send them to the Printer:

```
10 LPRINT CHR$(18)
20 FOR R=1 TO 4
30 READ N:IF N=999 THEN 80
40 LPRINT CHR$(128+N);:GOTO 30
80 LPRINT :NEXT R
90 LPRINT CHR$(30)
100 LPRINT "DMP-110"
```

and RUN.

Not much to brag about yet. Maybe what it needs is to be jazzed up to repeat a number several times. A good approach is to use negative numbers to indicate the number of repetitions followed by the number to be repeated. Add:

```
110 DATA -35,0,-5,64,-4,96,80,80,-3,48,40
120 DATA -4,24,-4, 28,30,30,-3,46,38,38,36,36,-3,34,66
130 DATA -7,65,-3,66,-8,2,-8,4,-6,8,-5,72,104,-3,48,-3,16
150 DATA -16,0,-2,64,32,-2,96,80,112,-2,104
170 DATA -2,3,2,-4,0,-2,2,-2,4,-4,0,-2,4,-2,8,-4,0,-3,9,80
180 DATA 64,64,-3,96,80,80,48,-3,40,56,49,81,81,89,-4,73,69,69,
190 DATA -3,6,-4,2,1,-4,65,-2,64,-4,32,-2,33,-4,17,18,-5,10
```

Don't RUN yet!

In line 120, the sequence −4, 24 is used to mean four 24s: 24, 24, 24, 24. You must modify the program to recognize the negative numbers. Change:

```
40 IF N>=0 THEN LPRINT (128+N);:GOTO 30
50 READ M
60 LPRINT CHR$(28);CHR$(-N);CHR$(128+M);
70 GOTO 30
```

and RUN.

The figure still doesn't look like much. Add the remaining DATA lines and see what you've been working on.

```
210 DATA -5,0,8,-2,24,-2,44,-2,42,50,81,-5,83,-3,87,-6,39,-5,47
220 DATA -3,79,-8,95,31,-3,63,-6,62,-3,126
230 DATA -3,124,-2,60,28,30,-2,14,15,7,23,19,27,59,57,61,60
240 DATA 62,30,30,94,76,76,44,36,36,16,16,-3,8,4,4,5,-3,3
250 DATA 15,15,-3,31,14,14,-5,64,-3,32,-3,96,-2,80,-3,48,-3,40
270 DATA -19,0,-3,2,-3,3,-6,5,-4,6,-5,10,-4,12,-2,13,-4,21
280 DATA -4,25,26,26,-3,42,-3,50,-3,18,-3,20,-3,36,60,-2,34,18
290 DATA -3,17,15,16,-4,8,24,20,20,-4,12,-2,10,-3,6
```

and RUN.

Now that's worth the effort!

High Resolution Graphics

Once you get familiar with the standard graphics mode, the high resolution graphics are simple to operate.

Send code sequence (27 73) to enter the high resolution graphics. The big difference between standard graphics and high resolution graphics is that you must send the codes for printing data together with the command to enter the high resolution graphics.

Then, the code should be sent in the following way:

```
CHR$(27) CHR$(73) CHR$(n1) CHR$(n2) CHR$(b1) CHR$(b2).....
```

The first two codes set the printer to high resolution graphics mode. The next *n*1 and *n*2 specify the number of columns to be printed, in binary form. *b*1 and *b*2 specify which dot(s) of the column should be printed.

The number of columns must be up to 960. So, *n*1 must be between 0-3 and *n*2 can be between 0-255, but can't be greater than 191 if *n*1 is 3. A little reflection will soon let you understand why.

There are 16 dots (remember, high resolution graphics use two passes of the print head) vertically. Only 8 dots can be specified by one byte code. Thus two bytes are required to specify printing dots of one column. In other words, the number of the dot specifying codes must be double the number of columns specified by *n*1 and *n*2.

To get the figures for *b*1, *b*2 etc., divide one column into upper and lower. Then apply the similar formula used for defining figures of dot specifier in standard graphics printing.

