TANDY®

Dot-Matrix Printer
DMP 130A

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 bottom of the unit.

Serial Number _____

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Dot Matrix Printer DMP 130A Operation Manual:
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Introduction

About the Printer

Congratulations for selecting this Tandy computer product! The DMP 130A is a high-density, dot-matrix printer which can perform a variety of different printing operations. For instance, it can print:

- Proportionally spaced characters
- Monospaced characters (standard, condensed and compressed)
- Correspondence quality characters
- Italic cursive characters
- Super-/subscript
- Microfont
- Graphics – standard and high-resolution

The DMP 130A operates in 3 modes:

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

For word processing, you'll find the DMP 130A's proportionally spaced characters (created on a variable $n \times 18$ dot matrix) can produce letter-quality results. If, however, you need a printout that is produced faster, monospaced characters (created on a 9×9 dot matrix) are just the thing for you! In graphics mode, you can use graphic data to draw just about any type of graphic configuration you desire.

You can use 2 types of paper with the DMP 130A:

- Standard 4″ (10cm) to 10″ (25cm) wide computer fanfold forms with guide holes (Radio Shack Cat. Nos. 26-1243, 26-1427, 26-1403, and 26-1456)
- Standard, single-sheet typewriter paper

Other software-controlled features include:

- Full- or half-line feed and 3/4 or 4/5 line feed
- Software-controlled form feed (from your computer)
- Underline capability
- Buzzer function
- Automatic paper loading
- Margin-set function
- Automatic paper feed at paper end. When the DMP 130A detects paper end, it automatically advances the paper 3 inches (7.5cm) for easier paper removal.

Start-up Checklist

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

☑ Find a good spot for your Printer. Be sure to consider:

- Printer should be placed on a sturdy work surface.
- Length of the printer cable, which will determine how far from the computer you can place the Printer.
- Paper takes up space. Be sure to leave enough room for smooth paper flow.
- Do not place the Printer near noise generators such as refrigerators and industrial equipment.

☑ Be sure the POWER switch (on the right side of the Printer) is OFF.

☑ Open the printer cover.

☑ Install continuous-form fanfold or single-sheet paper.

☑ Check the ribbon cassette. If it has not been installed, see *Ribbon Cassette.*

☑ Set the print function (DIP) switches (on the rear of the Printer).

☑ Connect the AC power plug to a 120-volt, 60 Hz, grounded AC outlet (220/240V, 50 Hz, where the unit is so marked).

☑ Connect the interface cable from the computer to the printer interface connector.

☑ Turn on the power and check that the POWER indicator (on the front panel) is illuminated.

☑ Check to see that the Printer is ready by running the self-test. To do this, turn the POWER switch OFF. Press and hold the LINE FEED switch or NLQ (Near Letter Quality) switch while turning the power back ON. If you press the LINE FEED switch, the self-test is performed in standard mode. If you press NLQ, the self-test runs in NLQ mode. Printing will continue until you press the ON/OFF LINE switch.

Setting Up the DMP 130A 1

This section will show you how to set up the DMP 130A so you can begin using it as quickly as possible. This includes:

- Installing the paper rack
- Installing/adjusting the tractor feed unit
- Replacing a ribbon
- Loading paper
- Connecting the DMP 130A to a computer

Carefully unpack the DMP 130A, being sure to locate the ribbon and the paper rack. Keep the empty box and packing material just in case you ever need to transport the Printer.

