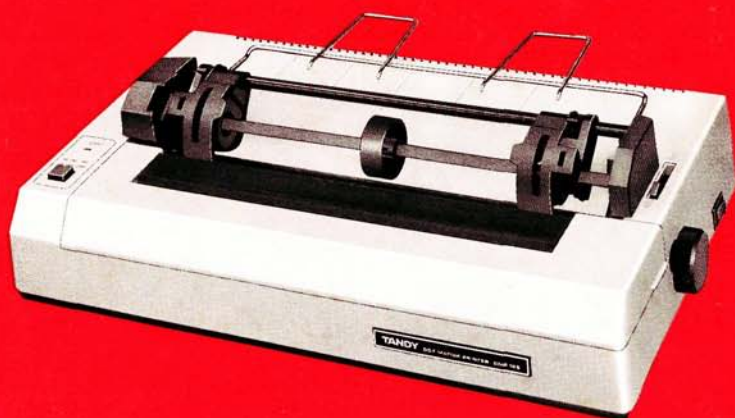


TANDY®

Dot Matrix Printer DMP 106

OPERATION MANUAL

CAT. NO. 26-2802



For your own protection, we urge you to record the serial number of this unit in the space provided. You will find the serial number on the back panel of the unit.

Serial Number _____

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It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna
- Relocate the computer with respect to the receiver
- Move the computer away from the receiver
- Plug the computer into a different outlet so that computer and receiver are on different branch circuits.

Warning

This equipment has been certified to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of FCC Rules. Only peripherals (computer input/output devices, terminals, printers, etc.) certified to comply with the Class B limits may be attached to this computer. Operation with non-certified peripherals is likely to result in interference to radio and TV reception.

2/86

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Introduction

Tandy is proud to introduce the newest addition to its line — the DMP 106. It is a very portable dot-matrix printer which can perform a variety of different printing operations. For instance, it can print:

- Standard characters — Normal, Condensed and Compressed.
- Graphics characters.

The DMP 106 operates in two modes:

- Character Printing Mode for output of program listings, report writing, or the creation of any text documentation.
- Graphics Mode for drawing pictures, figures, or graphs.

In the Character Printing Mode, the DMP 106 prints monospaced, 9×7 dot-matrix characters.

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 106:

- Standard (4"—9.5" wide) computer fanfold forms with guide holes. The Printer can also print one original plus one carbon copy.
- Standard (4"—9.5" wide) single-sheet typewriter paper.

Other software-controlled features include:

- Bidirectional minimum-distance access carriage motion.
- Full, half, and 3/4 Forward Line Feed.
- Underline capability.

and much more!

Description of the DMP 106 1

Unpacking

Carefully unpack the DMP 106, being sure to locate the Ribbon Cassette and the Paper Separator. Keep the empty box and packing materials just in case you ever need to transport the Printer.

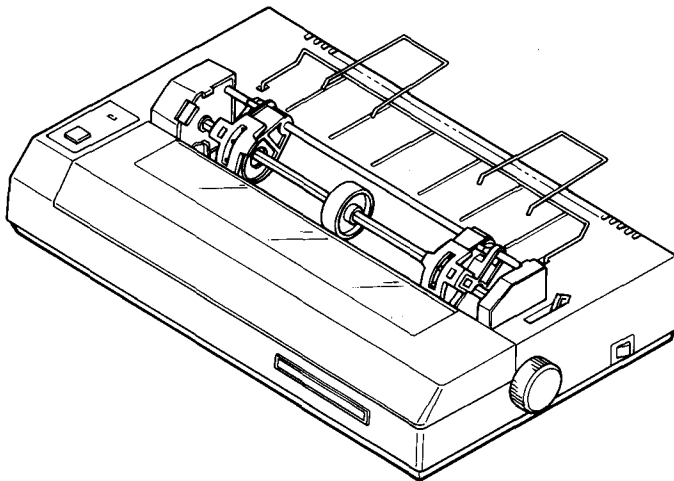


Figure 1. DMP 106 Dot Matrix Printer

Description of the DMP 106

Be sure to remove the Yellow Band from the Carriage. (Refer to Figure 2.)

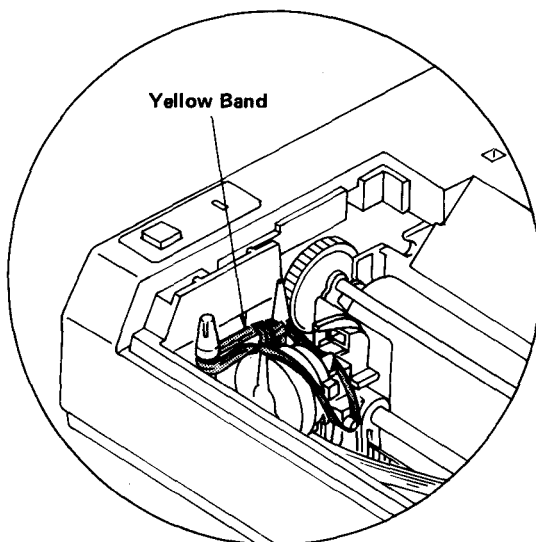
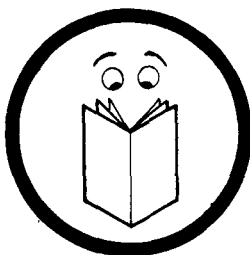


Figure 2. Removing the Yellow Band

Read this manual carefully. The more familiar you become with the DMP 106, the more value you will get from the Printer.



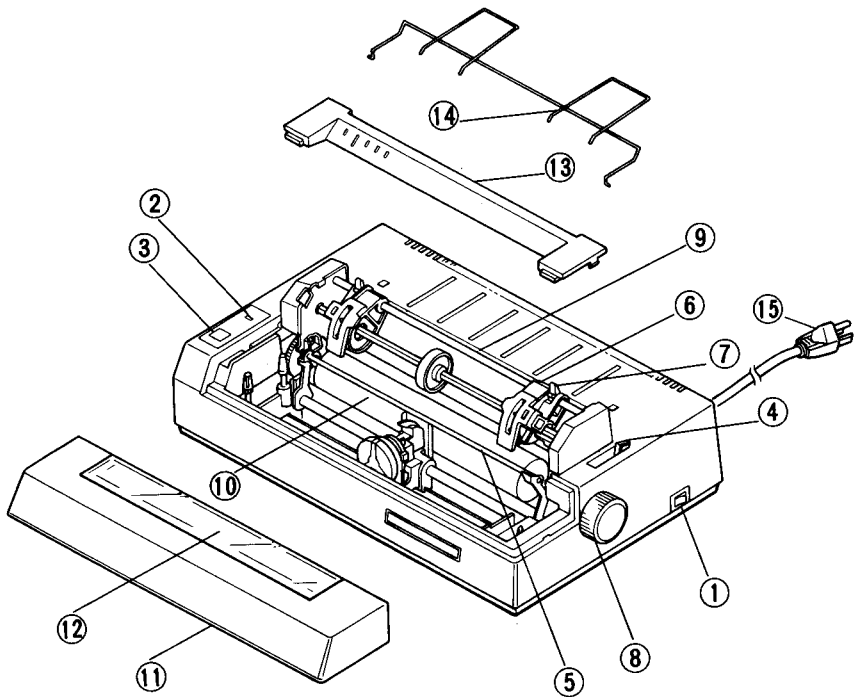


Figure 3. DMP 106 (Top View)

- ① **Power ON/OFF Switch.** Press the side of the switch marked “|” to turn the power ON. Press the switch the other way to turn the power OFF. **Note:** Turning the power OFF and ON during operation may cause loss of the current data.

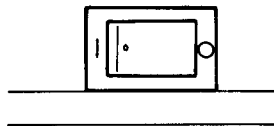


Figure 4. Power Switch

Description of the DMP 106

- ② **POWER ON Indicator.** Illuminates when the DMP 106 is properly connected with the Power ON/OFF Switch **ON**.
- ③ **ON-LINE/OFF-LINE Switch.** When pressed in, the Printer is ready to communicate with the computer. When pressed again and released, the Printer stops the communication.
- ④ **Platen Pressure Lever.** This lever has two positions. One is **Release**, for the tractor feed feature (toward the front of the Printer); the other is **Friction**, for the friction feed feature (toward the rear side of the Printer).
- ⑤ **Paper Bail.** For optimum print quality, keep the Bail down on the paper.
- ⑥ **Tractor Feed.** This Tractor Feed is removable. See **Setting Up the DMP 106** for details on using the Tractor Feed. You can remove the Tractor when printing on single-sheet paper.
- ⑦ **Tractor Cam.** When the Cam is moved toward the rear side of the Printer, the Tractor can slide from side to side, and when moved toward the front, it is locked into position.
- ⑧ **Paper Feed Knob.** Turn clockwise to manually advance the paper.
- ⑨ **Paper Insertion Opening.** Insert the paper here.
- ⑩ **Platen.**
- ⑪ **Top Cover.**
- ⑫ **Transparent Cover.** Should be opened while handling the Paper Bail.
- ⑬ **Hole Cover.** Put this Cover in place when the Tractor is removed.
- ⑭ **Paper Separator.**
- ⑮ **AC Power Cord.**

Model II users: If a BASIC program stops execution because of a Printer error, typing: `CONT` ENTER will cause printing to resume. However the entire contents of the print buffer will be printed, starting with the current Print Head position.

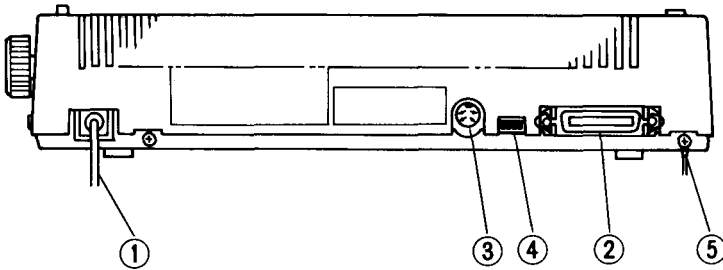


Figure 5. DMP 106 (Rear View)

- ① **Power Cord.** Plug the power cord into a wall outlet or approved power strip.
- ② **Parallel Interface Connector.** If your computer has parallel interface capabilities, connect the cable here. See **Setting Up the DMP 106** for the right cable for your computer.
- ③ **Serial Interface Connector.** If you have a computer with serial printer interface capabilities, connect the cable to the serial interface connector indicated. See **Setting Up the DMP 106** for the right cable for your Color Computer or Data Terminal.

Note: Serial interface is not supported in IBM emulation mode.

- ④ **Print Function (DIP) Switches.** The settings of these switches will determine exactly how your Printer prints in various situations. See **Setting Print Function (DIP) switches.**
- ⑤ **Ground Screw.** Connect the ground wire from the shielded printer cable here.

Setting Up the DMP 106 2

The following Start-Up Checklist is a summary of how to set up your Printer. You should follow this procedure every time you start-up the Printer — **NOT JUST THE FIRST TIME.**

- ☒ Find a good spot for your Printer. Be sure to consider:
 - Work surface. Place the Printer on a sturdy desk, table, or printer stand.
 - Length of the printer cable. This determines the maximum distance allowed between your computer and printer.
 - Paper takes up space. Be sure to leave enough room for smooth paper flow.
 - Noise factors. Situate the Printer as far as possible from noise generators such as refrigerators and industrial equipment.
- ☒ Be sure the Power Switch is **OFF**.

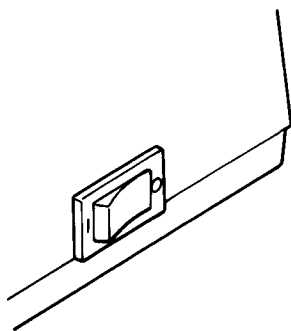


Figure 6. Power Switch (OFF Position)

- ☒ Remove the packing materials, including the Yellow Band.
- ☒ Install continuous form fanfold paper or single-sheet paper.
- ☒ Check the Ribbon Cassette. If it has not been installed, see **Ribbon Installation/Replacement**.
- ☒ Set the Print Function (DIP) Switches (on the rear side of the Printer).
- ☒ Connect the AC power plug to a 3-wire, 120 volt, 60 Hz grounded AC outlet (220/240 V, 50 Hz where the unit is so marked).

- ☒ Check to see if the Printer is ready by running the Self-Test.
- ☒ Connect the interface cable from the computer to the printer interface connector.
- ☒ Turn the Power **ON** and check that the Power **ON** Indicator (on the Control Panel) is illuminated.
- ☒ Place the ON-LINE/OFF-LINE Switch in the **ON-LINE** position.
- ☒ Be sure that the Top Cover is closed securely.

Paper Separator Installation

Install the Paper Separator by inserting the tips of the Separator into holes provided on the top of the Printer (behind the Paper Insertion Opening).

Tractor Installation and Removal

This Printer can be used with either the Tractor Feed system or the Friction Feed system. The difference is that the Tractor Feed system is used with paper which has guide holes on both edges, while the paper used with the Friction Feed system does not have these holes.

The Friction Feed system may be used with the Tractor installed; however, better operation can be achieved if it is removed — especially when using single sheets of paper.

Installing the Tractor

1. Set the Power ON/OFF Switch to **OFF**.
2. Open the Top Cover and remove the Hole Cover.
3. Move the Paper Bail forward (toward the front of the Printer)
4. Place the pins in the Tractor onto the cutouts, as shown. Then push down on the Tractor until it is securely locked into position.
5. Move the Paper Bail back against the platen.
6. Close the Top Cover.

Removing the Tractor

1. Set the Power ON/OFF Switch to **OFF**.
2. Open the Top Cover.
3. Move the Paper Bail forward (toward the front of the Printer).
4. Hold the front bar of the Tractor in your hand and pull upward; then push it away and remove the Tractor.
5. Move the Paper Bail back against the platen.
6. Replace the Hole Cover.
7. Close the Top Cover.

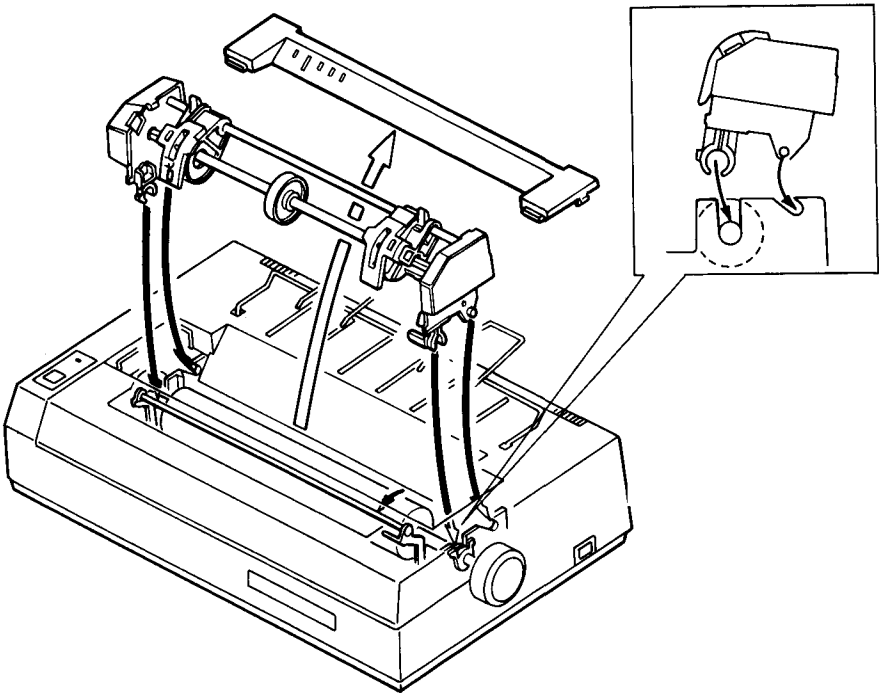
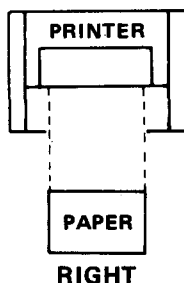
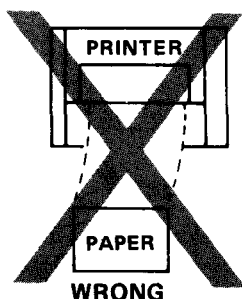


Figure 7. Installing the Tractor

Paper Loading

Warning! When loading paper (single-sheet or fanfold), be sure the paper correctly enters the Paper Insertion Opening.