Confused? Let's try an example. Suppose we want to print 1st, 3rd, 7th, 10th, 13th and 16th dots of one column. First, divide into upper and lower. Up to 8th dot is an upper column. So, 1st, 3rd and 7th dots belong to upper. The rest, 10th, 13th and 16th are in lower column.

For upper column,
1st is 1
3rd is 4
7th is 64
Adding up, we get 69.

For lower column,
10th (i.e. 2nd lower column) is 2
13th (5th in lower column) is 16
16th (8th in lower column) is 128
Add these together and we get 146.

So the *b*1 should be 69, *b*2 should be 146.

Upper Column	Lower Column	Number to Add
1	9	1
2	10	2
3	11	4
4	12	8
5	13	16
6	14	32
7	15	64
8	16	128

Table 14

Appendix A/ Control Code Summary

If you're in:	and want to change to:	Send a CHR$ ( ):
DP	WP	20 (14) Hex
	Graphics	18 (12) Hex
WP	DP	19 (13) Hex
	Graphics	18 (12) Hex
Graphics	DP	30* (1E) Hex
	WP	30* (1E) Hex

* Returns to last Mode (WP or DP) used.

Control Code DEC. (HEX)	New Character Style/Width
27 19 (1B 13)	Normal } Standard
27 23 (1B 17)	Elite } Standard
27 20 (1B 14)	Condensed
27 17 (1B 11)	Proportionally Spaced
27 18 (1B 12)	Normal } Correspondence
27 29 (1B 1D)	Elite } Correspondence
27 66 (1B 42)	Italic Cursive
27 28 (1B 1C)	Subscript
27 30 (1B 1E)	Superscript
27 77 (1B 4D)	Microfont
27 14 (1B 0E)	Start Elongation
27 15 (1B 0F)	End Elongation
27 31 (1B 1F)	Start Bold
27 32 (1B 20)	End Bold

DMP-110 Ignored Control Codes

All Modes:

- Out of range on repeat sequence.
- Out of range on ESC POS sequence.
- Redundant codes that don't change the current printer status. For example, if you send a CHR$ (15) when underline is already set.

DP: 0,1,19,30,127,255
WP: 0,1,20,127,255, 27 54
GRAPHICS: All codes in the range 0-127 are ignored except
(10), (12), (13), (26), (27 14), (27 15), (27 16 n1 n2), (27 49),
(27 52 n), (27 71), (27, 73 n1 n2), (28 n1 n2), (30).
Unprintable repeat sequence data 'n2' is also ignored.

Codes printed as ⧖
DP and WP:

- All codes from 0-31, 128-159 and 224-254 except the active function codes or the above ignored codes.
- Unprintable repeat data 'n2'.
- Standard, Condensed, Italic cursive, and Microfont character styles; codes 128-254 are printed as ⧖ .
- Conrespondence and proportional character styles; codes 128-159 and 224-254 are printed as ⧖ .

** When a certain condition has been set, if a code or a sequence which is identical one with former one is received, it is ignored