Paper Rack

Open the printer cover. Holding the paper rack upright, insert the tips of the rack onto the supporters on both sides of the Printer, as shown.
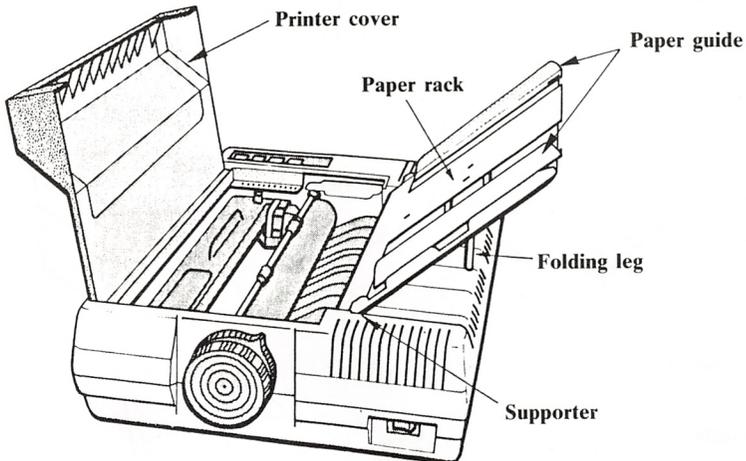
Figure 1. Installing the Paper Rack

For single-sheet printing, insert the folding leg into the hole centered on top of the case. For the continuous fan-fold paper, fold the leg and lay the rack down, or, if you prefer, detach the paper rack from the Printer.

You can adjust the paper guide on the paper rack. Pull the guide upward to remove it from the rack. Then position it as you desire (within the range allowed) and insert it fully. When using narrower paper, insert it so 'hat the left edge of the paper is within the range of the paper guide. This

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ensures proper operation of the paper empty switch and also reduces the possibility of paper jam.

Tractor Feed Unit

This Printer can be used with either the tractor feed system or friction feed system. The difference is that the tractor feed system is used with paper (fanfold) which has guide holes on both edges, while the paper used with the friction feed system does not have these holes.

When you use the friction feed system, be sure to remove the tractor. When the tractor is installed, the friction mechanism is released and the Printer may not feed the paper properly.

Installing the Tractor

1. Be sure the Printer's power switch is OFF.
2. Remove the paper rack and open the printer cover.
3. Turn the paper loading knob forward to move the paper bail forward.
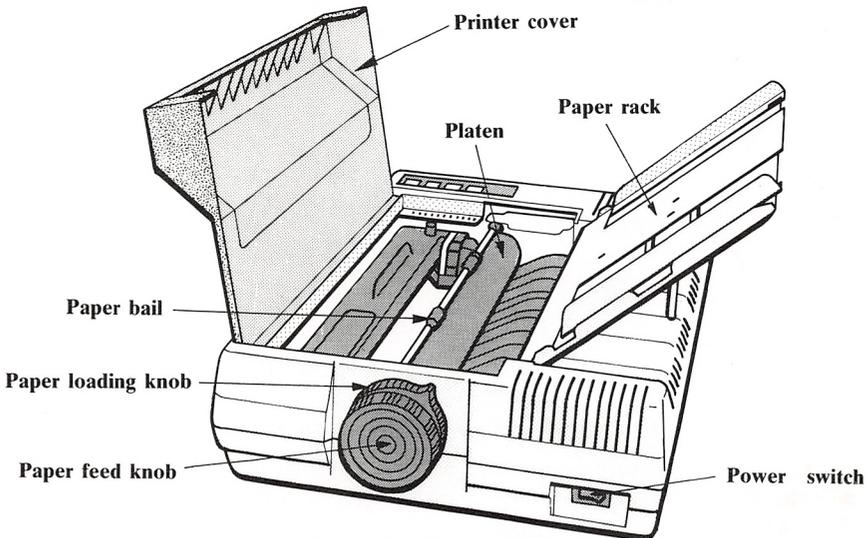
Figure 2. Right Side View

4. Place the front pins of the tractor unit into the holes on both sides. Then push down on the rear of the tractor unit until the tractor is securely locked into position.
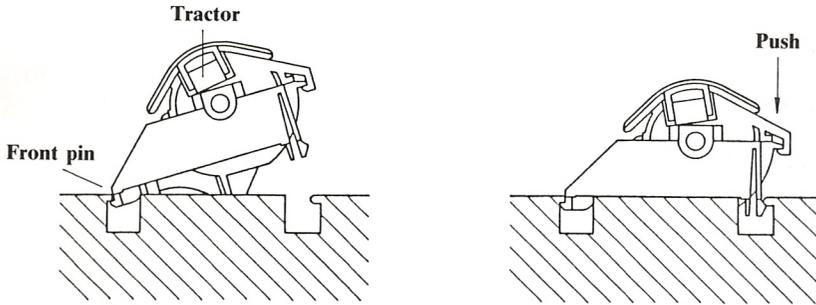
Figure 3. Installing the Tractor