It is very important that the paper enters the DMP 106 straight. The paper must be directly behind the Printer or paper skewing or jamming may occur. Proper positioning of the Paper Separator is also important to help prevent paper jamming.



If the fanfold paper is correctly loaded, it should **enter between the body of the Printer and the Paper Separator**. Once the paper is loaded and power is **ON**, press to set the **ON-LINE/OFF-LINE** Switch to **ON-LINE**. Then you may begin printing.

Single-Sheet paper Loading

1. Be sure the Power Switch is **OFF**.
2. Remove the Tractor and replace the Hole Cover. (See **Tractor Installation and Removal**.)
3. Move the Platen Pressure Lever forward (toward the front of the Printer).
4. Open the Transparent Cover and tilt the Paper Bail forward.
5. Insert the paper into the Paper Insertion Opening and push the Platen Pressure Lever back toward the rear side of the Printer. Use the Paper Feed Knob to pull the paper around until it appears between the Platen and the Print Head.
6. Move the Platen Pressure Lever forward to align the paper. Push the Platen Pressure Lever back again.

7. Tilt the Paper Bail back toward the rear side of the Printer.
8. Close the Transparent Cover.

Warning! The gap between the Print Head and the Platen is mechanically adjusted properly at the factory. Do not try to adjust it. If it looks like it is out of position, contact your local Radio Shack Computer Service Center.

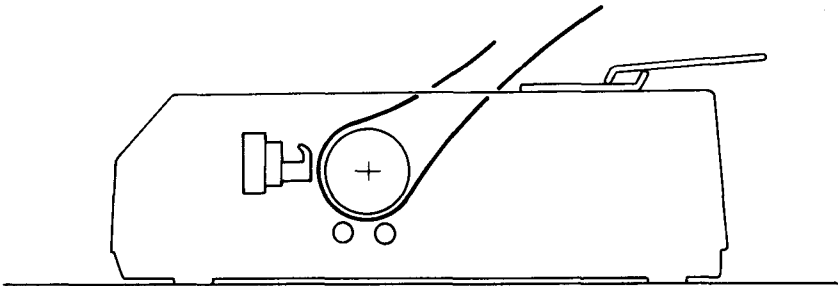


Figure 8. Single-Sheet Paper Loading

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**. First, press to release the ON-LINE/OFF-LINE Switch to **OFF-LINE**. Next, insert another piece of paper and turn the Paper Feed Knob to advance the paper. When the paper is in place, press the ON-LINE/OFF-LINE Switch again and the DMP 106 will continue printing from where it left off, without loss of data in the print buffer.
- Remember to set the Platen Pressure Lever and the Paper Bail toward the rear side of the Printer while using single-sheet paper.
- When you want to print a few more lines after the paper has passed the Paper Empty Sensor, press the ON-LINE/OFF-LINE Switch once to set it to **OFF-LINE**; then press it again to set it to **ON-LINE**. This will print one more line. Just follow this procedure once for each additional line you wish to print.

Fanfold Paper Loading

The DMP 106 will accept standard fanfold paper that is from 4" to 9.5" wide. The paper may contain one original plus one copy.

Before using fanfold paper, however, the Tractor should be installed.

To load fanfold paper into the DMP 106 :

1. Set the Power ON/OFF Switch to **OFF**.
2. Open the Transparent Cover.
3. Gently move the Platen Pressure Lever and the Paper Bail toward the front of the Printer.
4. Open the Pin Feed Clamps.
5. Pass the paper between the body of the Printer and the Paper Separator. Insert the paper into the Paper Insertion Opening and push the Platen Pressure Lever back toward the rear side of the Printer. Use the Paper Feed Knob to pull the paper around until it appears between the Platen and the Print Head. Be sure the paper is straight so that the holes will line up with the pin feed sprockets. Move the Platen Pressure Lever forward to align the paper; since pin feed paper is being used, leave the Platen Pressure Lever in the forward position.

Note: If re-positioning of the Tractors is necessary, move the Tractor Cams toward the rear side of the Printer so that the Tractors can slide from side to side; after adjustment, pull the Cams forward to lock the Tractors into position.

6. Close the Pin Feed Clamps to secure the paper.
7. Move the Paper Bail toward the paper.
8. Close the Transparent Cover.

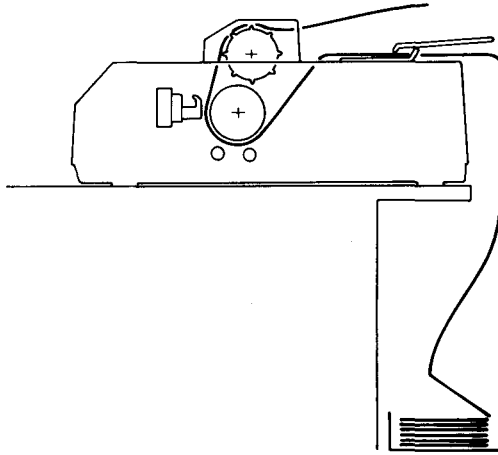


Figure 9. Fanfold Paper Loading

Warning! The gap between the Print Head and the Platen is mechanically adjusted properly at the factory. Don't try to adjust it. If it looks like it is out of position, contact your local Radio Shack Computer Service Center.

Hints and Tips on Fanfold Paper Loading...

- Remember to set the Platen Pressure Lever toward the front of the Printer and the Paper Bail toward the rear side of the Printer while using fanfold paper.

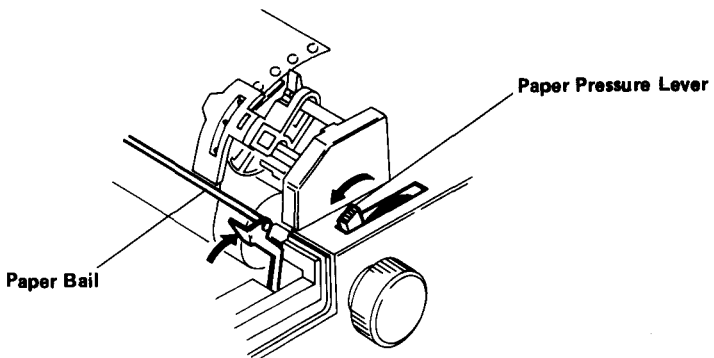


Figure 10. Platen Pressure Lever and Paper Bail Position

- Be sure that the paper is positioned so that it can travel through the Printer without binding.
- **Do not let paper pile up** on top of unprinted paper or printed paper may be pulled back into the Paper Insertion Opening. This could jam the paper feed or damage the Printer.

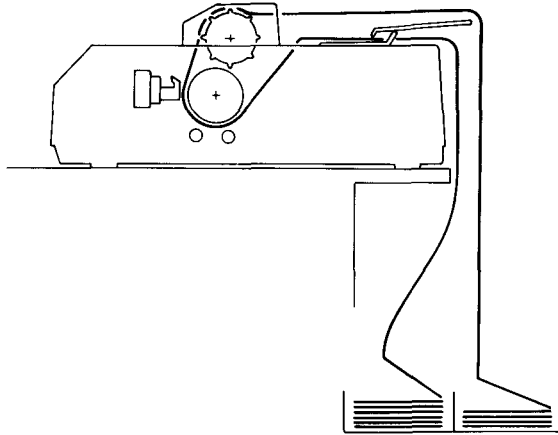


Figure 11. Paper Insertion

Ribbon Installation/Replacement

If the Ribbon Cassette 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 the Power Switch to **OFF**.
NOTE: When you turn the power **OFF**, any information stored in the Printer's buffer will automatically be lost.
2. Open the Top Cover.
3. Gently grasp the Ribbon Cassette and remove the Cassette by lifting it upward.

Note: Every time you replace the ribbon cassette, clean the two ribbon guide posts (located at the left end of the carriage shaft) with a soft dry cloth.

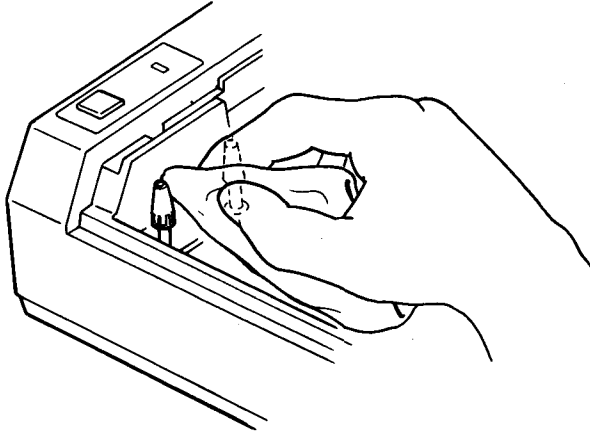


Figure 12. Cleaning the Ribbon Guide Posts

4. Unwrap the new Cassette and remove the packing foam.
5. Gently move the Print Head to the extreme right.

CAUTION: Be sure Printer power is **OFF** before manually moving the Print Head.

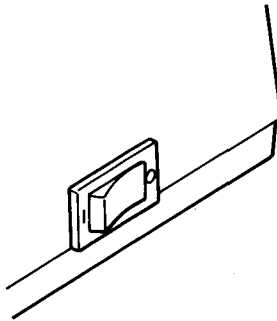


Figure 13. Power Switch (OFF Position)

Setting Up the DMP 106

6. Hold the new Ribbon Cassette and pass the ribbon end around the Ribbon Guide Posts near the left edge of the Printer; then move the Cassette toward the right to draw out the ribbon.
7. Gently press the Cassette down until it is firmly secured by the **Stopper Claw** of the Cassette Holder.
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 Cassette Holder. Do not force the Cassette down, but fit it in gradually while pushing and turning the Cassette Knob in the indicated direction. (See Figure 15.)
8. Once the new Cassette is installed, move the carriage back and forth manually. The ribbon will be gradually inserted between the Ribbon Guide and Print Head.

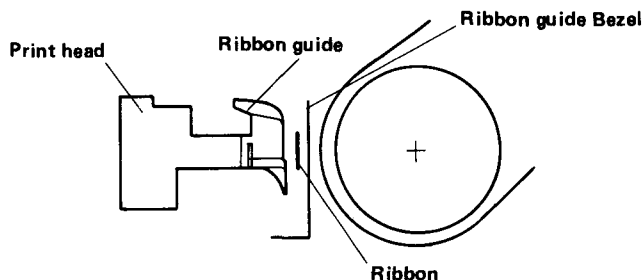


Figure 14. Ribbon Position

9. Keep moving the Carriage and check that the ribbon advances properly. If the ribbon has not been properly fitted between the Ribbon Guide and Print Head (i.e., into the Print Head Ribbon Guide Bezel), the ribbon feed will not operate smoothly.
10. Close the Top Cover.

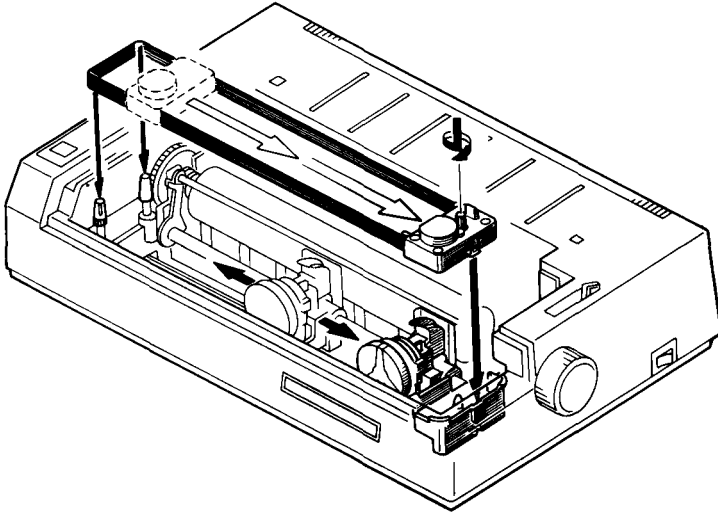


Figure 15. Ribbon Cassette Installation

Setting Print Function (DIP) Switches

There are four switches located on the left rear side of the Printer. These switches allow you to customize some of the DMP 106 features for your own applications.

When you set switch 1 to OFF before turning the DMP 106's power ON, the DMP 106 selects Tandy codes. In this setting, the switches function as shown in Table 1. On the other hand, if you set switch 1 to ON, the DMP 106 selects codes for IBM. In this case, the switches function as shown in Table 2. For instance, in Tandy mode, you can select different baud rates and interface modes.

Remember! The Printer power must be OFF before you change any of the switches.

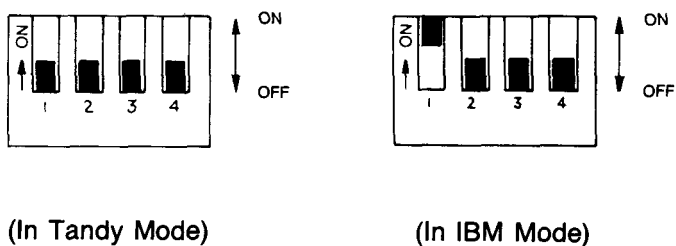


Figure 16. Print Function (DIP) Switches

**Table 1. DIP Switch Function in Tandy Mode
(Switch 1 set to OFF)**

Pos.	Symbol	ON	OFF
1	Control Codes		Tandy Codes
2	Serial/Parallel	Serial Interface	Parallel Interface
3	600/2400 BPS	600 BPS in Serial Interface	2400 BPS in Serial Interface
4	CR	Carriage Return Only (CR = CR)	Carriage Return & Line Feed (CR = NL)

**Table 2. DIP Switch Function in IBM Mode
(Switch 1 set to ON)**

Pos.	Symbol	ON	OFF
1	Control Codes	Codes for IBM	
2	LF	Line Feed Only (LF = LF)	Line Feed & Carriage Return (LF = NL)
3	Character Set	Character Set 2	Character Set 1
4	CR	Carriage Return Only (CR = CR)	Carriage Return & Line Feed (CR = NL)

Connecting the DMP 106 to a Power Source

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

- ☒ Is the Printer Power ON/OFF Switch set to **OFF**?
- ☒ Have you removed the Yellow Band from the Carriage?
- ☒ Don't connect the Printer to your Computer yet.

Connect the AC power plug to a 3-wire, 120 volt, 60 Hz grounded AC outlet (220/240 V, 50 Hz where the unit is so marked), or to an approved power strip such as the Plug-In Power Strip (Radio Shack Cat. No. 61-2619) or the Automatic Power Controller, SW-301 (26-1429).

Carriage Movement Test

The Carriage Movement Test allows you to check that the Carriage moves freely from one end of the Platen to the other and that the Platen is turning properly.