Code Dec.	(Hex)	Symbol	Data Processing mode	Word Processing mode	Graphics mode	Remarks
00 01	(00) (01)		Ignored	Ignored	Ignored	
08 n	(08)	BS	Backspace (n=Binary) n: Back spaced dot number	Backspace (n=Binary) n: Back spaced dot number	Ignored Receives n as character data	
10	(0A)	LF	Executes LF according to latched information	1/6" line feed	7/60" line feed	
12	(0C)	FF	Form feed	Form feed	Form feed	Form length is selectable
13	(0D)	CR	LF and CR LF pitch is latched one	1/6" LF and CR. 1/12" LF at micro font	7/60" LF and CR	
14	(0E)	SO	End underline	End underline	Igored	
15	(0F)	SI	Start underline	Start underline	Igored	
18	(12)	DC2	Select graphics	Select graphics	Ignored	
19	(13)	DC3	Ignored	Select Data Processing mode	Ignore	
20	(14)	DC4	Select Word Processing Mode	Ignored	Ignored	
26	(1A)	SUB	Carriage return	Carriage return	Carriage return	No line feed
27 1~9	(1B)	ESC n	Increment n microspaces	Increment n microspaces	Ignored	2nd byte is dot column number
27 14	(1B) (0E)	ESC SO	Start elongation	Start elongation	Start elongation	
27 15	(1B) (0F)	ESC SI	End elongation	End elongation	End elongation	
27, 16 n_1, n_2	(1B,10)	ESC,POS n_1, n_2	Positioning (n_1, n_2 indicate dot position from home position)	Positioning (n_1, n_2 indicate dot position from home position)	Positioning (n_1, n_2 indicate dot position from home position)	n_1, n_2: Binary value
27 17	(1B) (11)	ESC DC1	Select proportional character	Select proportional character	Ignored	
27 18	(1B) (12)	ESC DC2	Select correspondence normal character	Select correspondence normal character	Ignored	10 CPI
27 19	(1B) (13)	ESC DC3	Select standard normal character	Select standard normal character	Ignored	10 CPI
27 20	(1B) (14)	ESC DC4	Select condensed character	Select condensed character	Ignored	17 CPI
27 23	(1B) (17)	ESC ETB	Select standard elite character	Select standard elite character	Ignored	12 CPI
27 28	(1B) (1C)	ESC FS	1/12" LF pictch is latched	Select subscript character	Ignored	17 CPI
27 29	(1B) (1D)	ESC GS	Select correspondence elite character	Select correspondence elite character	Ignored	12 CPI
27 30	(1B) (1E)	ESC RS	Ignored	Select superscript character	Ignored	17 CPI

Code Dec.	(Hex)	Symbol	Data Processing mode	Word Processing mode	Graphics mode	Remarks
27 31	(1B) (1F)	ESC US	Start bold character	Start bold character	Ignored	
27 32	(1B) (20)	ESC SP	End blod character	End bold character	Ignored	
27 49	(1B) (31)	ESC 1	1/120" line feed	1/120" line feed	1/120" line feed	
27 52 n	(1B) (34)	ESC 4 n	Sets n/6" as form lenth	Sets n/6" as form length	Sets n/6" as form length	n: Binary Value
27 54	(1B) (36)	ESC 6	1/6" LF pitch is latched	Ignored	Ignored	
27 66	(1B) (42)	ESC B	Select Italic cursive character	Select Italic cursive character	Ignored	
27 71	(1B) (47)	ESC G	8/60" line feed	8/60" line feed	8/60" line feed	For high-res graphics
27, 73 n_1, n_2 b	(1B,49)	ESC,I n_1, n_2 b	Transfers High- res graphics data	Transfers High- res graphics data	Transfers High- res graphics data	n_1, n_2 indicate number of data
27 77	(1B) (4D)	ESC M	Select micro font	Select micro font	Ignored	17 CPI
28 n_1 n_2	(1C)	FS n_1 n_2	Repeat character (Undefined code is changed to "⧖".)	Repeat character (Undefined code is changed to "⧖".)	Repeat print data (Data is ignore if MSB= 0.)	n_1: Repeat number n_2: Char. or print data
30	(1E)	RS	Ignored	Ignored	End graphics mode	
127	(7F)		Ignored	Ignored	Ignored	
255	(FF)		Ignored	Ignored	Printing data	
Other codes in function area, 02 to 31 (02 to 1F hex.)			Prints "⧖"	Prints "⧖"	Ignored	
Codes 128 to 159 (80 to 9F.) 224 to 254 (E0 to FE.)			Prints "⧖"	Prints "⧖"	Printing data	