5. Turn the paper loading knob backward (away from you) to move the paper bail toward the platen.

6. Close the printer cover and replace the paper rack.

Removing the Tractor

1. Turn off the Printer.

2. Open the printer cover and remove the paper rack.

3. Turn the paper loading knob toward you.

4. Lift the tractor unit from the rear, then pull it upward.

5. Turn the paper loading knob away from you.

6. Replace the paper rack and close the printer cover.

Ribbon Cassette

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

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

1. Set the power switch to OFF. (*Note:* When you turn off the power, any information stored in the Printer's buffer will automatically be lost.)

2. Remove the printer cover.

3. Unwrap the new cassette. Before inserting the new cassette, tighten the ribbon by turning the knob in the direction indicated by the arrow. To replace the ribbon cassette, grasp the fin on the cassette and gently pull the ribbon cassette upward.
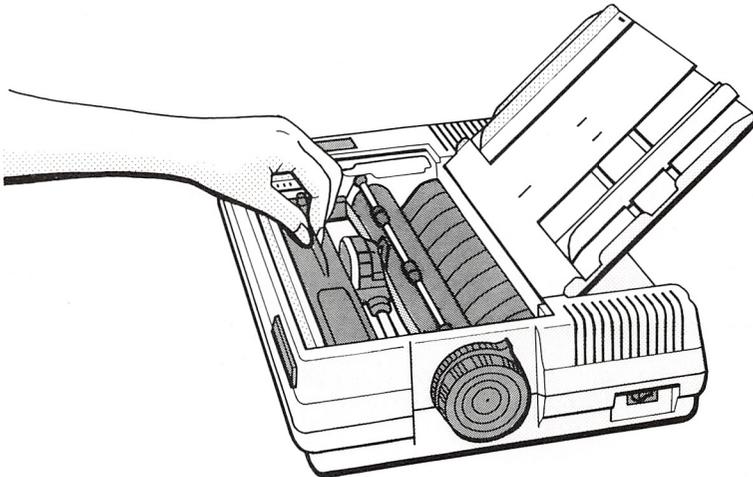
Figure 4. Removing the Ribbon Cassette
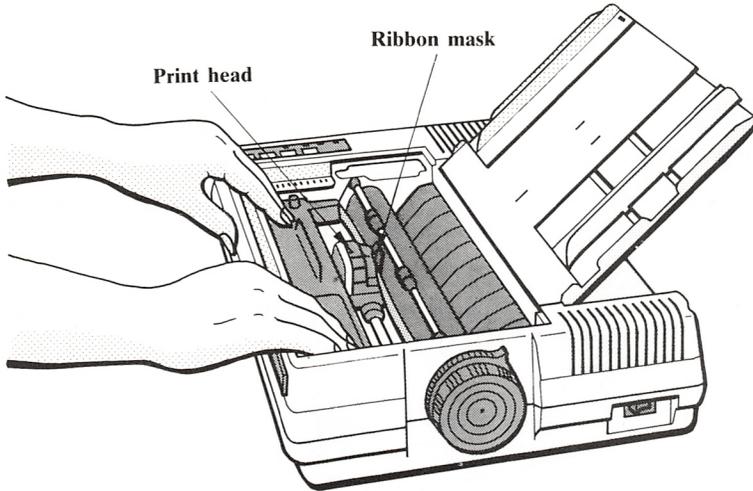
Figure 5. Installing the Ribbon Cassette

4. Gently slide the ribbon between the ribbon mask and the print head. Gently press down on the left side of the cassette until you hear a click sound. While rotating the cassette knob in the direction indicated by the arrow, press down the right side of the cassette.