Printing is not performed during the Carriage Movement Test.

You can run the Carriage Movement Test by following these steps:

1. Set the ON-LINE/OFF-LINE Switch to **OFF-LINE** and then set the Power Switch to **ON**.
2. The Carriage first moves toward the right until it strikes the Right Switch which determines how far it must move to reach the home position at the left; then it moves left until it reaches the home position.
Press the ON-LINE/OFF-LINE Switch to set it to **ON-LINE** while the Carriage is moving toward the left. The Carriage will move back and forth, performing a Line Feed at the end of each line.
3. Turn the power **OFF** to end the Carriage Movement Test.

Self-Test

The DMP 106 has a **built-in** Self-Test feature which lets you check printing quality and general printer operation before you connect the Printer to your computer. This is a good time to check that the Print Head is set properly (printing is neither too faint nor smudged) and that paper is feeding correctly. The Self-Test will last for several minutes.

Before running the Self-Test, however, always be sure to load the DMP 106 with wide paper (9.5" wide) since the test prints from one end of the Platen to the other. **Printing on the Platen can shorten the life of the Platen and the Print Head.**

To run the Self-Test:

1. Plug the Printer into an AC power outlet.
2. Set the ON-LINE/OFF-LINE Switch to **ON-LINE**.
3. Set the Power ON/OFF Switch to **ON**.
4. Press the ON-LINE/OFF-LINE Switch to set it to **OFF-LINE** while the Carriage is moving toward the left.

The Printer will begin printing rolling ASCII 96 characters in Standard 10 CPI mode.

5. Printing will continue until you turn the power **OFF**.

Connecting the DMP 106 to a Computer

Before making any connections between the Printer and your computer, be sure all units are off!

You need the correct cable for your computer. Table 3 describes the printer cables carried by Radio Shack; Table 4 provides a quick reference for printer connection locations.

Table 3. Computer to DMP 106 Cables

COMPUTER	Cable Number
Model I (Keyboard only)	26-1411 (available through National Parts)
Model I (Exp. Interface)	26-1401
Model II/12/16/16B/DT-1/ Tandy 2000	26-4401
Model III/4/4D/4P/Tandy 1000	26-1401
Color Computer*	26-3020
Model 100/Tandy 200/600	26-1409
DT-100*	26-1361
Tandy 1200/3000	26-1347
Tandy 1000EX/1000SX	26-225
Tandy 3000HL/3000HD	26-227

Table 4. Computer Connection Points

COMPUTER	Connector
Model I (Keyboard only)	Rear side of Keyboard
Model I (Exp. Interface)	Left side of E.I.
Model II/4P/12/16/100	Rear Panel of Computer
Model III/4/DT-1/DT-100	Underneath Panel
Color Computer	Rear Panel of Computer
Tandy 200/600/1000/1000EX/ 1000SX/1200/2000/3000/ 3000HL/3000HD	Rear Panel of Computer

* When you use the Color Computer or the DT-100 data terminal, always set DIP switch 1 to the off position. Serial interface is not supported in IBM emulation mode.

Setting Up the DMP 106

1. Attach the molded male end of the cable to the connector on the left rear side of the Printer.
Do not force the plug. If it doesn't fit one way, turn it over and try again.
If you are using shielded printer cable, connect the ground wire to the ground screw shown in Figure 17.
2. Connect the other end of the cable to the Printer Jack of your Computer. See your computer owner's manual for specific instructions.

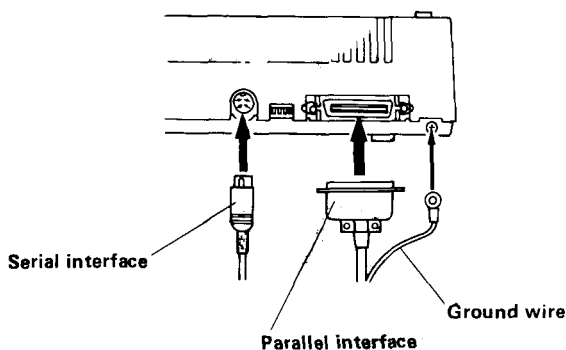


Figure 17. Connecting the Interface Cable

Power-Up Sequence

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

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

It is essential that the Printer remains **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.

Using the DMP 106 (General Printer Operation) 3

The DMP 106 is designed for two distinct applications:

- Character Printing
- Graphics Printing

The Printer responds to software codes from the computer in two different ways — one for each application. The two response patterns, or modes, have many similarities, but each has its own unique features.

The Character Printing Mode is used for printing characters. In this 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 List Feed commands stored in the memory determine the pitch of the paper feed.

The Print Pitch (character spacing) is determined by the space the DMP 106 puts between each printed character and also by the Font Style. Consequently, you must think of Pitch in terms of the number of characters printed per inch 10 CPI, 12 CPI, and 16.7 CPI for Standard printing and 5 CPI, 6 CPI, and 8.3 CPI for Elongated printing.

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 Graphic operation, many control codes (which can be used with Character Printing operation) cannot be used.

The DMP 106 doesn't return an error when you send such a code — it simply ignores the code. This includes codes that change line feed pitch. Graphics Mode uses only one Line Feed (7/72") to insure full coverage of the paper.

Control Codes

Before investigating the various print modes, consider how the computer 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 code. (See **Appendix C** for a list of ASCII codes.) Most numbers (or codes) 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, 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 X. The next few sections demonstrate how some of the Control codes activate various Printer functions. Read these sections carefully.

Sending Control Codes from BASIC

Note: Tandy codes are discussed in this section (DIP switch 1 set to OFF). For IBM codes, refer to Chapter 8, **IBM Emulation Mode**.

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 Tandy Color Computer, substitute **PRINT #2,** for **LPRINT**.

For instance, set up the DMP 106 as described earlier and enter BASIC in the normal way. Then type the following program:

```
10 REM
20 LPRINT"DATA";CHR$(27);CHR$(28);"PROCESSING"
30 LPRINT"MODE"
```

and **RUN** it.

DATAPROCESSING
MODE

Roll the paper forward and look at the results. The word **MODE** printed over part of **DATA PROCESSING**. Why? The codes `CHR$(27)` and `CHR$(28)` are the guilty parties. Take a quick look at **Appendix A**. This chart shows the various code sequences understood by the DMP 106. The Control Code sequence `CHR$(27); CHR$(28)` means **change the forward line feed to half its normal distance**.

Character Printing Mode

Line Feed commands are not executed immediately. The (27 28) sequence did not cause a Half Forward Line Feed until after the first line was printed. The set Line Feed pitch stays in effect until a new Line Feed pitch is designated.

Type: LLIST

Sure enough. You still have that short Line Feed.

Type: LPRINT CHR\$(27);CHR\$(54) to return to normal Line Feed pitch.

Graphics Mode

Graphics Mode is very different from the Character Printing Mode. For one thing, Graphics Mode accepts only one Line Feed Code — CHR\$(10). This Line Feed is fixed at 7/72". Furthermore, only a few of the Character Printing Mode features are available in the Graphics Mode. Standard letters and symbols, for example, are ignored 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 high-resolution graphic print-outs 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 I:LPRINT CHR$(30);
```

and RUN the program.



CHR\$(18) puts the DMP 106 into Graphics Mode. The numbers 128 through 255 are interpreted as dot patterns.

Type: LPRINT CHR\$(30) to return the Printer to CP Mode. Try LLISTING the program to be sure you're not stuck in Graphics land.

Selecting a Print Mode

Table 5 summarizes the Control Codes required to move from one mode to another.

Table 5. Control Codes for Changing Modes

If you're in:	and want to change to:	Send a CHR\$(); (Dec)	(Hex)
CP	Graphics	18	12
Graphics	CP	30	1E

Hints and Tips About Print Modes...

Character Printing Mode

- All commands which determine Line Feed pitch are stored in the Printer's memory. They are not executed until a LF code (10 Dec. or 138 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, or until the Printer is turned off.
- All printable characters (except user-defined Graphics) can be printed in this mode.

Graphics Mode

- Only one Line Feed Code (10 Dec.) is acceptable. The LF Code causes the paper to move 7/72" forward. No other pitch is allowed.
- Decimal numbers 128-255 sent via CHR\$ in BASIC are interpreted as pin firing patterns for the Print Head.
- Only a few code sequences are recognized in Graphics Mode.

Print Font Styles and Character Widths 4

The DMP 106 has two distinct print (character) font styles:

- Standard
- Graphic Characters

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

The character styles differ in the size of the matrix and the way individual characters are created within the matrix.

The horizontal dot positions overlap; vertical ones don't.

Table 6. Character Widths and Densities

Font Style	Matrix Size	Pitch
Standard	9 × 7	Normal 10 CPI/Elongated 5 CPI Compressed 12 CPI/Elongated 6 CPI Condensed 16.7 CPI/Elongated 8.35 CPI
Block Graphics	6 × 6	Normal 10 CPI Compressed 12 CPI Condensed 16.7 CPI

Table 6 shows that there are three basic pitches:

- Normal
- Compressed
- Condensed

When character pitch is changed (for example from Normal to Condensed), the data in the buffer is printed, some dot space is added, and then printing will continue in the current line with the new character style.

Selecting Font Styles

Character styles are selected by Control Codes from your computer during operation.

Character styles stay in effect until another style is selected. Even entering Graphics Mode does not change the font. The DMP 106 returns to the last active font on leaving the Graphics Mode.

Table 7 is a summary of the Character Style change commands:

Table 7. Character Style Change Commands

Send a CHR\$(): (Dec)		(Hex)	If You Want:
27	19	1B 13	Normal
27	23	1B 17	Compressed
27	20	1B 14	Condensed
27	14	1B 0E	Start Elongation
27	15	1B 0F	End Elongation
27	31	1B 1F	Start Bold
27	32	1B 20	End Bold

Standard Character Font Style

The Standard character set is printed in a 9×7 dot matrix (9 dots wide by 7 dots high).

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

- Normal 10 Characters Per Inch (CPI)
- Compressed 12 CPI
- Condensed 16.7 CPI

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

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

```
NEW 
110 F$="STANDARD "
120 N=19: W$="NORMAL ":GOSUB 240
130 N=23: W$="COMPRESSED ":GOSUB 240
140 N=20: W$="CONDENSED ":GOSUB 240
230 LPRINT CHR$(27);CHR$(19):STOP
240 LPRINT CHR$(27);CHR$(N);F$;"CHARACTERS ";
    W$;"DENSITY"
250 RETURN
```

and RUN it.

```
STANDARD CHARACTERS NORMAL DENSITY
STANDARD CHARACTERS COMPRESSED DENSITY
STANDARD CHARACTERS CONDENSED DENSITY
```

The subroutine in line 240 sends the required Control Codes to the DMP 106. Line 230 returns to Normal character width and stops program execution.

Graphics Characters

The second character set is a 6×6 dot-matrix character set used for Block Graphics printing. The characters can be Normal 10 CPI width, Compressed 12 CPI, or Condensed 16.7 CPI. This set is not fully compatible with the screen graphics of most computers; it is a unique character set.

A 6×6 dot-matrix character set is available in Normal 10 or 5 CPI, Compressed 12 or 6 CPI, and Condensed 16.7 or 8.3 CPI character conditions.

To see how the various character widths affect the Graphics characters, add:

```
190 N=19: W$="NORMAL ":F$="GRAPHIC ":LPRINT
200 GOSUB 240:GOSUB 260
210 N=23: W$="COMPRESSED ":GOSUB 240: GOSUB 260
220 N=20: W$="CONDENSED ":GOSUB 240: GOSUB 260
260 FOR I=224 TO 254:LPRINT CHR$(I);: NEXT I
270 LPRINT: RETURN
```

and RUN the program.

```
STANDARD CHARACTERS NORMAL DENSITY
STANDARD CHARACTERS COMPRESSED DENSITY
STANDARD CHARACTERS CONDENSED DENSITY
```

```
GRAPHIC CHARACTERS NORMAL DENSITY
```

```
  . . . . .
```

```
GRAPHIC CHARACTERS COMPRESSED DENSITY
```

```
  . . . . .
```

```
GRAPHIC CHARACTERS CONDENSED DENSITY
```

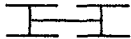
```
  . . . . .
```

Since the normal line-to-line spacing is 1/6" or 12 dots high and the Graphics characters are 6 dots high, we can create continuous vertical graphics by using the Half Forward Line Feed (CHR\$(27);CHR\$(28)). Add these lines to the program:

```
10 LPRINT CHR$(27);CHR$(28);
20 FOR R=1 TO 3
30 FOR C=1 TO 7
40 READ N: LPRINT CHR$(N);
50 NEXT C: LPRINT
60 NEXT R: LPRINT CHR$(27);CHR$(54);
70 DATA 241,243,241,224,241,243,241
80 DATA 224,244,241,241,241,249,224
90 DATA 241,248,241,224,241,248,241
```

Print Font Styles and Character Widths

and RUN it.



STANDARD CHARACTERS NORMAL DENSITY
STANDARD CHARACTERS COMPRESSED DENSITY
STANDARD CHARACTERS CONDENSED DENSITY

GRAPHIC CHARACTERS NORMAL DENSITY



GRAPHIC CHARACTERS COMPRESSED DENSITY



GRAPHIC CHARACTERS CONDENSED DENSITY



When you've printed out the results, delete lines 10 through 90.

Wrap-Around

The DMP 106 is a dot-addressable Printer. Therefore, line length is not determined by the number of characters, but by the number of dots-per-line. By counting dot columns, a combination of different font styles, including standard and elongated, can be printed on each line. The numbers of addressable dots-per-line in the Character Printing Mode is:

- Normal = 960
- Compressed = 1152
- Condensed = 1600

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 font styles can be elongated to twice their normal width.

Table 8. Elongated Printing

Send a CHR\$(): (Dec)		(Hex)	To:
27	14	1B 0E	Start Elongation
27	15	1B 0F	End Elongation

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.

STANDARD CHARACTERS NORMAL DENSITY
STANDARD CHARACTERS COMPRESSED DENSITY
STANDARD CHARACTERS CONDENSED DENSITY

GRAPHIC CHARACTERS NORMAL DENSITY
GRAPHIC CHARACTERS COMPRESSED DENSITY
GRAPHIC CHARACTERS CONDENSED DENSITY

Bold Characters

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

Table 9. Bold Printing

Send CHR\$():		To	
(Dec)	(Hex)		
27 31	1B 1F	Start Bold Printing	
27 32	1B 20	End Bold Printing	

Bold characters start when you send a CHR\$();CHR\$(31) and stop when you send a CHR\$(27);CHR\$(32).

When a (27 31) code sequence is received, the DMP 106 prints the current buffer contents; then it resumes Bold character printing from the 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
```


When a (27 83 0) or (27 83 1) code sequence is received, subsequent characters are printed in Superscript or Subscript printing mode until a (27 88) is received. When a (27 88) is received, the DMP 106 prints the current buffer contents; then it returns to the font style which prevailed before entering Super-/Subscript character printing.

The character style of Super-/Subscript printing is the same as the one used before entering Super-/Subscript mode.

Type in this program:

```
10 LPRINT CHR$(27);CHR$(83);CHR$(0);
20 LPRINT "SUPERScript";
30 LPRINT CHR$(27);CHR$(83);CHR$(1);
40 LPRINT "SUBScript";
50 LPRINT CHR$(27);CHR$(88);
60 LPRINT "CHARACTER"
70 END
```

and RUN it.