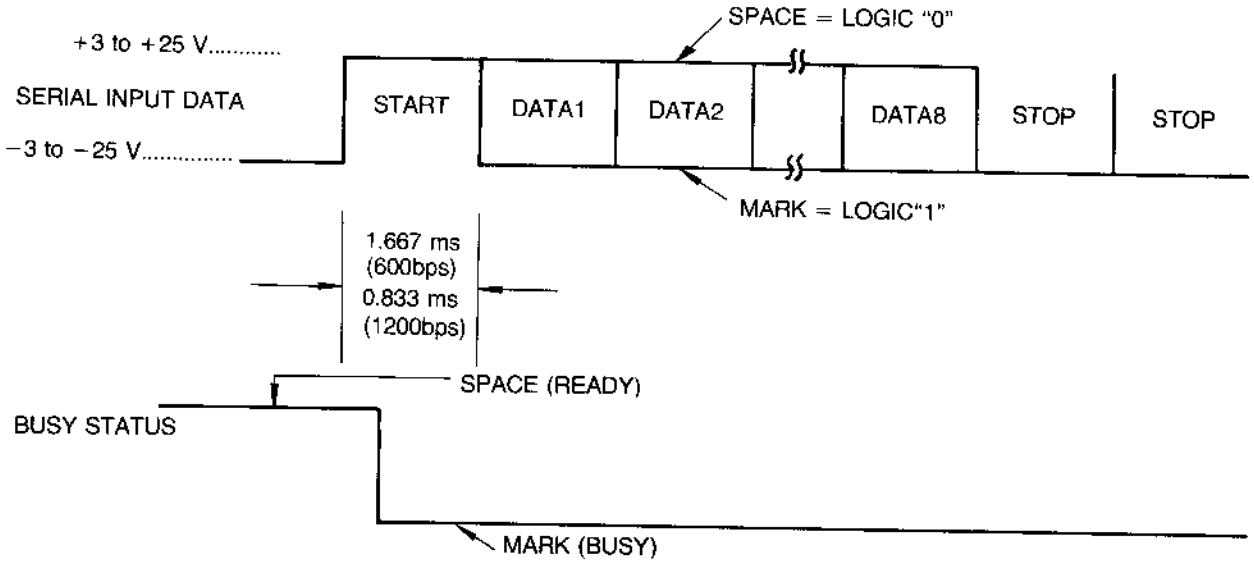
In High-resolution graphics printing, all the print data ranging from 0 to 255 are valid.

Appendix B/ Interfaces

- Pin Configuration of the Serial RS-232C DIN Jack

Pin No. 1	NOT USED
Pin No. 2	STATUS
Pin No. 3	GROUND
Pin No. 4	DATA

- Time Chart of Serial Input
  Baud rate is selectable to 600 bps or 1200 bps.



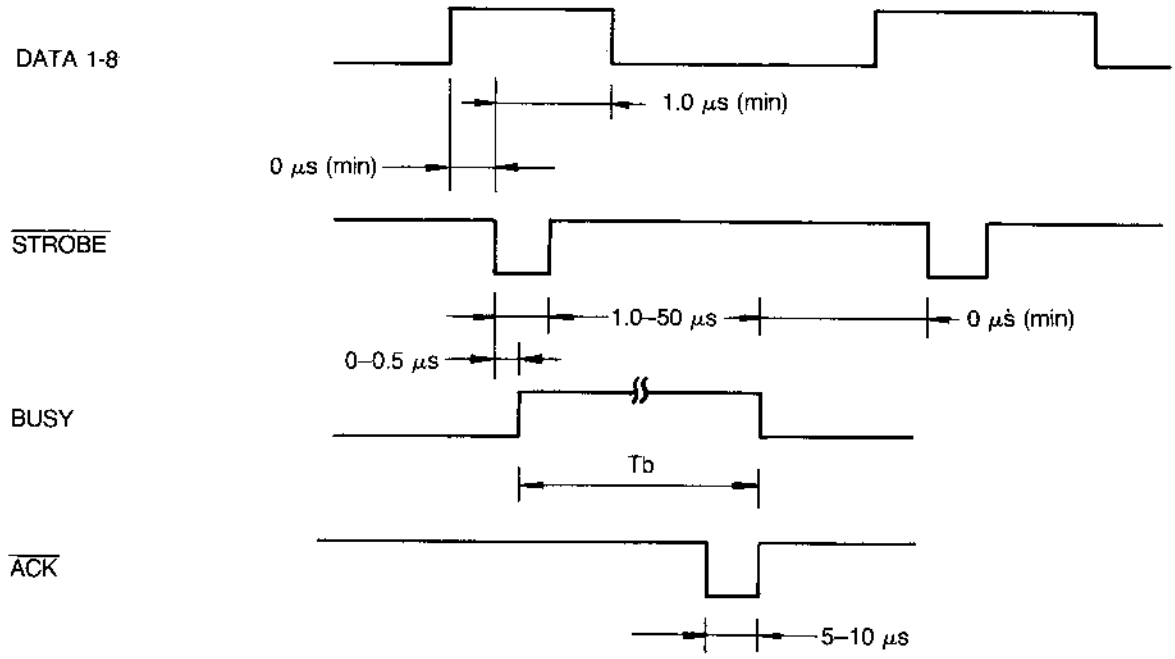
  - 8 bit data: 8-bit data, no parity, one or two stop bits