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

5. Once the new cassette is installed, tighten the ribbon by turning the cassette knob in the indicated direction.

6. Replace the printer cover.

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

Power Source

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

☑ Printer's power ON/OFF switch is set to OFF.

☑ Printer is not connected to the computer yet.

Connect the AC power plug to a 120-volt, 60 Hz, grounded AC outlet (220/240 V, 50 Hz, where the unit is so marked).
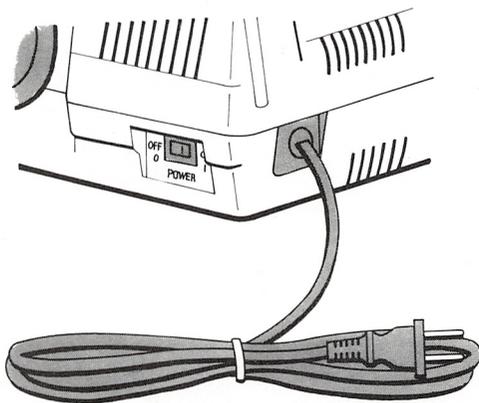
Figure 6. Connecting to a Power Source

Set the power switch to ON/1 to turn on the power. Press the left side of the switch to turn off power. Note that turning the power OFF and ON during operation may cause loss of the current program.

Paper Loading

Important! When loading paper (single-sheet or fanfold), be sure the paper correctly enters the paper insertion opening.

The paper must enter the DMP 130A straight and directly behind the Printer, or paper skewing or jamming may occur. Proper positioning of the paper guide (which attaches to the paper rack) is also important to help prevent paper jamming.

Single-Sheet Paper

1. Be sure the Printer's power is OFF. Open the printer cover.

2. Lift the paper rack and insert the folding leg into the hole centered on the top case.
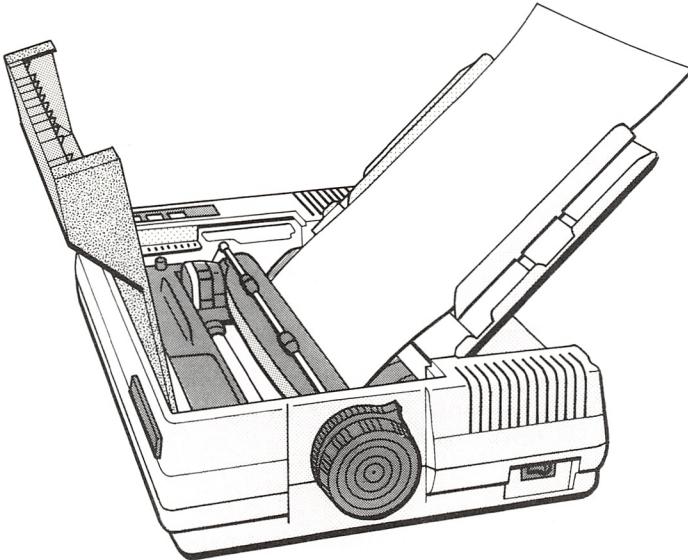
Figure 7. Positioning the Paper

3. Position the single-sheet paper on the paper rack, aligning it with the paper guide. Since the auto-paper-loading system will pull the paper into the Printer, just placing the paper on the paper rack is sufficient. If you insert the paper into the opening, the Printer may "think" that the paper is already in place and may not activate the auto-loading mechanism.

4. Turn on the Printer's power switch.

5. Turn the paper loading knob toward you. The paper automatically advances to the print-start position.

6. Turn the paper loading knob away from you to return the paper bail to the platen.

7. When you want to align the paper, use the paper feed knob or the front panel LINE FEED switch (see *Operator Controls*) to advance the paper. Then, adjust the position.
    Note: The paper bail MUST be against the platen for paper adjustment.

8. Set the print head adjustment lever located on the inside right of the Printer to the appropriate position. Refer to *Print Head Adjustment Lever.*

9. Close the printer cover.

Hints and Tips on Single-sheet Paper Loading

- With the paper properly installed, printing will continue until the paper passes the paper empty sensor. The Printer will then go OFF LINE. Insert another sheet and turn the paper loading knob to set the paper. When the paper is in place, press the ON/OFF LINE switch and the DMP 130A will continue printing where it left off.