SUPERScript_{SUBScript}CHARACTER

In this program, lines 10 and 30 start Superscript and Subscript and line 50 ends the Super-/Subscript.

Selecting Character Sets

The character set can be selected by the following commands:

Table 11. Character Set Change Commands

Send CHR\$():		To:	
(Dec)	(Hex)		
27 58	1B 3A	IBM Character Set	
27 59	1B 3B	Tandy Character Set	

- When a (27 58) code sequence is received, the DMP 106 prints the current Tandy characters stored in the buffer; then it starts IBM character set 2 printing from the next character received.
- When a (27 59) code sequence is received, the DMP 106 prints the current IBM characters stored in the buffer; then it resumes Tandy character printing from the next character received.

General Control Codes 5

Line Feed Codes (LF)

When a LF (ASCII 10) code is received by the DMP 106, all data in the Printer buffer is printed followed by a Line Feed. Unless you tell it otherwise, the DMP 106 uses 1/6" Forward Line Feed when advancing paper.

Pitch settings are sent to the DMP 106 in a two-code sequence. First, a Control Code 27 is sent (CHR\$(27)). This tells the DMP 106 that a special code sequence will follow. The next number determines the specific pitch. These Control Codes are listed in Table 12.

Table 12. Line Feed Control Codes

Send CHR\$(): (Dec)		(Hex)		To:
27	28	1B	1C	1/2 Forward LF (1/12")
27	54	1B	36	Full Forward LF (1/6")
27	56	1B	38	3/4 Forward LF (1/8")

Hints and Tips on Line Feed...

- In the Character Printing Mode, codes are stored in the Printer buffer. They are not activated until a LF code is sent.
- Line Feed Pitch codes have no effect in the Graphics Mode. The Line Feed is set at 7/72" forward.

Special Line Feed Codes

There are two $n/72$ " Forward Line Feed codes that operate in different ways; one is for execution and the other is for setting.

Table 13. Special Line Feed Control Codes

Send CHR\$(): (Dec)		(Hex)		To:
27	90	1B	5A	$n/72$ " Forward Line Feed Execution
27	91	1B	5B	$n/72$ " Forward Line Feed Set

$n/72$ " Forward Line Feed Execution:

This code is effective in both CP and Graphics Modes.

General Control Codes

- When a CHR\$(27);CHR\$(90);CHR\$(n) is received by the DMP 106, all data in the Printer buffer is printed followed by the LF code. The Forward Line Feed pitch is determined by the value n between 0-255. For example, if n is set to 12, one full Line Feed will be carried out because one full Line Feed is 12/72" (1/6").

n/72" Forward Line Feed Set:

This code is similar to the above code except the timing to be executed. It is effective only in CP Mode.

- When a CHR\$(27);CHR\$(91);CHR\$(n) is received by the DMP 106, no Line Feed occurs but it is stored in the Printer buffer. The *n/72" Forward Line Feed* will be executed with the reception of the Line Feed code (LF = 10 or 138).
n is a value between 0-127.

Carriage Return (CR)

A CR (13 or 141) code tells the Printer to print the current buffer contents, and then performs either a Carriage Return followed by a Line Feed or a Carriage Return only, depending upon the following New Line Control Code setting.

Table 14. New Line Control Codes

Send CHR\$(): (Dec)		(Hex)		To:
27	21	1B	15	CR = CR Set
27	22	1B	16	CR = CR + LF(NL) Set

- When a CR (13 or 141) Code is received by the DMP 106 with a CHR\$(27);CHR\$(21) already received, only a Carriage Return is performed after printing the buffer.
- When a CR Code is received with a CHR\$(27);CHR\$(22) already received, a Carriage Return followed by a Line Feed (NL) is carried out.
- DIP switch 4 determines the mode at power on. (ON: CR only, OFF: CR with NL).

Setting Top-of-Form and Form Length

The control code CHR\$(27);CHR\$(52) is used to set the Form Length. 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 so that $n: (\times 1/6")$ is used with the Form Feed code. If n is 0 or 1, it is changed to 2. Whenever any Line Feed operation is activated, the Line Feed pitch is counted up and compared with $n (\times 1/6")$.

On initial power-up, the DMP 106 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.

Entering IBM Mode

When a CHR\$(27);CHR\$(33) code is received, the DMP 106 is reset to the defaults of the IBM mode. That is, buffer contents are printed out, the carriage returns to its home position, and all DIP switches (except switch 1) are read again.

Note: When serial interface is selected (DIP switch 2 is on), the code sequence (27 33) is ignored and the Printer stays in Tandy mode.

Ignored or Undefined Codes

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

There are several reasons why 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 Graphics Mode, sending a CHR\$(18) (used to enter Graphics Mode) is useless. And there are many ASCII control codes in the range 0 to 31 that the DMP 106 simply doesn't recognize. ASCII 0, for example, is not used in either print mode.

The following summarizes the undefined codes:

Table. 15. DMP 106 Ignored Control Codes

Both Modes:

- Out of range on repeat sequence.
 - Out of range on positioning sequence.
 - Redundant codes that don't change the current printer status.
For example, if you send a CHR\$(14) when underline is already set.
-

CP Mode: 0, 1, 127, 255

Graphics Mode:

All codes in the range 0-127 are ignored, except (10), (13), (30), (27 14), (27 15), (27 90 n), (27 16 n1 n2) and (28 n1 n2)

Codes printed as X

CP Mode only:

- All codes from 0-31 and 128-159, except the active function codes or the above ignored codes.
 - All codes between 192-223.
-

DMP 106 Buffer Operation

The DMP 106'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 (i.e., LF or CR), the buffer is emptied and all data is then 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 CP Mode, commands for changing print fonts, Line Feed, etc., can be stored in the buffer to take effect 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 106.

Hints and Tips on the DMP 106 Buffer...

For CP and Graphics Modes

- The buffer allocates a fixed number of dots, depending on the character width selected. The buffer is emptied when the data stored equals that number.
If different character widths have been used on the same line, the last character added may exceed the dot count. The buffer is printed without this last character.

- The Carriage Return (CR = 13 decimal) code automatically activates printing (assuming at least one character code is already in the buffer).
- The Line Feed (LF = 10) code automatically activates printing, and the Print Head is positioned at the start of the next print line.
- If the computer delays more than a second before sending the next print code, the buffer is printed. Printing continues from the current position.
- The Head Positioning sequence (27 16 *n1 n2*) prints the buffer. Printing continues in the current line at the dot address specified by the (27 16) command.
- When the buffer is full, the buffer is printed. Printing continues from the current position.

CP Mode only

- If a character set of different dot density is selected, the data in the buffer is printed. Codes for changing character sets are: (27 19), (27 20), and (27 23).
Printing continues in the current line with the new character style after adding some dot space.
- Dot graphics printing continues from the current character position.
- When a start Bold or end Bold is received, the buffer is printed. Bold printing continues from the current character position.
- Since the buffer capacity is small, if you frequently use the Underline and/or Elongated features, the buffer may be printed before the contents exceed the capacity for one line. Printing will continue from the current character position.
- If a CR = CR feature has been selected, reception of the Carriage Return (CR = 13) code causes the buffer contents to be printed followed by a Carriage Return, and the next full buffer will overprint on the current line. If CR = CR + LF(NL) has been selected, it will cause the buffer contents to be printed followed by a New Line (CR and LF).
Printing will resume at the start of the next print line.

Graphics Mode only

- When the **End Graphics Mode** command is received, the buffer is printed. The Printer returns to the CP Mode and printing continues in the same line from the current print position.

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

Character Printing Mode 6

Repeat Printing

The DMP 106 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, repeated block graphics, etc. The Repeat features use a three-code sequence:

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

Type in this new program:

```
10 LPRINT CHR$(30):REM To be sure in character  
   print mode  
20 FOR I=1 TO 8  
30 LPRINT CHR$(28);CHR$(I);CHR$(I+48);  
40 NEXT I
```

Now RUN the program.

```
1223334444555556666677777788888888
```

Note: Depending on the computer, the second parameter (number of repetitions) is interpreted differently. For example, CHR\$(9) may be interpreted as the TAB command, causing the print head to move to the next TAB position instead of printing characters 9 times. Refer to the owner's manual of your computer for details.

Underline Printing

If you need to underline any text in Character Printing Mode, send the DMP 106 a CHR\$(15). All text that follows this code will be underlined until you send a CHR\$(14) which stops underlining.

Underline is accomplished by two pass printing; this means the second pass creates a continuous unbroken line after the first pass prints the characters to be underlined.

If a Print Head Positioning code is received while the Printer is in an underline-selected condition, the underline is not printed between the home position (left-most printing position) and the dot column position designated by the Print Head Positioning code.

If you enter Graphics Mode while the Printer is in an underline-selected condition, when you return to the Character Printing Mode, the designation of underline is the same as it was before entering Graphics Mode.

Character Printing Mode

Table 16. Underline Printing

Send CHR\$(): (Dec) (Hex)		To:
15	0F	Start Underline
14	0E	Stop Underline

For example, type in this short program:

```
10 LPRINT CHR$(30);:REM CHARACTER PRINTING
20 LPRINT CHR$(15);:REM START UNDERLINE
30 LPRINT "LEEWAY BUSINESS PRODUCTS "
40 LPRINT CHR$(14);:REM STOP UNDERLINE
50 LPRINT "GIVES GOOD SERVICE"
```

If this example, line 20 turns on the underline and the first line of text (LEE WAY BUSINESS PRODUCTS) is underlined. Line 40 turns the underline off and GIVES GOOD SERVICE is not underlined.

Print Head Positioning

In any mode, you can position the Print Head to a specific dot position.

Every other Print Head position is accessible through the position sequence. The characters stored in ROM can use the half step positions — you can't.

Using the Normal character sets (10 CPI), there are 960 dot positions per line, but only half (480) are accessible by you. The same is true for Compressed and Condensed characters.

Table 17. DMP 106 Print Head Positioning

Character Width	Dots-per-Line	Available Columns
Normal	960	480
Compressed	1152	576
Condensed	1600	800

Elongated characters use the same dot columns, even though the characters are printed twice as wide.

Even if underline is designated, underline does not appear between the home position (the leftmost printing position) and the position designated by the Print Head Positioning code.

To position the Print Head to a specific position, send a (27 16), then two numbers (we'll call them $n1$ and $n2$) that specify the desired position. In other words, just follow this general procedure:

1. Send a Control Code which specifies the Character set (Normal, Condensed, Compressed).
2. Send a CHR\$(27);CHR\$(16) to tell the Printer you want to position the Print Head to print a specific dot column.
3. Tell the Printer 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.
4. Tell the Printer what you want to print.

When you want to specify a dot column where printing is 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 $n1$ is a value between 0-3 and $n2$ is a value between 0-255.

Table 18. Print Head Positioning

If you wish to specify dot column:	$n1$ must be:	$n2$ must be:
0-255	0	0-255
256-511	1	0-255
512-767	2	0-255
768-799	3	0-31

Remember! Normal printing allows you to access dot columns up to 479 ($n1 = 1$, $n2 = 223$); Compressed printing allows you to access dot columns up to 575 ($n1 = 2$, $n2 = 63$); Condensed printing allows you to access up to 799 ($n1 = 3$, $n2 = 31$).

Why two numbers ($n1$ and $n2$)? The maximum value you can send to the DMP 106 with one number is 255, and clearly you have more than 255 dot positions available.

Those of you who are fans of binary math will recognize that the DMP 106 is interpreting these two numbers as a single 10-bit ($b(0)$ — $b(9)$) value. The two lower bits of $n1$ are used as $b(8)$ and $b(9)$.

Character Printing Mode

Note: Use 9.5" wide paper for this next example.

See if you can print a character starting in position 480 in Normal density. $n1 = 1$ gives 256 of those dots, and $480 - 256 = 224$ is the difference to be sent as $n2$. Type:

```
10 LPRINT CHR$(27);CHR$(16);CHR$(1);CHR$(224);"*"
```

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$(1);CHR$(218);"*"
```

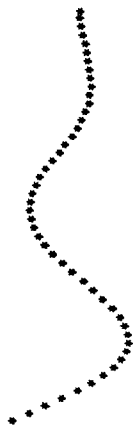
and RUN the program. That's better. It fits nicely at the end of the line. Try this program with the different character densities.

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 both 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 50  
30 LPRINT CHR$(27);CHR$(16);CHR$(1);  
   CHR$(100+I*SIN(I/5));  
40 LPRINT "*"  
50 NEXT I
```

Get out of the double-width mode and then RUN the program.



Printing Directions

In the Character Printing Mode, either bi- or unidirectional printing is selectable. At power ON, bidirectional printing is selected initially. If you need to select unidirectional printing, send a (27 85 1); and for bidirectional printing, send a (27 85 0).

Table 19. Printing Direction Control Codes

Send CHR\$(): (Dec)		(Hex)		To:
27	85	1	1B 55 1	Select Unidirectional
27	85	0	1B 55 0	Select Bidirectional

Graphics Mode 7

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 106 allows you to have direct, programmable control over all of the available graphic dots.

How many **across the paper** addressable dot columns are there? That varies, depending on the character style you're using. See Table 20.

```
10 LPRINT CHR$(27);CHR$(85);CHR$(1);
20 FOR I=1 TO 5
30 LPRINT "Unidirectional Printing"
40 NEXT I
50 LPRINT CHR$(27);CHR$(85);CHR$(0);
60 FOR N=1 TO 5
70 LPRINT "Bidirectional Printing"
80 NEXT N
```

Now RUN the program.

Table 20. DMP 106 Print Head Positioning

Character Style	Available Dot Columns
Normal	480
Compressed	576
Condensed	800

How many **up and down** (dot columns) addressable dots are there? The answer is 7.

That means you can specify any one of up to 5,600 individual dots ($7 \times 800 = 5600$).

Graphics Mode

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 Control Code which specifies the character set (Normal, Condensed, Compressed).
2. Send a CHR\$(18) to put the DMP 106 into Graphics Mode.
3. Send a CHR\$(27);CHR\$(16) to tell the Printer you want to position the Print Head to print a specific dot.
4. Tell the Printer in which dot column you wish 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.
5. 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 where printing is 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 *n1* is a value between 0-3 and *n2* is a value between 0-255.

Table 21. Graphic Dot Positioning

If you wish to specify dot column:	<i>n1</i> must be:	<i>n2</i> must be:
0-255	0	0-255
256-511	1	0-255
512-767	2	0-255
768-799	3	0-31

Remember! Normal graphic printing allows you to access dot columns up to 479 (*n1* = 1, *n2* = 223); Compressed graphic printing allows you to access dot columns up to 575 (*n1* = 2, *n2* = 63); Condensed graphic printing allows you to access up to 799 (*n1* = 3, *n2* = 31).

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.

For instance, to draw a vertical bar at dot column 144, try this program:

```
10 LPRINT CHR$(18)
20 LPRINT CHR$(27);CHR$(16);CHRA$(0);CHR$(144);
   CHR$(255)
```

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

In line 10, `CHR$(18)` puts the Printer into Graphics Mode and, in line 20, `CHR$(27);CHR$(16)` tells it to get ready to position the Print Head. (Note that `CHR$(0)` is necessary.)

Try this line to print a vertical bar at the rightmost available dot column — 799.

```
10 LPRINT CHR$(27);CHR$(20);CHR$(18);CHR$(27);
   CHR$(16);CHR$(3);CHR$(31);CHR$(255);
```

What happens is:

- `CHR$(27);CHR$(20)` puts the DMP 106 into the Condensed character set.
- `CHR$(18)` puts the Printer into Graphics Mode.
- `CHR$(27);CHR$(16)` tells the DMP 106 to get ready to position the Print Head.
- `CHR$(3)` tells the Printer that the position will be greater than 768.
- `CHR$(31)` specifies the last available dot column.