- Pin Configuration of the PARALLEL Connector

PIN	SIGNAL	PIN	SIGNAL
1	$\overline{\text{STROBE}}$	19	TWISTED PAIR GND (PAIR WITH 1 PIN)
2	DATA1	20	TWISTED PAIR GND (PAIR WITH 2 PIN)
3	DATA2	21	TWISTED PAIR GND (PAIR WITH 3 PIN)
4	DATA3	22	TWISTED PAIR GND (PAIR WITH 4 PIN)
5	DATA4	23	TWISTED PAIR GND (PAIR WITH 5 PIN)
6	DATA5	24	TWISTED PAIR GND (PAIR WITH 6 PIN)
7	DATA6	25	TWISTED PAIR GND (PAIR WITH 7 PIN)
8	DATA7	26	TWISTED PAIR GND (PAIR WITH 8 PIN)
9	DATA8	27	TWISTED PAIR GND (PAIR WITH 9 PIN)
10	$\overline{\text{ACK}}$	28	TWISTED PAIR GND (PAIR WITH 10 PIN)
11	BUSY	29	TWISTED PAIR GND (PAIR WITH 11 PIN)
12	P.E.	30	GND
13	$\overline{\text{BUSY}}$	31	NC
14	GND	32	$\overline{\text{FAULT}}$
15	GND	33	NC
16	GND	34	NC
17	GND	35	NC
18	+ 5V 80mA Max.	36	$\overline{\text{TEST}}$

NOTES: You can conduct a SELF-TEST by terminating $\overline{\text{TEST}}$ to GND. This line is terminated by a resistor to +5 volts, thus this line can be left open.

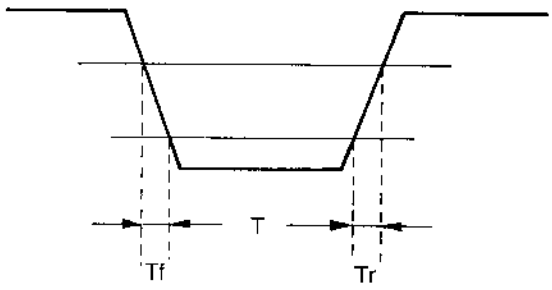
- Parallel Input Timing Chart



Tb. CHARACTER CODE .....60 μs OR MORE

- Signal Levels

All input/output signals are TTL level
"HIGH" level + 2.4~5.0V
"LOW" level + 0.0~0.4V (for the input on the printer)



Tf, Tr = 100ns or less
T is the value as shown in the timing chart.

Appendix C/ Character Codes

The DMP-110 has the following 95 character patterns in the ROM (Read Only Memory) for each character set.