- If you want to print another few lines after the paper empty sensor detects the paper end, press ON/OFF LINE. Be careful not to exceed the bottom edge of the paper.

Fanfold Paper

The DMP 130A will accept standard fanfold paper from 4″ to 10″ wide. Before using fanfold paper, however, the tractor unit should be installed. Refer to *Tractor Feed Unit.*

1. Turn off the power.

2. Open the printer cover. Remove the paper rack temporarily.

3. Turn the paper loading knob toward you to move the paper bail away from the platen.

4. Feed the paper into the Printer through the paper insertion opening. Use the paper feed knob to pull the paper around until it appears between the platen and the print head.

5. Adjust the pin-feed paper clamp positions for the width of the paper. Refer to Figure 8.

6. Open the pin-feed paper clamps.

7. Align the holes in the paper with the pin-feed sprockets. If you need to align the paper, return the paper bail to the platen to release friction on the paper.

8. Close the pin-feed clamps to secure the paper.

Pin-feed paper clamps
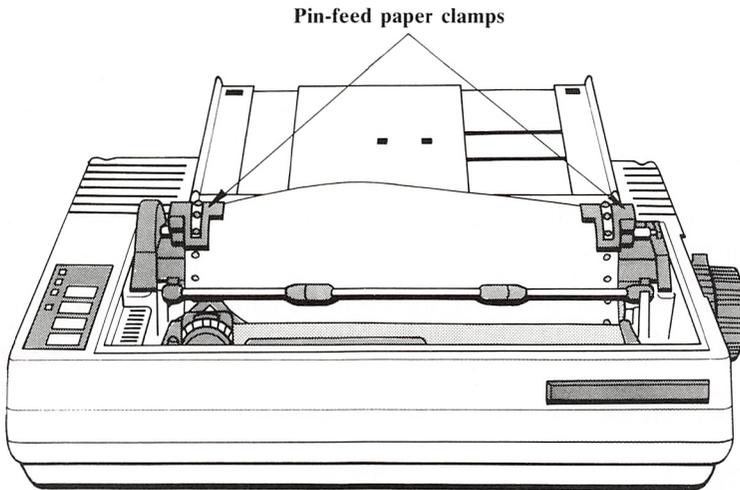
Figure 8. Front View

9. Set the print head adjustment lever located on the inside right of the Printer. Refer to *Print Head Adjustment Lever.*

10. Turn the paper loading knob away from you to move the paper bail toward the platen. This is important: the friction roller under the platen is released by setting the paper bail against the platen, otherwise, a paper jam may occur.

11. Replace the paper rack and the printer cover. Proper paper flow will be obtained if you attach the paper rack and lay it down flat with the paper feeding underneath it into the Printer (Figure 9).
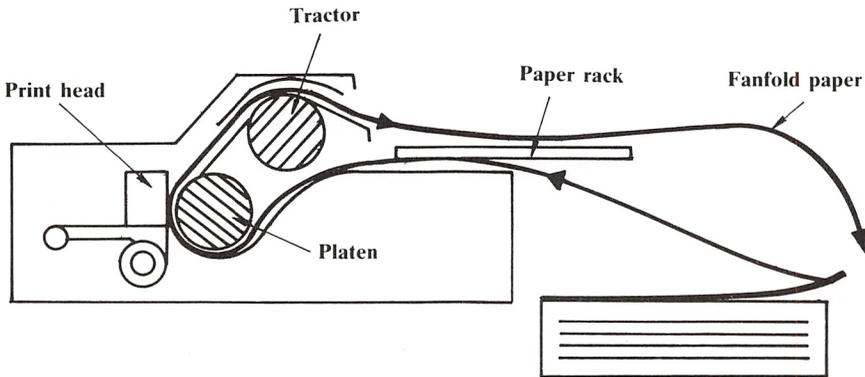
Figure 9. Fanfold Paper Path

If fan fold paper is correctly loaded, it should enter between the body of the Printer and the paper rack. Once the paper is loaded and power is ON, check the ALERT indicator on the front panel (see *Operator Controls*). Press the ON/OFF LINE switch if the lamp is illuminated. When the lamp remains lit, the paper is probably loaded incorrectly.