Note: If you used `CHR$(32)` in this line instead of `CHR$(31)`, the DMP 106 would **wrap-around** to the first dot column in the next line.

Printing Graphics Patterns

By now, you should be adept at positioning the Print Head. But you also need to be able to tell the DMP 106 what to print once the Head is positioned.

Remember that we said there were 7 vertical dots in each 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.

Graphics Mode

Try printing just the top dot of that last dot column (799):

```
10 LPRINT CHR$(27);CHR$(20);CHR$(18);CHR$(27);  
    CHR$(16);CHR$(3);CHR$(31);CHR$(129);
```

How does 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 22 describes the numbering system you must use with the DMP 106 when specifying an individual dot:

Table 22. DMP 106 Addressable Dot Numbering System

Dot #:	Dot:	Number You Must Use To Print the Dot:
1	.	129
2	.	130
4	.	132
8	.	136
16	.	144
32	.	160
64	.	192

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$(27);CHR$(20);CHR$(18);CHR$(27);  
    CHR$(16);CHR$(3);CHR$(31);CHR$(192);
```

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

That's actually quite simple, too.

1. Specify the Dot # (1-64, see Table 22) 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$(27);CHR$(20);CHR$(18);CHR$(27);  
    CHR$(16);CHR$(3);CHR$(31);CHR$(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$(27);CHR$(20);CHR$(18);CHR$(27);
   CHR$(16);CHR$(3);CHR$(31);CHR$(255);
   CHR$(210);CHR$(201);CHR$(201);CHR$(201);
   CHR$(255);
```

Now try the following program.

Type in NEW

```
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)
```

RUN the program. 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.

Graphics Mode

Modify the current program to demonstrate this fixed Line Feed. Add or change:

```
20 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 the program.

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 Function

CHR\$(28) will tell the DMP 106 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 the program.



Print Density

Horizontal dot density in Graphics Mode is the same as that of the character width prior to entering Graphics Mode.

If you have been using Standard font style and then enter Graphics Mode, resolution will be 480 dots per line; if you have been using Compressed characters before entering Graphics Mode, resolution will be 576 dots per line; if you have been using Condensed characters, resolution will be 800 dots per line. Add to the current sample program:

```
5 LPRINT CHR$(27);CHR$(23);" COMPRESSED  
  CHARACTER WIDTH";
```

and RUN it.

Line 5 activates the Compressed character set. Graphics are then printed in Compressed character density.

Leaving Graphics Mode

CHR\$(30) is used to exit Graphics Mode. It returns the DMP 106 to the CP Mode. In addition, all the previous conditions, such as underline and character style, are restored. Change the sample program to:

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

and RUN it.

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

Mixing Modes on the Same Line

The fact that character density is unaffected as the DMP 106 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.

Graphics Mode

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   
120 DATA 999  
160 DATA 19,12,112,999  
190 DATA 40,39,16,16,8,15,999  
210 DATA 16,16,8,8,4,4,2,2,1,1,999
```

The 999's will be used to signify the end of a line. The other numbers 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 106"
```

Now RUN the program.

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:

```
120 DATA 17,33,33,34,-4,66,68,-4,4,-5,8,-5,16,  
-5,32,-5,64,999  
130 DATA 64,96,80,72,68,66,97,112,120,124,126,  
-7,127,-5,126  
180 DATA 95,79,71,67,65,32,16,8,4,2,1,0,1,2,4,  
11,87,76
```

Don't RUN it yet!

In line 120, the sequence -4,66 is used to mean four 66s: 66,66,66,66. Now modify the program to recognize the negative numbers.

Change:

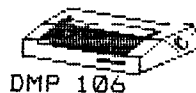
```
40 IF N>=0 THEN LPRINT CHR$(128+N);:GOTO 30
50 READ M
60 LPRINT CHR$(28);CHR$(-N);CHR$(128+M);
70 GOTO 30
```

and RUN the program.

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

```
110 DATA -7,0,-2,96,80,-2,72,-2,-2,100,-2,114,
        -2,57
140 DATA -5,124,-2,120,-3,121,-2,113,-3,114,98,
        98,-2,100
150 DATA -2,116,92,88,72,64,32,32,16,80,104,72,
        5,5,3
170 DATA 127,-4,64,3,-3,2,3,-5,7,-5,15,-5,31,
        -5,63,-6,127
200 DATA -5,0,-5,1,-5,2,-5,4,-5,8,-5,19,-5,38,
        -4,64,127,32,32
```

RUN the program.



Now that's worth the effort!

IBM Emulation Mode 8

Description of the IBM Emulation Mode

The DMP 106 has two different control code sets; one is the original Tandy control code set and the other is the IBM control code set. These two-code sets are independent of each other.

Code set selection

The IBM emulation mode is provided to use with the IBM code set. You can select it by setting DIP switch 1 to ON and then turning the power ON.

If you send a `CHR$(27);“!”`, it resets the Printer to the default of Tandy mode. (Refer to **Appendix A**.)

The IBM emulation mode does not support serial interface. If you connect your computer to a serial interface, any attempt to select IBM emulation mode will be ignored.

Character set selection

Two different character sets (not character styles) are also provided in the DMP 106; one is the Tandy character set and the other is the IBM character set (refer to **Appendix C**). Each character set is automatically selected according to the setting of DIP switch 1. Setting DIP switch 1 to OFF (Tandy mode) selects the Tandy character set, while setting it ON (IBM emulation mode) selects the IBM character set.

When an IBM character set is selected, you can designate character set 1 or character set 2 by sending the control codes `CHR$(27);“7”` with DIP switch 3 OFF (set 1) or `CHR$(27);“6”` with DIP switch 3 ON (set 2).

When `CHR(27);“7”` is received with DIP switch 3 OFF, control codes with a high bit set are interpreted to be control codes and not printable characters.

When `CHR(27);“6”` is received with DIP switch 3 ON, control codes with a high bit set are interpreted to be printable characters.

Carriage Return

The code `CHR$(13)` or `CHR$(27);CHR$(13)` prints the buffer contents and then moves the printing position to the leftmost dot position.

A line feed is executed if DIP switch 4 is set to OFF (CR with LF).

When CR is received, only a carriage return is performed if `CHR$(27);"5";CHR$(0)` is set; both carriage return and line feed are performed if `CHR$(27);"5";CHR$(1)` is set.

Vertical Formatting Control Codes

Setting the line feed pitch

The LF pitch is set to 1/6 inch unless you change it by sending the command `CHR$(27);"0"`, `CHR$(27);"1"`, `CHR$(27);"2"`, `CHR$(27);"3"` or the command `CHR$(27);"A"`.

1/8-inch line feed

The control code `CHR$(27);"0"` changes the line feed distance to 1/8 inch.

7/72-inch line feed

The control code `CHR$(27);"1"` changes the line feed distance to 7/72 inch.

Variable line feed

The control code `CHR$(27);"2"` is an execution command for the `CHR$(27);"A"` command. That is, the LF pitch designated by the `CHR$(27);"A"` command is executed after the `CHR$(27);"2"` command. If no `CHR$(27);"A"` command has been given, the line feed distance is set to 1/6 inch.

Useful Hint:

If you want to return the LF pitch to 1/6 inch when, for example, the line spacing has been set to 7/72 inch for the bit image mode, send a control code `CHR$(27);"2"` only (without a `CHR$(27);"A"` command). The LF pitch will return to 1/6 inch.

Setting the variable pitch line feed

The control code `CHR$(27);"A";CHR$(n)` defines the line feed pitch in increments of 1/72 inch. *n* is a single-byte binary number and can represent any value between one and 85. For bit image graphics, line spacing can be set to 7/72 inch by designating *n* as 7.

This command is only to define the LF pitch; you need to send a control code `CHR$(27);"2"` to change the line feed pitch.

Enter the following program:

```
10 LPRINT CHR$(27);"A";CHR$(6);
20 LPRINT CHR$(27);"2"
30 LPRINT "NORMAL SPACING LINE FEED"
40 LPRINT "HALF LINE FEED IS EXECUTED"
```

Setting the variable line feed ($n/216''$)

The control code `CHR$(27);"3";CHR$(n)` sets the line feed pitch to $n/216$ inch. n is a value between 1 and 255.

Since the Printer has a minimum line feed pitch of $1/144''$, the actual line feed pitch is in multiples of $1/144$ inch.

Variable line feed execution ($n/216''$)

The control code `CHR$(27);"J";CHR$(n)` executes a $n/216''$ line feed determined by the value of n . n is a number between 1 and 255.

Since the Printer has a minimum line feed pitch of $1/144''$, the actual line feed pitch is in multiples of $1/144$ inch.

Execution command for line feed

The code `CHR$(10)` or `CHR$(27);CHR$(10)` prints out the character and feeds the paper one line. The paper feed distance is specified by the line spacing set commands (mentioned above). This command will terminate a double-width print mode set by code 14 or code sequence (27 14).

Setting top-of-form and form length

The form length can be changed at any time if either the friction feed or bidirectional tractor feed is used. The control code `CHR$(27);"C";CHR$(n)` sets the lines per page and the control code `CHR$(27);"C";CHR$(0);CHR$(m)` sets the inches per page. n is a single-byte binary number and can represent any value between one and 127. m is also a single-byte binary number and can represent any value between one and 22. The top-of-form position is set at the current line after a form length setting command is executed. The top-of-form position can also be set at the current line by sending `CHR$(27);"4"`. The form length is set to 11 inches at power ON.

Vertical tabulation

When a control code CHR\$(11) or CHR\$(27);CHR\$(11) is issued, the Printer prints out the buffer contents and feeds the paper to a predetermined vertical TAB position set by the CHR\$(27);"C"; sequence. If no vertical TAB position is predetermined, this code functions the same as an LF code.

Form feed

When a control code CHR\$(12) or CHR(27);CHR\$(12) is issued, the Printer prints out the buffer contents and feeds the paper to the next top-of-form position.

Skip perforation

The skip perforation function can be set by the CHR\$(27);"N"; CHR\$(*n*) command. *n* designates the number of lines to skip. *n* is a single-byte binary number and can represent any value between one and 127. This function is terminated by the CHR\$(27);"0" command or the form length set command.

If you want to print 60 lines per page on a sheet of 11-inch paper, RUN the following program:

```
10 LPRINT CHR$(27);"N";CHR$(60);
```

The 61st line is printed on the next top-of-form without a form feed command.

Horizontal Formatting Control Codes

Horizontal tabulation

With horizontal tabulation, you can easily align sections horizontally. The maximum 16 horizontal TAB stops can be set to any column (the left margin is column 0) by using the following control codes:

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

n indicates the horizontal column position and can represent any number between 1 and 80 for 10-pitch mode, 1 and 96 for 12-pitch mode, and 1 and 133 for Condensed mode; column positions should be designated in ascending order. When all TABs have been selected, send a null code (CHR\$(0)) to terminate the horizontal TAB designation. Once the TABs are set, send

control code `CHR$(9)` or `CHR$(27);CHR$(09)` to skip to the next right TAB position.

- When TAB stops are not set, control code `CHR$(9)` is ignored.
- During horizontal TAB setting, if TAB stops are not entered in ascending order, or if the number of TABs is more than 16, horizontal TAB setting should be terminated.
- All the previously set TABs are cleared by designating new TAB stop positions.
- Horizontal TAB stops are set at every 8th column when the Printer is powered ON.

Reset all TABs

The code `CHR$(27);“R”` restores all TAB columns to the default value of every 8th column.

Backspace

`CHR$(8)` or `CHR$(27);CHR$(8)` causes the print head to backspace the length of one character after printing the current buffer contents. If proportional spacing is selected, the length of the backspace is the same as the length of a space (ASCII 32, 20 hex).

Home head

If you send the code sequence `CHR$(27);CHR$(60)`, the print head will return to the left margin to print a line. This will occur for one line only.

Set left/right margin

Left and right margins can be set simultaneously by the `CHR$(27);“X”;CHR$(n1);CHR$(n2)` command.

n1 indicates the left margin and *n2* indicates the right margin, counting from the leftmost column.

Printing Mode Control

In IBM emulation mode, you can print elongated, condensed, bold, and emphasized characters; you can also print in super- or subscript mode, bit image mode and so on. Use these various print styles to print a title or to highlight effectively in the character printing mode.

Double-width printing

In double-width printing mode, the width of a printed character is doubled; the pitches of horizontal TABs and spaces are also doubled. Double-width printing can be executed via CHR\$(14) or CHR\$(27);CHR\$(14) or CHR\$(27);"W";CHR\$(1). When this mode is established with CHR\$(14) or CHR\$(27);CHR\$(14), it is released by CHR\$(20), CHR\$(27);CHR\$(20), CHR\$(27);"W";CHR\$(0), a carriage return or a line feed; when it is established with CHR\$(27);"W"; CHR\$(1), it is released by CHR\$(27);"W";CHR\$(0) only.

For instance, enter the following program:

```
10 LPRINT CHR$(27);CHR$(14);"TITLE"  
20 LPRINT "TEXT PRINTING"
```

Now RUN the program.

```
T I T L E  
TEXT PRINTING
```

and RUN it. **TITLE** is printed in double-width character mode, but **TEXT PRINTING** is not since a LF took place at the end of line 10. Compare these results with the results of the following program:

```
10 LPRINT CHR$(27);"W";CHR$(1);"      TITLE      "  
20 LPRINT "TEXT PRINTING"
```

Selecting 10-pitch (Pica) mode

When the code CHR\$(18), CHR\$(27);CHR\$(18) or CHR\$(27);"M" is sent to the Printer, 10-pitch will be selected.

Condensed printing

In the condensed printing mode, dot density can be condensed from 1/120 inch to 1/200 inch, and 10-pitch is changed to 16.7-pitch. Horizontal TABs and spaces are condensed, too. Condensed printing can be selected with CHR\$(15) or CHR\$(27);CHR\$(15), and released with CHR\$(18), CHR\$(27);CHR\$(18) or CHR\$(27);"M".

Note: Condensed printing is suspended in bit image or emphasized printing mode; when the Printer exits either of these modes, condensed printing is restored.

Type in the following program:

```
10 LPRINT CHR$(15);  
20 LPRINT "THIS IS COMPRESSED"
```

and RUN it. Data can be printed with up to 133 characters in a line.
THIS IS COMPRESSED

Selecting 12-pitch mode

When the code CHR(27);“:” is sent to the Printer, 12-pitch will be selected.

Proportional spacing ON/OFF

Proportional spacing OFF

When the code CHR\$(27);“P”;CHR\$(0) is received, the current buffer contents are printed out and the font is changed to a monospaced font.

Proportional spacing ON

When the code CHR\$(27);“P”;CHR\$(1) is sent to the DMP 106, the current buffer contents are printed out and the font is changed to a proportional spacing font.

Emphasized printing is executed simultaneously.

Emphasized printing

In the emphasized printing mode, each character is printed once on the normal printing line, and again with a small shift vertically. This emphasized printing mode is established by the control code, CHR\$(27);“E”, and cancelled by CHR(27).“F”. The printing speed is reduced to half in this mode.

Enter the following program:

```
10 LPRINT CHR$(27);"E";  
20 LPRINT "Emphasized ";  
30 LPRINT CHR$(27);"F";  
40 LPRINT "Printing"
```

and RUN the program.

Emphasized Printing

Double-strike printing

In the double-strike printing mode, characters are printed twice on the same position through two-pass printing; therefore, highlighted characters can be printed not only by bold printing, but also by the double-strike printing mode which only slightly intensifies the appearance of designated characters. This mode is established by `CHR$(27);"G"`, and cancelled by `CHR$(27);"H"`.

Superscript and subscript

With your DMP 106, you can print superscript and subscript characters. In superscript mode, a character is printed on the upper half of a normal character line, and in subscript mode, a character is printed on the lower half of a normal character line. The superscript printing mode is established by `CHR$(27);"S";CHR$(0)`, and the subscript printing mode is established by `CHR$(27);"S";CHR$(1)`. Both superscript and subscript can be cancelled by `CHR$(27);"T"`.

This function is useful for printing algebraic expressions.

Try the example program below:

```
10 LPRINT "Y=AX";
20 LPRINT CHR$(27);"S";CHR$(0);
30 LPRINT "3"
40 LPRINT CHR$(27);"T";
50 LPRINT "=BX";
60 LPRINT CHR$(27);"S";CHR$(0);
70 LPRINT "2";
80 LPRINT CHR$(27);"T";
90 LPRINT "+C"
```

and RUN the program.