ASCII Character

Code			Char.	Code			Char.	Code			Char.
Dec.	Hex	Oct.		Dec.	Hex	Oct.		Dec.	Hex	Oct.	
32	20	40	(Space)	64	40	100	@	96	60	140	'
33	21	41	!	65	41	101	A	97	61	141	a
34	22	42	"	66	42	102	B	98	62	142	b
35	23	43	#	67	43	103	C	99	63	143	c
36	24	44	$	68	44	104	D	100	64	144	d
37	25	45	%	69	45	105	E	101	65	145	e
38	26	46	&	70	46	106	F	102	66	146	f
39	27	47	'	71	47	107	G	103	67	147	g
40	28	50	(	72	48	110	H	104	68	150	h
41	29	51	)	73	49	111	I	105	69	151	i
42	2A	52	*	74	4A	112	J	106	6A	152	j
43	2B	53	+	75	4B	113	K	107	6B	153	k
44	2C	54	,	76	4C	114	L	108	6C	154	l
45	2D	55	−	77	4D	115	M	109	6D	155	m
46	2E	56	.	78	4E	116	N	110	6E	156	n
47	2F	57	/	79	4F	117	O	111	6F	157	o
48	30	60	0	80	50	120	P	112	70	160	p
49	31	61	1	81	51	121	Q	113	71	161	q
50	32	62	2	82	52	122	R	114	72	162	r
51	33	63	3	83	53	123	S	115	73	163	s
52	34	64	4	84	54	124	T	116	74	164	t
53	35	65	5	85	55	125	U	117	75	165	u
54	36	66	6	86	56	126	V	118	76	166	v
55	37	67	7	87	57	127	W	119	77	167	w
56	38	70	8	88	58	130	X	120	78	170	x
57	39	71	9	89	59	131	Y	121	79	171	y
58	3A	72	:	90	5A	132	Z	122	7A	172	z
59	3B	73	;	91	5B	133	[	123	7B	173	{
60	3C	74	<	92	5C	134	\	124	7C	174	|
61	3D	75	=	93	5D	135	]	125	7D	175	}
62	3E	76	>	94	5E	136	^	126	7E	176	~
63	3F	77	?	95	5F	137	_				

The table below shows the character codes valid only for Correspondence and Proportional character styles.

Code			Char.	Code			Char.
Dec.	Hex	Oct.		Dec.	Hex	Oct.	
160	A0	240	'	192	C0	300	â
161	A1	241	à	193	C1	301	ê
162	A2	242	Ç	194	C2	302	î
163	A3	243	£	195	C3	303	ô
164	A4	244	`	196	C4	304	û
165	A5	245	μ	197	C5	305	^
166	A6	246	°	198	C6	306	ë
167	A7	247	▼	199	C7	307	ï
168	A8	250	†	200	C8	310	á
169	A9	251	§	201	C9	311	í
170	AA	252	®	202	CA	312	ó
171	AB	253	©	203	CB	313	ú
172	AC	254	¼	204	CC	314	¡
173	AD	255	¾	205	CD	315	ñ
174	AE	256	½	206	CE	316	ã
175	AF	257	¶	207	CF	317	õ
176	B0	260	¥	208	D0	320	Æ
177	B1	261	Ä	209	D1	321	æ
178	B2	262	Ö	210	D2	322	Ä
179	B3	263	Ü	211	D3	323	ä
180	B4	264	¢	212	D4	324	Ø
181	B5	265	~	213	D5	325	ø
182	B6	266	ä	214	D6	326	Ñ
183	B7	267	ö	215	D7	327	É
184	B8	270	ü	216	D8	330	Á
185	B9	271	β	217	D9	331	Í
186	BA	272	TM	218	DA	332	Ó
187	BB	273	é	219	DB	333	Ú
188	BC	274	ù	220	DC	334	¿
189	BD	275	è	221	DD	335	Ù
190	BE	276	¨	222	DE	336	È
191	BF	277	ſ	223	DF	337	À

Appendix D/ Programming Information

The following items should be considered when you program the Computer.