If the ALERT lamp does not illuminate after the paper is loaded, the Printer is ready for operation.

Hints and Tips on Fanfold Paper Loading

- Be sure the paper is positioned so that it can travel through the Printer without binding.

- Do not let paper pile on top of unprinted paper or the printed paper may be pulled into the paper insertion opening. This could jam the paper feed or damage the Printer.

- As much as possible, place the paper on the same height as the printer.

Print Head Adjustment Lever

You have to adjust the print head according to the thickness of the paper you use. The print head adjustment lever is located on the inside right of the Printer.

Position ③ is suitable for one-part paper. Position ⑤ or ⑥ is for multiple part paper. See Figure 10.
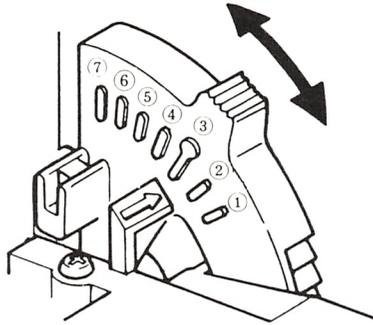
Figure 10. Print Head Adjustment Lever

Single-part forms. Set the lever in position ③.

Multiple-part forms. Set the lever to position ⑤ or ⑥. Check for smudging by performing the self-test at each of the lever settings.

Warning! The print head must always be as close to the platen as possible; otherwise, damage to the print head may result.

Self-Test

The DMP 130A has a built-in, self-test feature which lets you check the print 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 adjusted properly (printing is neither too faint nor smudged) and the paper is feeding smoothly.

Before running the self-test, be sure to load the DMP 130A with 10-inch-wide paper 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. Press and hold either the LINE FEED switch or NLQ switch (see *Operator Controls*).

3. Set the POWER switch to ON. Starting with the "music" of the internal buzzer, the Printer will begin printing rolling ASCII 96 characters after the version of the ROM.

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If you press LINE FEED, the self-test is performed in the standard font. The correspondence quality font is used during the test when the NLQ switch is pressed.

Printing will continue until you press the ON/OFF LINE switch (or paper end is detected).

Operator Controls

It's important to become familiar with the DMP 130A before you begin using it.
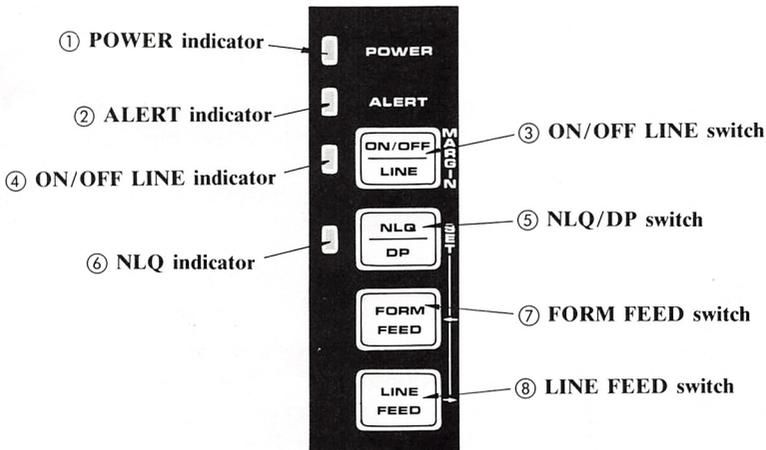
Figure 11. Front Panel Controls

① **POWER indicator.** Illuminates when the DMP 130A is properly connected and the POWER ON/OFF switch is set to ON.

② **ALERT indicator.** Lights when the Printer is out of paper. In this case, the Printer enters the OFF-LINE state and the buzzer sounds for 1 second. Load more paper and press the ON/OFF LINE switch. It flickers when there is a carriage fault or some sort of electrical problem.