```
Y=AX3
=Bx2+C
```

Underlining

In the underlining mode, all characters, spaces and the spaces which are moved by horizontal TABs (except bit image data and graphic symbols) will be underlined. This mode is established by `CHR$(27);"-" ;CHR$(1)`, and cancelled by `CHR$(27);"-" ;CHR$(0)`. Underlining is accomplished through two-pass printing.

Type in the following program:

```
10 LPRINT "THIS FUNCTION CAN PRINT"
20 LPRINT CHR$(27);"-" ;CHR$(1) ;"UNDERLINE" ;
   CHR$(27);"-" ;CHR$(0) ;
30 LPRINT " WITH TEXT AUTOMATICALLY"
```

and RUN it.

```
THIS FUNCTION CAN PRINT
UNDERLINE WITH TEXT AUTOMATICALLY
```

The word **UNDERLINE** is printed with an underline.

Bit image mode

There are four kinds of bit image modes in the DMP 106. One vertical line of dot image consists of 8-bit data. Each mode has its particular horizontal dot density, and its maximum number of bits on a line, as indicated below:

Mode	Number of Bits/Line
480 Bit Image	480 Bits/Line
960 Bit Image	960 Bits/Line
960 Bit Image (Normal Speed)	960 Bits/Line
1920 Bit Image	1920 Bits/Line

480 bit image mode:

In 480 bit image mode, horizontal dot (bit) density is 1/60 inch. The code sequence of this mode is as follows:

```
CHR$(27); "K"; CHR$(n1); CHR$(n2); CHR$(v1); . . .
CHR$(vK)
```

$n1$, $n2$ are the numbers of the horizontal dot positions. Each of them is a single-byte binary number; $n1$ is the lower part of the value and $n2$ is the upper part of the value. Therefore, the actual value is $n1 + 256 \times n2$. The total data number ($n1$, $n2$) should not exceed 480.

IBM Emulation Mode

v1 through vK represent the dot patterns for each vertical line and single-byte binary number. Unlike in the Tandy mode, the dot patterns are numbered from bottom to top:

128
64
32
16
8
4
2
1

Add the numbers of the dot patterns you want to print to obtain the data for v1 through vK.

960 bit image mode:

In 960 bit image mode, horizontal dot (bit) density is 1/120 inch. The code sequence of this mode is as follows:

CHR\$ (27); "L"; CHR\$ (n1); CHR\$ (n2); CHR\$ (v1); . . .
CHR\$ (vK)

The total data number (n1, n2) should not exceed 960.

960 bit image mode (normal speed)

In 960 bit image mode (normal speed), the dot density is equally 1/120 inch. The difference between these two 960 bit image modes is equivalent to the difference between boldfaced characters and normal characters. The code sequence of this mode is as follows:

CHR\$ (27); "L"; CHR\$ (n1); CHR\$ (n2); CHR\$ (v1); ...
CHR\$ (vK)

The total data number (n1, n2) should not exceed 960.

1920 bit image mode:

In 1920 bit image mode, horizontal dot (bit) density is 1/240 inch. The bits on the same vertical line are printed every third position in this mode. The code sequence of this mode is as follows:

CHR\$ (27); "Z"; CHR\$ (n1); CHR\$ (n2); CHR\$ (v1); . . .
CHR\$ (vK)

The total data number (n1, n2) should not exceed 1920.

Other Control Codes

Paper end detection

The FAULT signal to the interface, when a paper end condition is detected, can be turned ON or OFF. By combining this function with an override function, the last printable line on the paper can be printed without a device fault on the external terminal. The FAULT signal is inhibited by `CHR$(27);"8"` (ignore paper end), and is made available by `CHR$(27);"9"` (cancel ignore paper end).

Cancel

`CHR$(24)` or `CHR$(27);CHR$(24)` clears the data in the print buffer that was received prior to this command; the other control codes that were received prior to this control code remain in effect.

Unidirectional printing

Usually, the DMP 106 executes bidirectional printing, but this Printer allows you to print by using a unidirectional printing method to avoid slight vertical misalignment. By using this function, you can print a chart or a graph perfectly. This function is executed by the code sequence `CHR$(27);"U";CHR$(1)`, and cancelled by `CHR$(27);"U";CHR$(0)`. When only a small number of characters are to be printed unidirectionally, printing all the characters on a page in the unidirectional mode decreases the efficiency of the DMP 106. Use the code `CHR$(27);"<"` to print only specific characters in the unidirectional mode. This code is cancelled by `CHR$(13)`; only one line which follows this code is printed unidirectionally.

Printing characters below 20 hex

The code sequence `CHR$(27);"^^";CHR$(n)` prints the character assigned to *n* when *n* is below 20 hex. If there is no character assigned to *n*, a space (20 hex) will be printed instead.

Appendices

Control Code Summary **A**

Tandy Control Codes

Code		Character Printing Mode	Graphics Mode	Remarks
Dec.	Hex.			
00	00	Ignored	Ignored	
01	01	Ignored	Ignored	
10 or 138	0A or 8A	Executive Line Feed (Execute LF in accordance with information latched)	7/72" Line Feed (Executive) 8A hex.: Printing data	
13 or 141	0D or 8D	Carriage Return (When NL, LF pitch is latched one.)	Carriage Return (When NL, LF pitch is 7/72" per line.) 8D hex.: Printing data	NL/CR Code Selectable
14	0E	End Underline	Ignored	
15	0F	Start Underline	Ignored	
18	12	Select Graphics Mode	Ignored	
27 14	1B 0E	Start Double-width	Start Double-width	
27 15	1B 0F	End Elongation	End Elongation	
27 16 n1 n2	1B 10 n1 n2	Positioning (3 pitches are available.) (n1, n2 indicate dot position from Home position.)	Positioning (3 pitches are available.) (n1, n2 indicate dot position from Home position.)	n1, n2: Binary value ***
27 19	1B 13	Select Standard Character	Ignored	
27 20	1B 14	Select Condensed Character	Ignored	
27 21	1B 15	Set CR = CR (No motion)	Ignored	
27 22	1B 16	Set CR = LF + CR (NL) (No motion)	Ignored	

Control Code Summary

Code		Character Printing Mode	Graphics Mode	Remarks
Dec.	Hex.			
27 23	1B 17	Select Compressed Character	Ignored	
27 28	1B 1C	Set Half Forward Line Feed (No motion)	Ignored	
27 31	1B 1F	Start Bold	Ignored	
27 32	1B 20	End Bold	Ignored	
27 33	1B 21	Enters IBM Mode	Enters IBM Mode	
27 52 n	1B 34 n	Form Length Set	Ignored	
27 54	1B 36	Set Full Forward Line Feed (No motion)	Ignored	
27 56	1B 38	Set 3/4 Forward Line Feed (No motion)	Ignored	
27 58	1B 3A	Select IBM Character Set	Select IBM Character Set	
27 59	1B 3B	Select Tandy Character Set	Select Tandy Character Set	
27 83 0	1B 53 0	Select Superscript Character	Ignored	
27 83 1	1B 53 1	Select Subscript Character	Ignored	
27 85 0	1B 55 0	Select Bidirectional Printing	Ignored	
27 85 1	1B 55 1	Select Unidirectional Printing	Ignored	
27 88	1B 58	End Super-/Subscript Character	Ignored	

Appendix A

Code		Character Printing	Graphics Mode	Remarks
Dec.	Hex.	Mode		
27	1B	<i>n</i> /72" Forward	<i>n</i> /72" Forward	
90	5A	Line Feed	Line Feed	
<i>n</i>	<i>n</i>	(Executive)	(Executive)	
27	1B	Set <i>n</i> /72" Forward	Ignored	
91	5B	Line Feed		
<i>n</i>	<i>n</i>	(No motion)		
28	1C	Repeat Print Data	Repeat Print	
<i>n1 n2 n1 n2</i>		(Undefined Code is changed to X)	Data (IF MSB = 0, Data is ignored.)	
30	1E	Ignored	End Graphics Mode	
Other Codes in Function Area (02 to 31 dec.) (02 to 1F hex.)		Prints X	Ignored	
Other Codes in Function Area (128 to 159, 192 to 223 dec.) (80 to 9F, C0 to DF hex.)		Prints X	(Printing Data)	

Control Code Summary

IBM Control Codes

Dec.	Hex.	ASCII	Function
00	00	NULL	Terminator
08	08	BS	Backspace
09	09	HT	Horizontal Tab
10	0A	LF	Line Feed
11	0B	VT	Vertical Tab (same as LF)
12	0C	FF	Form Feed
13	0D	CR	Carriage Return
14	0E	SO	Double-Width Printing
15	0F	SI	Select Compressed Mode
18	12	DC2	Select 10-Pitch Mode
20	14	DC4	Stop Double-Width Printing
24	18	CAN	Clear Printer Buffer
27 + 08	1B + 08	ESC + BS	Backspace (same as BS)
27 + 09	1B + 09	ESC + HT	Horizontal Tab (same as HT)
27 + 10	1B + 0A	ESC + LF	Line Feed (same as LF)
27 + 11	1B + 0B	ESC + VT	Vertical Tab (same as VT)
27 + 12	1B + 0C	ESC + FF	Form Feed (same as FF)
27 + 13	1B + 0D	ESC + CR	Carriage Return (same as CR)
27 + 14	1B + 0E	ESC + SO	Double-Width Printing (same as SO)
27 + 15	1B + 0F	ESC + SI	Select Compressed Mode (same as SI)
27 + 18	1B + 12	ESC + DC2	Select 10-Pitch Mode (same as DC2)
27 + 20	1B + 14	ESC + DC4	Stop Double-Width Printing (same as DC4)
27 + 24	1B + 18	ESC + CAN	Clear Printer Buffer (same as CAN)
27 + 33	1B + 21	ESC + !	Return to Tandy Mode
27 + 45 + 0	1B + 2D + 00	ESC + - + NULL	Cancel Underline
27 + 45 + 1	1B + 2D + 01	ESC + - + SOH	Set Underline

Dec.	Hex.	ASCII	Function
27 + 48	1B + 30	ESC + 0	1/8" Line Feed Set
27 + 49	1B + 31	ESC + 1	7/72" Line Feed Set
27 + 50	1B + 32	ESC + 2	ESC A Execution
27 + 51 + n	1B + 33 + n	ESC + 3 + n	Variable Line Feed
27 + 52	1B + 34	ESC + 4	Set Top of Form
27 + 53 + 00	1B + 35 + 00	ESC + 5 + NULL	CR Only
27 + 53 + 01	1B + 35 + 01	ESC + 5 + SOH	CR = NL (CR + LF)
27 + 54	1B + 36	ESC + 6	Select Character Set 2
27 + 55	1B + 37	ESC + 7	Select Character Set 1
27 + 56	1B + 38	ESC + 8	Ignores Paper End
27 + 57	1B + 39	ESC + 9	Cancel Ignore Paper End
27 + 58	1B + 3A	ESC + :	Select 12 Pitch
27 + 60	1B + 3C	ESC + <	Home Head
27 + 65 + n	1B + 41 + n	ESC + A + n	Set Variable Line Feed
27 + 67 + n	1B + 43 + n	ESC + C + n	Set Lines Per Page
27 + 67 + 0 + m	1B + 43 + 00 + m	ESC + C + NULL + m	Set Inches Per Page
28 + 68 + $n1$ + ... + 00	1B + 44 + $n1$ + ... + 00	ESC + D + $n1$ + ... + NULL	Set Horizontal Tab Stops
27 + 69	1B + 45	ESC + E	Set Emphasized Mode
27 + 70	1B + 46	ESC + F	Cancel Emphasized Mode
27 + 71	1B + 47	ESC + G	Set Double-Strike Mode
27 + 72	1B + 48	ESC + H	Cancel Double-Strike Mode
27 + 74 + n	1B + 4A + n	ESC + J + n	Variable Line Feed Execution
27 + 75 + $n1$ + $n2$	1B + 4B + $n1$ + $n2$	ESC + K + $n1$ + $n2$	60 DPI Bit Image Mode
27 + 76 + $n1$ + $n2$	1B + 4C + $n1$ + $n2$	ESC + L + $n1$ + $n2$	120 DPI Bit Image Mode
27 + 77	1B + 4D	ESC + M	Select 10-Pitch Mode (same as DC2)
27 + 78 + n	1B + 4E + n	ESC + n + n	Set Skip Perforation
27 + 79	1B + 4F	ESC + O	Cancel Skip Perforation

Control Code Summary

Dec.	Hex.	ASCII	Function
27 + 80 + 00	1B + 50 + 0	ESC + P + NULL	Proportional Spacing Off
27 + 80 + 01	1B + 50 + 1	ESC + P + SOH	Proportional Spacing On
27 + 82	1B + 52	ESC + R	Reset All Tabs
27 + 83 + 00	1B + 53 + 00	ESC + S + NULL	Set Superscript Mode
27 + 83 + 01	1B + 53 + 01	ESC + S + SOH	Set Subscript Mode
27 + 84	1B + 54	ESC + T	Cancel Super-/Subscript Mode
27 + 85 + 00	1B + 55 + 00	ESC + U + NULL	Cancel Unidirectional Printing
27 + 85 + 01	1B + 55 + 01	ESC + U + SOH	Set Unidirectional Printing
27 + 87 + 00	1B + 57 + 00	ESC + W + NULL	Cancel Double-Width Printing
27 + 87 + 01	1B + 57 + 01	ESC + W + SOH	Start Double-Width Printing
27 + 88 + n1 + n2	1B + 58 + n1 + n2	ESC + X + n1 + n2	Set Left/Right Margin
27 + 89 + n1 + n2	1B + 59 + n1 + n2	ESC + Y + n1 + n2	120 DPI Bit Image Mode in Normal Speed
27 + 90 + n1 + n2	1B + 5A + n1 + n2	ESC + Z + n1 + n2	240 DPI Bit Image Mode
27 + 94 + n	1B + 5E + n	ESC + ^ + n	Prints Characters Below 20 Hex.
Other codes in Function Area (01 to 1F and 7F hex.)			Ignored

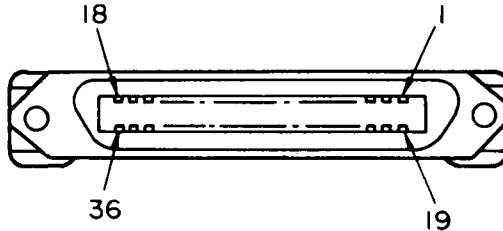
Interface **B**

Parallel Interface

Interface Connector

Type36-Pin Receptacle
Model552742-1 or equivalent
ManufacturerAMP or equivalent

Pin Assignment

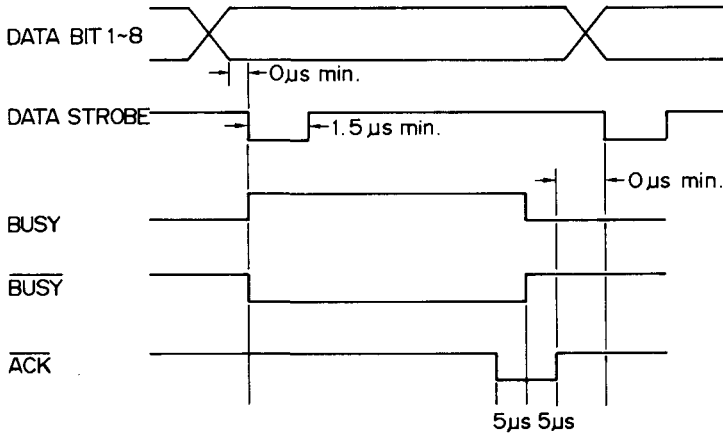


Signals

Signal Pin	Name of Signal	Signal Pin	Name of Signal
1	STROBE	19	0 V (Return for 1)
2	DATA 1	20	0 V (Return for 2)
3	DATA 2	21	0 V (Return for 3)
4	DATA 3	22	0 V (Return for 4)
5	DATA 4	23	0 V (Return for 5)
6	DATA 5	24	0 V (Return for 6)
7	DATA 6	25	0 V (Return for 7)
8	DATA 7	26	0 V (Return for 8)
9	DATA 8	27	0 V (Return for 9)
10	ACK	28	0 V (Return for 10)
11	BUSY	29	0 V (Return for 11)
12	PE (Paper Out)	30	0 V
13	BUSY	31	NC (Not Connected)
14	0 V	32	FAULT (Printer Error Condition)
15	NC (Not Connected)	33	INIT
16	0 V	34	NC (Not Connected)
17	CHASSIS GROUND	35	NC (Not Connected)
18	+5 V (80 mA Maximum)	36	NC (Not Connected)

Interface

Parallel Interface Signals



Timing Diagram

DB1-DB3 — Host Generated

Data Bits DB1-DB8 contain ASCII character data information. Data bit levels are positive true logic.

ACKNOWLEDGE — Printer Generated

The ACK signal is a negative-going signal which indicates that the Printer is no longer busy.

BUSY — Printer Generated

The BUSY signal goes positive to indicate when the Printer cannot accept new data from the Host, or some Fault condition has occurred. Timing is illustrated in the Timing Diagram.

PAPER OUT (PE) — Printer Generated

The paper out signal is a positive-going pulse which indicates that the Printer is out of paper or that the Printer is not ready to receive data.

BUSY — Printer Generated

The $\overline{\text{BUSY}}$ signal is the logical inverse of BUSY.

FAULT — Printer Generated

The **FAULT** line is a negative-going signal that indicates there is a fault condition present; i.e., paper out, logic fault, off-line condition, or other mechanical fault.

STROBE — Host Generated

The **STROBE** signal is a negative-going signal which indicates, by the rising edge, that the Host sends data to the Printer.

CHASSIS GROUND

This line is connected to the chassis of the Printer.

5 V — Printer Generated

This line is connected to the Printer's logic +5 V line.

Maximum supply current is 80 mA.

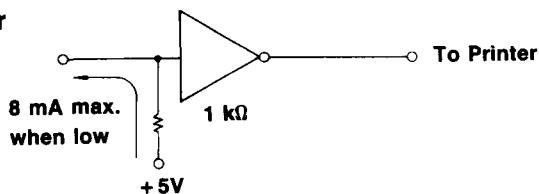
INIT — Host Generated

The **INIT** signal is a negative-going 50-microsecond pulse, which resets the printer controller to its initial state and clears the print buffer. This signal is available only in IBM mode.

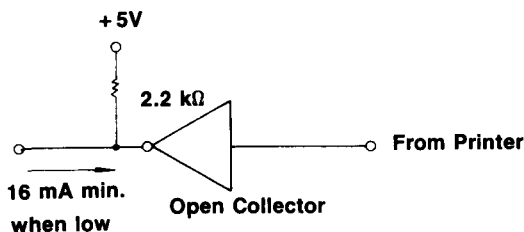
Parallel Interface Receivers and Drivers

All I/O Signals are TTL-compatible.

Receiver



Driver



Note: Printer-generated signals, **BUSY**, **FAULT**, **PE**, **BUSY**, and **ACK**, have a 2.2 kohm pull-up resistor.

Interface

Serial Interface (For Tandy mode only)

Serial Interface is selected by setting Function Selection Switch 2 to ON, and 1 to OFF.

Transmission Rate is selected from two rates (600 BPS and 2400 BPS) by Function Selection Switch 3; **OFF** designates 2400 BPS and **ON** designates 600 BPS.

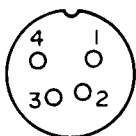
General Specifications of Serial Interface

Standard	Meet with RS-232C Serial
Baudrate	600 or 2400 BPS Serial
Parity	Non-parity
Buffer	Up to 148 characters
Data Bit	8
Start Bit	1 Space bit
Stop Bit	1 or 2 Mark bits
Signal Cable	15 m Max.

Interface Connector and Signals

Type	4-Pin DIN Jack (Receptacle)
Model	TCS 4640-01A or equivalent
Manufacturer	HOSHIDEN CO., LTD. or equivalent

Pin Assignment and Signals



Pin No.	Signal
1	NS
2	BUSY
3	GND (0 V)
4	DATA

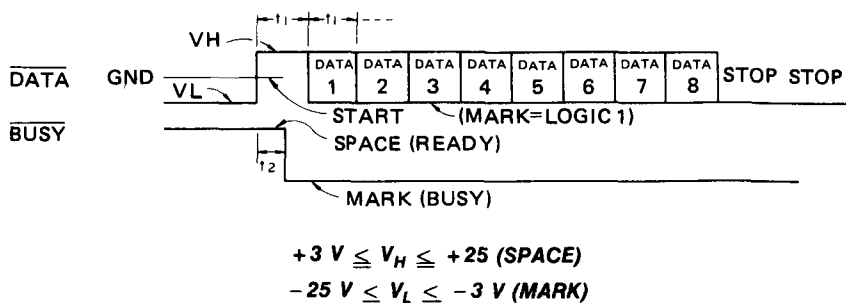
DATA — To Printer

Signals on this circuit are generated by the Computer for transmission of data to the Printer.

BUSY — From Printer

This signal indicates to the Computer whether or not the Printer can accept data. The **OFF** condition (low) indicates that the Printer is **BUSY** and cannot accept any more data.

Interface Timing and Signal Level



Baudrate	f_1	f_2
600 BPS	1.67 msec.	0.83 msec.
2400 BPS	1.417 msec.	0.208 msec.

Remarks on Serial Interfacing Conditions

- When a Framing **ERROR** is detected, the Printer will print only one X data, then stop printing until the data line goes to VL. In Graphics Mode, this X data is unprintable code, so no printing will be performed.
- The Printer checks only the first stop-bit and ignores the second stop-bit when a two-stop-bit condition exists.
- When a string of data is transmitted to the Printer in Serial Interfacing Mode, if each item of data is transmitted intermittently (every one second or more), printing will be performed every second.

Character Sets C

Tandy Character Sets

The DMP 106 has 158 dot-matrix patterns in the ROM (Read Only Memory). The following is a table of the Character Codes.

The printable characters may be classified as follows.

● Condensed or Condensed Elongated	}	ASCII.....	95
● Compressed or Compressed Elongated		European Symbol.....	32
● Standard or Standard Elongated		Block Graphic.....	31

Character Sets

95 ASCII Code

ASCII Character Sets

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	_				

Note: The following characters descend by one dot: Small Letters g,p,q,y,j,
(Underline),;

32 European Symbol Code

Standard, Compressed or Condensed Character Set

Code			Char.	Code			Char.
Dec.	Hex.	Oct.		Dec.	Hex.	Oct.	
160	A0	240	/	176	B0	260	¥
161	A1	241	à	177	B1	261	Å
162	A2	242	ç	178	B2	262	Ö
163	A3	243	£	179	B3	263	Ü
164	A4	244	`	180	B4	264	¢
165	A5	245	μ	181	B5	265	~
166	A6	246	°	182	B6	266	ä
167	A7	247	▼	183	B7	267	ö
168	A8	250	†	184	B8	270	û
169	A9	251	§	185	B9	271	ß
170	AA	252	®	186	BA	272	T _M
171	AB	253	©	187	BB	273	é
172	AC	254	¼	188	BC	274	ù
173	AD	255	¾	189	BD	275	è
174	AE	256	½	190	BE	276	ˆ
175	AF	257	q|	191	BF	277	f

Note: 1 The optimizer function allows the following: If a spacing code is received, the Carriage moves only the shortest distance, and the action will take place without unnecessary movement. This saves printing time. When character data is sent to the Printer within a one-second interval, the Printer automatically stores it until: (1) Function codes are sent, (2) the interval is greater than one second. Printing is then executed.