1. When Printer Power is turned on.
   - 11 inch (66 lines) is set as the form length.
   - If Data Processing mode is selected, Full Forward Line Feed is set.
   - Sets normal character (not-Elongated and not-Bold)
   - Buffer memory is completely cleared.
   - Underline is not set.

2. Every character font can be intermixed with another style of character in the same line. However, the printer will insert dot spaces to ensure that the new dot position is valid for the current character size. This may cause unexpected auto-wraparound. To prevent this, intermix characters only on short lines, or don't mix character sizes on the same line.

3. Elongated (Double-width) characters and Underline are not terminated at the end of the line and printing continues until a terminating command is received.

4. You should avoid wrap-around. Wrap-around will disturb the dot count of the text in a line.

5. Backspace is performed in the same manner under any character set condition. This command indicates the number of dots to backspace.

6. In the Repeat Data command, printable characters can be repeated as many times as provided for in the count number. If any function code is received for repetition, it will be considered an invalid symbol (⧖ mark).

7. ESC POS command can be used at any dot position. Overprint will occur, if you designate so.

8. Graphics printing can be intermixed with character printing in a same line.

9. Bold character is useful for heading or title.

Programming Examples

Note to Model II Programmers:

If the Printer goes off-line during a print operation, and remains off-line for a certain period of time, Model II TRSDOS will present an error message. Application progarms should be written to trap such errors, inform the opeator of the error condition, and give the operator a chance to correct the condition and continue printing. If it is a BASIC applications program, an I/O error will occur, and the operator may type CONT (ENTER)

The BASIC statements LPRINT and LLIST output to the Line Printer. See Your Computer's Reference Manual for syntax details. If you have a Color Computer, read all LPRINT as PRINT#-2,.

Examples:

```
LLIST
```

Lists the resident program to the Printer.

```
LPRINT "THIS IS A TEST"
```

Prints the message in quotes and tells the Printer that the next printable character brings a new line.

```
LPRINT "THIS IS PART OF A  LINE ";:LPRINT "THIS IS THE REST"
```

Prints both messages on the same line (because of the semicolon).
The next printable character received starts a new line.

```
LPRINT "SMALL";CHR$(27);CHR$(14);"LARGE";CHR$(27);CHR$(15);
"SMALL AGAIN"
```

Prints both normal and elongated characters on the same line.

```
LPRINT CHR$(27);CHR$(17);"PROPORTIONAL ";CHR$(27);CHR$(18);
"CORRESPONDENCE ";CHR$(27);CHR$(20);"CONDENSED ";CHR$(27);CHR$(23);
"STANDARD ELITE ";CHR$(27);CHR$(19);"STANDARD NORMAL"
```

Prints proportional, correspondence, condensed, standard elite and standard normal characters in the same line.

```
LPRINT "X";CHR$(20);CHR$(27);CHR$(30);"2";CHR$(27);CHR$(28);"+X=Y"
```

Prints an algebraical function expression $X^2+X=Y$

```
LPRINT "H";CHR$(27);CHR$(28);"2";CHR$(27);CHR$(30);"O"
```

Prints the formula of water H_2O

```
LPRINT CHR$(15);"UNDERLINE";CHR$(14);" WITHOUT UNDERLINE"
```

Prints both messages underlined and non-underlined in the same line.

```
LPRINT CHR$(27);CHR$(31);"BOLD LETTERS ";CHR$(27);CHR$(32);
"NORMAL LETTERS"
```

Prints Bold letters and normal letters in the same line.

```
LPRINT CHR$(28);CHR$(9);"AB"
```

Prints 9 characters of "A" and one character "B"

```
LPRINT CHR$(13);CHR$(27);CHR$(16);CHR$(01);CHR$(43);"300TH
POSITION"
```

Prints above message from 300th column address.

```
LPRINT CHR$(27);CHR$(17);"ABCDEFGHIJK"
```

Prints ABCDEFGHIJK by using proportional spacing.

```
LPRINT CHR$(18);CHR$(255);CHR$(247);CHR$(227);CHR$(193);
CHR$(227);CHR$(247);CHR$(255);CHR$(30)
```

Prints a special symbol in Graphic mode.

```
LPRINT "DELETE";CHR$(08);CHR$(72);"//////"
```

Prints the message DELETE, then it is deleted by diagonal lines.