Model II users: When a BASIC program stops execution because of a Printer error, type CONT ENTER to resume printing. However, the entire contents of the print buffer will be printed starting with the current print head position.

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③ **ON/OFF LINE switch.** At power-up, the Printer is ON LINE; pressing this switch one time causes the Printer to go OFF LINE. To stop printing at any time or to use other front panel switches, press this switch to set the Printer to OFF LINE.

Press and hold this switch 1 second while in ON LINE mode to enter the margin-set mode.

The print head does not move when the Printer goes ON LINE after this switch is pressed.

Note: To print the remaining data in the buffer when the ON/OFF LINE switch is pressed to stop the printing, first, cancel the printing process using your computer software, then press the ON/OFF LINE switch to set the DMP 130A to ON LINE.

④ **ON/OFF LINE indicator.** When this indicator is ON, the DMP 130A is ON LINE and ready to print. This indicator will flicker in the margin-set mode.

⑤ **NLQ/DP switch.** Press this switch to select the print mode – Near-Letter Quality or standard. When the NLQ mode is selected, the NLQ indicator turns ON. Press again for standard mode. This switch will work only when the Printer is OFF LINE.

In the margin-set mode, pressing this switch will set the margin position.

⑥ **NLQ indicator.** Illuminates when the Printer is in the NLQ mode.

⑦ **FORM FEED switch.** When pressed, the paper advances to the logical top of the next form. It is effective only when the Printer is OFF LINE.

In the margin-set mode, pressing this switch moves the print head to the left.

⑧ **LINE FEED switch.** When this switch is pressed, the paper advances 1 line. When it is held down, continuous paper feed is performed. This switch will work only when the Printer is OFF LINE.

In the margin-set mode, pressing this switch moves the print head to the right.

Computer Connections

Before making any connections between the Printer and computer, be sure the power to all units is OFF!
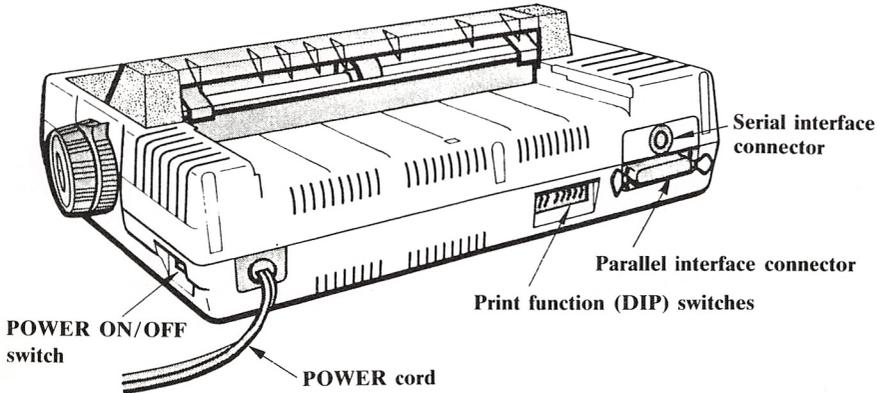
Figure 12. Computer Connections

You need the correct cable for your computer. Table 1 describes the printer cables Tandy provides. Table 2 provides quick instructions for the printer connection locations. If you have a color computer or DT - 100 data terminal, connect the cable to the serial interface connector. If your computer has parallel interface capabilities, connect the cable to the parallel interface connector.

1. Attach the molded male end of the cable to the connector on the right rear of the Printer. Do not force the plug. If it does not fit one way, turn it over and try again.

2. Connect the other end of the cable to the Printer jack of your computer. See your computer owner's manual for specific instructions.

Table 1. Computer to DMP 130A Cables

Computer	Cable Number
Model I (Keyboard only)	26-1411
Model I (Exp. Interface)	26-1401
Model II/12/16/16B/DT-1/Tandy 2000	26-4401
Model III/4/4D/4P/1000	26-1401
Model 100/Tandy 102/200/600	26-1409
Tandy 1000EX	*
Tandy 1000SX	*
Tandy 1200/3000/3000HL/3000HD	26-1347
DT-100	26-1361
Color Computer	26-3020

*Cable is supplied with the computer.