2 The following characters descend by one dot.

ç, μ, §, ①

31 Block Graphic Code

Standard, Compressed or Condensed Set

Code			Char.	Code			Char.
Dec.	Hex.	Oct.		Dec.	Hex.	Oct.	
224	E0	340	(Blank)	240	F0	360	┐
225	E1	341	■	241	F1	361	—
226	E2	342	■	242	F2	362	└
227	E3	343	■	243	F3	363	┘
228	E4	344	■	244	F4	364	┌
229	E5	345	■	245	F5	365	└
230	E6	346	■	246	F6	366	┐
231	E7	347	■	247	F7	367	┘
232	E8	350	■	248	F8	370	┌
233	E9	351	■	249	F9	371	└
234	EA	352	■	250	FA	372	+
235	EB	353	■	251	FB	373	▴
236	EC	354	■	252	FC	374	▴
237	ED	355	■	253	FD	375	▴
238	EE	356	■	254	FE	376	▴
239	EF	357	■				

Note: These characters are composed of six vertical dots. When using these codes to prepare diagrams, Line Feed should be set to **Half Forward Line Feed**. If another paper feed pitch is used, the diagram will not be accurate.

IBM Character Sets

Character Set 1

When in Tandy mode and an IBM character set is selected, only set 2 is applicable and character set 1 may not be printed.

0	1	2	3	4	5	6	7	8	9
NUL								BS	HT
10	11	12	13	14	15	16	17	18	19
LF	VT	FF	CR	SO	SI			DC2	
20	21	22	23	24	25	26	27	28	29
DC4				CAN			ESC		
30	31	32	33	34	35	36	37	38	39
		SP	!	"	#	\$	%	&	'
40	41	42	43	44	45	46	47	48	49
(	)	*	+	,	-	.	/	0	1
50	51	52	53	54	55	56	57	58	59
2	3	4	5	6	7	8	9	:	;
60	61	62	63	64	65	66	67	68	69
<	=	>	?	@	A	B	C	D	E
70	71	72	73	74	75	76	77	78	79
F	G	H	I	J	K	L	M	N	O
80	81	82	83	84	85	86	87	88	89
P	Q	R	S	T	U	V	W	X	Y
90	91	92	93	94	95	96	97	98	99
Z	[	\	\]	^	_	`	a	b	c
100	101	102	103	104	105	106	107	108	109
d	e	f	g	h	i	j	k	l	m
110	111	112	113	114	115	116	117	118	119
n	o	p	q	r	s	t	u	v	w
120	121	122	123	124	125	126	127	128	129
x	y	z	{	|	}	~		NUL	

Character Sets

130	131	132	133	134	135	136	137	138	139
						BS	HT	LF	VT
140	141	142	143	144	145	146	147	148	149
FF	CR	SO	SI			DC2		DC4	
150	151	152	153	154	155	156	157	158	159
		CAN			ESC				
160	161	162	163	164	165	166	167	168	169
á	í	ó	ú	ñ	Ñ	ä	ö	¿	¬
170	171	172	173	174	175	176	177	178	179
┐	1/2	1/4	i	«	»	⋮	⋮	⋮	|
180	181	182	183	184	185	186	187	188	189
┌	┌	┌	┐	┐	┌		┐	┐	┐
190	191	192	193	194	195	196	197	198	199
┐	┐	┐	┐	┐	┐	┐	┐	┐	┐
200	201	202	203	204	205	206	207	208	209
┐	┐	┐	┐	┐	┐	┐	┐	┐	┐
210	211	212	213	214	215	216	217	218	219
┐	┐	┐	┐	┐	┐	┐	┐	┐	■
220	221	222	223	224	225	226	227	228	229
■	■	■	■	α	β	Γ	π	Σ	σ
230	231	232	233	234	235	236	237	238	239
μ	τ	Φ	Θ	Ω	δ	∞	ø	ε	η
240	241	242	243	244	245	246	247	248	249
≡	±	≥	≤	∫	J	÷	≈	°	•
250	251	252	253	254	255				
-	✓	n	2	■	SP				

Character Set 2

When in Tandy mode and an IBM character set is selected, only set 2 is applicable.

0	1	2	3	4	5	6	7	8	9
NUL			♥	♦	♣	♠		BS	HT
10	11	12	13	14	15	16	17	18	19
LF	VT	FF	CR	SO	SI			DC2	
20	21	22	23	24	25	26	27	28	29
DC4	§			CAN			ESC		
30	31	32	33	34	35	36	37	38	39
		SP	!	"	#	\$	%	&	'
40	41	42	43	44	45	46	47	48	49
(	)	*	+	,	-	.	/	0	1
50	51	52	53	54	55	56	57	58	59
2	3	4	5	6	7	8	9	:	;
60	61	62	63	64	65	66	67	68	69
<	=	>	?	@	A	B	C	D	E
70	71	72	73	74	75	76	77	78	79
F	G	H	I	J	K	L	M	N	O
80	81	82	83	84	85	86	87	88	89
P	Q	R	S	T	U	V	W	X	Y
90	91	92	93	94	95	96	97	98	99
Z	[	\	\]	^	_	`	a	b	c
100	101	102	103	104	105	106	107	108	109
d	e	f	g	h	i	j	k	l	m
110	111	112	113	114	115	116	117	118	119
n	o	p	q	r	s	t	u	v	w
120	121	122	123	124	125	126	127	128	129
x	y	z	{	|	}	~		ç	ü

Character Sets

130	131	132	133	134	135	136	137	138	139
é	â	ã	ä	å	ç	ê	ë	è	ì
140	141	142	143	144	145	146	147	148	149
î	í	Ä	Å	É	æ	Æ	ô	ö	ó
150	151	152	153	154	155	156	157	158	159
û	ù	ÿ	ö	Ü	¢	£	¥	Pl	f
160	161	162	163	164	165	166	167	168	169
á	í	ó	ú	ñ	Ñ	á	ó	¿	¬
170	171	172	173	174	175	176	177	178	179
┐	1/2	1/4	ı	«	»	⋮	⋱	⋲	|
180	181	182	183	184	185	186	187	188	189
└	└	└	┐	┐	└		┐	└	└
190	191	192	193	194	195	196	197	198	199
└	┐	└	└	└	└	—	+	└	└
200	201	202	203	204	205	206	207	208	209
└	┐	└	└	└	—	+	└	└	└
210	211	212	213	214	215	216	217	218	219
└	└	└	┐	┐	+	+	└	┐	■
220	221	222	223	224	225	226	227	228	229
—	ı	ı	—	α	β	┐	π	Σ	σ
230	231	232	233	234	235	236	237	238	239
μ	τ	Φ	Θ	Ω	δ	∞	ø	ε	∩
240	241	242	243	244	245	246	247	248	249
≡	±	≥	≤	∫	∫	÷	≈	°	•
250	251	252	253	254	255				
-	✓	n	2	□	SP				

Programming Information **D**

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

1. When Printer Power is turned on:
 - Optional functions are selected according to the setting of the Function Selection Switches.
 - If CP Mode is selected, Full Forward Line Feed is set.
 - NL (CR + LF) is selected.
 - Underline is not set.
 - Standard character is set (not Elongated and not Bold).
 - Buffer memory is completely cleared.
2. Every character font can be intermixed with another style of character in the same line. However, the Printer will insert dot spaces to insure that the new dot position is valid for the current character size. This may cause unexpected automatic wrap-around. 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 such 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. In the Repeat Data commands, 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 code (X).
6. POS commands can be used at any carriage position. If a designated dot column address is in the current text which is already printed out, overprint will occur.
7. Under Block Graphic printing, Half Forward Line Feed should be used for printing diagrams.
8. Line Feed in Graphics Mode is different from Line Feed pitches in the CP Mode. An odd vertical spacing is generated in Graphics Mode. Consider the following relationship between Line Feed pitches.
 - 11 times of Full Line Feed = 18 times of Graphics Line Feed
 - 11 times of Half Line Feed = 9 times of Graphics Line Feed

9. Graphic printing can be intermixed with character printing in the same line. Dot density in Graphics Mode is the same as the density of the former character style.
10. Bold character mode is useful for headings or titles.

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 programs should be written to trap such errors, inform the operator 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 to continue.

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 `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\$(20);"CONDENSED";CHR\$(27);CHR\$(23); "COMPRESSED";CHR\$(27);CHR\$(19); "STANDARD"

Prints condensed, compressed, and standard characters in the same line.

LPRINT "START";CHR\$(27);CHR\$(56);CHR\$(138);"ONE LINE";CHR\$(138);"TWO LINE"

Prints these letters at 3/4 line pitch.

LPRINT "START";CHR\$(27);CHR\$(90);CHR\$(12);"FULL ONE LINE";CHR\$(27);CHR\$(90);CHR\$(8);"2/3 LINE"

Prints these letters at full line pitch, then at 2/3 line pitch (8/72" = 1/9").

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);"ABC"

Prints 9 characters of **A** and one character **BC**.

LPRINT CHR\$(13);CHR\$(27);CHR\$(16);CHR\$(01);CHR\$(44);"300TH POSITION"

Prints above message from 300th column address.

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

Prints a special symbol in Graphics Mode.

LPRINT CHR\$(27);CHR\$(21);"XXXX";CHR\$(13);"—";CHR\$(27);CHR\$(22);"0000"

Prints **XXXX** and then **0000** in the next line.

Care and Maintenance E

1. Always plug the Printer into a 3-wire grounded receptacle.
2. Be sure that the Top Cover is closed and secured while in operation. If it is open, the Printer is OFF-LINE and printing is impossible.
3. Never operate the Printer without paper. If paper used is less than 4" wide, take care to see that printing does not exceed paper width.
4. Avoid leaning objects against the Printer or placing anything on top. If any object is accidentally dropped into the machine, turn power off and carefully remove the object.
5. Be sure to turn power **OFF** before replacing ribbon.

Note: When you turn power **OFF**, all data stored in the Printer's buffer will be lost; keep this in mind as you perform routine maintenance. Remember that toggling the Printer's power can also cause erratic operation of the CPU.

6. Use only lint-free cloth to clean the Printer surface. Do not use solvents or harsh cleaning agents. Mild detergent solution or desk top cleanser may be used sparingly.
7. Keep hands away from the Carriage mechanism while the Printer is in operation. Since the Carriage moves with considerable force, inserting your hand would be extremely hazardous.
8. The Printer must be kept dry. If water is accidentally spilled on the machine, turn power **OFF** immediately and wipe it dry. Do not turn power **ON** until completely dry.
9. If printed material is too light or too dark, check to see if the Print Head is positioned properly. If necessary, contact your local Radio Shack Computer Center.

Care

- Do not use organic solvents or alcohol when cleaning the cover.
- Never operate the Printer when the Top Cover is open.
- Never set the Printer where it is exposed to direct sunlight.
- Prevent the Printer from vibrating during operation.
- Graphics printing places a heavier load on the Print Head than do text characters. If you print too many block graphic characters or graphics without pausing, the Print Head could overheat, causing the fuse to blow.

Care and Maintenance

When you must print graphics continuously, be sure to pause the printing for at least one minute after each 1/6th paper is printed (assuming a 9" × 11" page). This will prevent the unit from overheating. In terms of load on the Print Head, the underline falls into the graphics category, and should be treated as such.

Maintenance

- If the Print Head becomes clogged with ribbon material or paper lint, carefully remove such material with a finely pointed tool (preferably a toothpick). This should be regularly checked.
- A Print Head's life expectancy is approximately 2000 hours (in other words, if you use the Printer two hours a day on the average, the Print Head should be changed every 32 months). When poor print quality, sticking ribbon, or bent character printing occurs, you should have the Print Head checked by a Radio Shack service technician.
- After cleaning with a soft cloth, lightly oil the *carriage guide* with a high-grade ester lubricating oil or with high-grade sewing machine oil. This should be done at least every six months. Lubricate the *platen removing shaft*, the *ribbon feed revolving shaft*, and the *gear revolving shaft*, using molybdenum disulfide compound or another high-grade lubricating grease.
- Because ink from the paper can get on the Paper Bail rollers, we suggest a periodic cleaning of the rollers. Use 90% isopropyl alcohol to remove ink build-up on the rollers as often as necessary.

If You Have Problems...

If the Printer fails to operate properly, try to solve the trouble by using the following table.

SYMPTOM	INSPECTION AND ADJUSTMENT
Printer does not operate when Power switch is turned ON . Printer stops before paper runs out.	<ul style="list-style-type: none">● Is power cord properly connected?● Is power source voltage too low? Printer should stop if below 90% of rated voltage.● If you cannot hear any sound or see any movement, remove the Printer Cover and check the fuses.

SYMPTIOM	INSPECTION AND ADJUSTMENT
Printer stops.	<ul style="list-style-type: none">• Is paper loaded properly?• Is carriage guide dirty? If so, clean it by using a soft cloth and lubricate it with a high-grade ester lubricating oil or high-grade sewing machine oil.• Has some object dropped inside the Printer?• If nothing is wrong, turn power OFF, then ON.
Ribbon fails to track properly.	<ul style="list-style-type: none">• Is ribbon cassette properly set?• Has ribbon come loose from the print head ribbon guide?• Is ribbon so worn that it does not feed smoothly from the cassette?• Has the Print Head reached its life expectancy? A worn out head will stick to ribbon and interfere with smooth movement. Replace the Print Head with a new one.
Poor print quality or smudging on paper.	<ul style="list-style-type: none">• Is ribbon old and/or worn?• Is the Print Head set at the proper position?• Is the tip of the Print Head dirty? If dirty, clean it off with a toothpick or needle.• Did you clean the ribbon guide posts when you replaced the ribbon cassette? If dirty, remove the ribbon cassette and clean the ribbon guide posts with a soft dry cloth.
Erratic operation or wrong character printing.	<ul style="list-style-type: none">• Is the interface cable and/or connector damaged?• Are interface connectors inserted properly to the Computer or to the Printer?
The paper cannot be advanced smoothly.	<ul style="list-style-type: none">• Is paper loaded properly into the entrance of the insertion opening?• Is any obstacle preventing smooth paper motion?• Does paper stick or tear because of the side guide pins?

Note: If the trouble cannot be corrected after making the above checks and adjustments, check for secure contacts of all connectors. If you cannot eliminate the problem, take the unit to your local Radio Shack store or Computer Center for service.

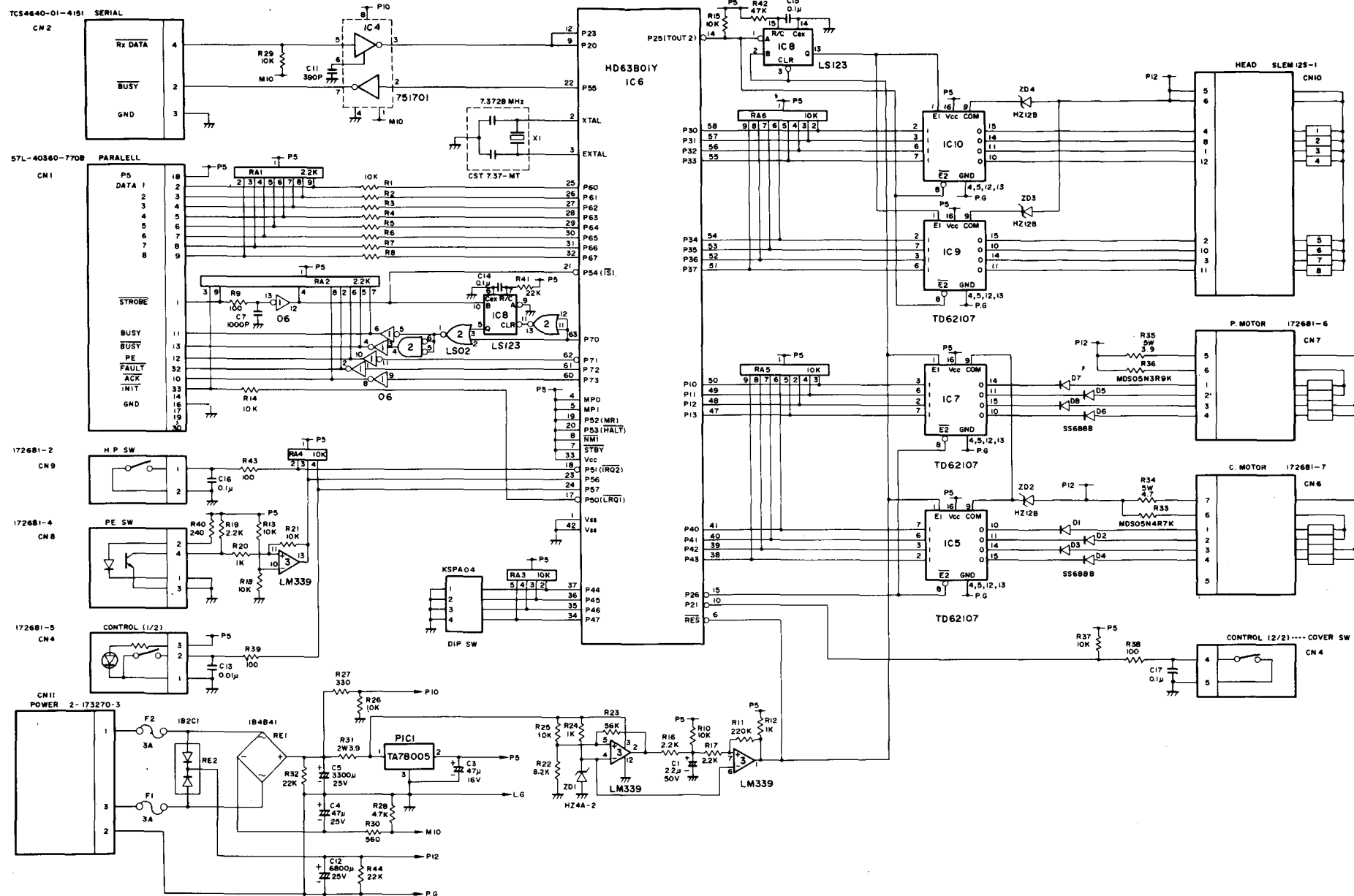
Printing Limits (Duty Cycle)

The DMP 106 does have its limits when it comes to heavy, continuous printing. Depending upon the type of printing being performed, those limits vary.

DMP106 Printing Limits				
Type of Printing		%	Number of Pages	
Character	at	100%	for	8
Graphics		100%		1/2
Block Graphic		100%		1/3

Note: These figures are based on an 80-column printing width. 100% printing would mean every column is printed.

Schematic Diagram F



Specifications G

Weight: 8.8 lbs (4 kg)

Dimensions: 15.2" × 2.9" × 9.3" (388 × 74 × 236 mm) H × W × D

Printing Speed (characters per second)

Standard 10 CPI.....	80
Elongated Standard 5 CPI	40
Compressed 12 CPI	65
Elongated Compressed 6 CPI ...	32.5
Condensed 16.7 CPI	46
Elongated Condensed 8.3 CPI...	23

Characters Per Line

Standard 10 CPI.....	80
Elongated Standard 5 CPI	40
Compressed 12 CPI	96
Elongated Compressed 6 CPI ...	48
Condensed 16.7 CPI	133
Elongated Condensed 8.3 CPI...	66

Dots Per Character

Standard 10 CPI.....	12
Elongated Standard 5 CPI	24
Compressed 12 CPI	12
Elongated Compressed 6 CPI ...	24
Condensed 16.7 CPI	12
Elongated Condensed 8.3 CPI...	24

Vertical Spacing..... 12, 6, 8 lines per inch (Computer selectable), 7/72" and n/72" (n/12 line feed) available.

Dots Per Line

Standard 10 CPI.....	960 dots
Elongated Standard 5 CPI	960 dots
Compressed 12 CPI	1152 dots
Elongated Compressed 6 CPI ...	1152 dots
Condensed 16.7 CPI	1600 dots
Elongated Condensed 8.3 CPI...	1600 dots

Character Set

Standard, Compressed, Condensed	ASCII 95, European Symbols 32, Block Graphics 31
--	---

Specifications

Interface

Parallel	8-bit with strobe signal
Serial	8-bit, Baud rate selectable (600 BPS or 2400 BPS).

Print Head Life	50 million characters typical
Preventive Maintenance	Normally every 6 months

Temperature and Humidity Range

Operating	55°F ~ 85°F (12.8°C ~ 29.4°C) 40 ~ 80% RH
Storage	- 40°F ~ 160°F (- 40°C ~ 71°C) 20% ~ 90% RH

Paper

Fanfold Paper	4" ~ 9.5" wide with guide holes
Single Sheets	4" ~ 9.5" wide, good quality, 14 ~ 22 lb (40 ~ 60 kg)
Copy Paper	1 original, 1 copy 11 lb (34 kg) non-carbon paper
Ribbon Cassette	Radio Shack Cat. No. 26-1288
Power Requirements	120 ± 15 VAC, 60 ± 3Hz (for USA/Canada), or 220 ± 22 V/240 ± 24 VAC, 50 ± 3 Hz (for Euro- pean and Australian models). 30 W typical (self-test)

SERVICE POLICY

Radio Shack's nationwide network of service facilities provides quick, convenient, and reliable repair services for all of its computer products, in most instances. Warranty service will be performed in accordance with Radio Shack's Limited Warranty. Non-warranty service will be provided at reasonable parts and labor costs.

RADIO SHACK
A Division of Tandy Corporation
Fort Worth, Texas 76102

2A7

Printed in Singapore
HG 13B01290A
E1-16229 870210000 ®