Appendix E/ Care and Maintenance

Caution

- Wait at least two seconds to turn on the power after it is turned off, otherwise the Printer will not be initialized properly.
- Never place the Printer where it is exposed to direct sunlight.
- Never turn the power on or off while you are plugging in or unplugging a Computer connector.
- Never turn off the power while the Printer is in motion.
- Never try to move the print head manually when ribbon is installed.
- Do not stop the print head motion while it is printing.
- Do not print without paper and/or ribbon because the print head or the platen might be damaged.
- Be sure the paper is not dragging as it feeds into the tractor mechanism. You may need to put the paper supply close to the Printer level, not on the floor.
- In graphic mode, the continuous printing of too high dot density patterns may affect the longevity of the print head. We recommend that you avoid printing all black patterns continuously.

Maintenance

The DMP-110 requires very little maintenance. Simply treat it with the same care you would give to any electro-mechanical device – avoid physical shocks, keep it dry, etc.

If You Have Problems

We hope you don't ... but just in case ... see if you can solve them by using the table below. If you can't, then try to determine which component in your system is at fault, and bring it into your local Radio Shack store for repair. We'll have it back to you as soon as we can.

Problems	Probable Causes/Solutions
Printer won't print. Power Indicator 'OFF'.	1) Print power is 'OFF'. Check the connection and the power switch. 2) Fuse may be blown. Replace only with a fuse of the same rating.
Printer won't print. Power Indicator 'ON'.	1) Improper connection. Check the wiring of input data to the Printer. 2) Wrong Input selected. Check the Input select switch. 3) Improper ribbon setting. Reset the ribbon.
Many errors are occurring In the Serial Interfadce Mode	Improper connection; bad electrical ground. Check the wiring to your DIN plug and ensure that the Printer is grounded at the power source.
Printer okay, but the paper won't advance.	Paper is jammed. Remove and reload the paper.
Printed characters are too light or smudging.	1) Improper stroke. Adjust the lever's position. 2) Wrong ribbon setting. Reset the ribbon. 3) Old or worn-out ribbon. Replace the ribbon.

Appendix F/ Specifications

MEASUREMENTS	W×H×D (mm) 420×118×316
• WEIGHT	12.1 lbs (5.5kg)
• PAPER FEED TYPE	Pin-feed and friction-feed
• LINE PITCH	1/6″, 1/8″, 7/60″, 1/12″, 2/15″ or 1/120″
• TYPES OF PAPER	Regular paper, up to 10″ wide
• PAPER FEED SPEED	10 lines/sec when continuously feeding by 1/6 inch unit
• PRINT METHOD	Impact dot-matrix (unique 2-hammer method)
• PRINT DIRECTION	Uni-directional (left to right)
• CHARACTER SIZE	1.9×2.8 mm (W×H)
• DOT PITCH	1/120″×1/120″ (H×V)
• GRAPHICS	Max. 960 columns; dot addressable 7 vertical dots per column mixed printing with characters is possible
• MINIMUM LINE FEED	1/120″
• INK RIBBON	Special cassette type cartridge built-in ink ribbon designed for this printer
• INK COLOR	Black
• POWER REQUIREMENTS	120±15 VAC, 60Hz for USA and Canada, 220/240 VAC, 50Hz for Europe and Australia
• POWER CONSUMPTION	30 watts (printing characters) 11 watts (standby)
• TEMPERATURE	OPERATION 32°F to 109°F (0°C to 43°C) STORAGE −40°F to 160°F (−40°C to 71°C)
• HUMIDITY	20% to 80% (non-condensing)

Appendix G/ Schematic Diagrams