Table 2. Computer Connection Points

Computer	Connector
Model I (Keyboard only)	Rear of keyboard
Model I (Exp. interface)	Left side of expansion interface
Model II/4P/12/16/100	Rear panel of computer
Model III/4/4D/DT-1	Bottom panel of computer
DT-100	Rear panel of terminal
Tandy 102/200/600/1000/1200/2000/3000	Rear panel of computer
Color Computer	Rear panel of computer

Print Function (DIP) Switches

There are 10 switches located on the rear panel of the Printer. These switches allow you to customize some DMP 130A features for your own applications.
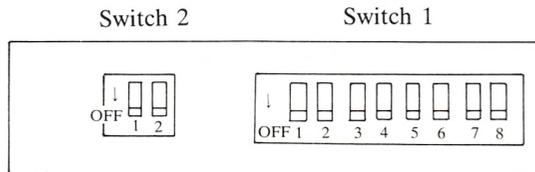
Figure 13. DIP Switch Panel

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When you set switch 1-1 to OFF before turning on the power, the DMP 130A selects Tandy codes. In this setting, the switches function as shown in Table 3. On the other hand, if you set switch 1-1 to ON, the DMP 130A selects codes for the IBM mode. In this case, the switches function as shown in Table 4.

For instance, in Tandy mode, you can select word processing mode (better print quality) or data processing mode (faster printing speed). Or, if you begin using the DMP 130A with a computer which has serial printer output (such as the Color Computer), turn off the power and set the appropriate switch accordingly.

When you receive the DMP 130A, all DIP switches should be set to OFF.

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

Table 3. DIP Switch Functions in Tandy Mode
(Switch 1-1 is set to OFF)

Sw.	Symbol	ON	OFF
1-1	Control Codes		Tandy Codes
1-2	CR	Carriage Return Only (CR = CR)	Carriage Return and Line Feed (CR = NL)
1-3	LF	Line Feed and Carriage Return (LF = NL)	Line Feed Only (LF = LF)
1-4	Form Length	12 Inches	11 Inches
1-5	1-Inch Skip Over Perforation	Valid	Not Valid
1-6	Line Spacing	1/8 Inch	1/6 Inch
1-7	Character Generator	IBM Character	Tandy Character
1-8	WP/DP Mode	Word Processing Mode	Data Processing Mode

SW2-1 and SW2-2 select the interface and baud rate for serial interfacing.

| Interface | Baud Rate | Switch | |
		2-1	2-2
Parallel		OFF	OFF
Serial	600	OFF	ON
Serial	1200	ON	OFF
Serial	2400	ON	ON

Table 4. DIP Switch Functions in IBM Mode
(Switch 1-1 is set to ON)

Sw.	Symbol	ON	OFF
1-1	Control Codes	Codes for IBM	
1-2	CR	Carriage Return Only (CR = CR)	Carriage Return and Line Feed (CR = NL)
1-3	LF	Line Feed and Carriage Return (LF = NL)	Line Feed Only (LF = LF)
1-4	Form Length	12 Inches	11 Inches
1-5	1-Inch Skip Over Perforation	Valid	Not Valid
1-6	Line Spacing	1/8 Inch	1/6 Inch
1-7	Character Generator	IBM Character Set 2	Tandy Character Set 1
1-8	Buffer Full	Carriage Return Only	Carriage Return and Line Feed
2-1	Cancel Code	Not Valid	Valid
2-2	Error Buzzer	Sounds	Does Not Sound

When using the IBM mode, DIP switches 2-1 and 2-2 must be set to OFF. Serial interface selection is not supported while in the IBM mode.

Power-up Sequence

The specific power-up sequence will depend on your computer. Consult your computer owner's manual for details on powering up your computer with peripheral devices (such as printers).

In any event, the POWER indication lamp on the DMP 130A will remain lit while the Printer is ON.

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

Margin-Set Switches
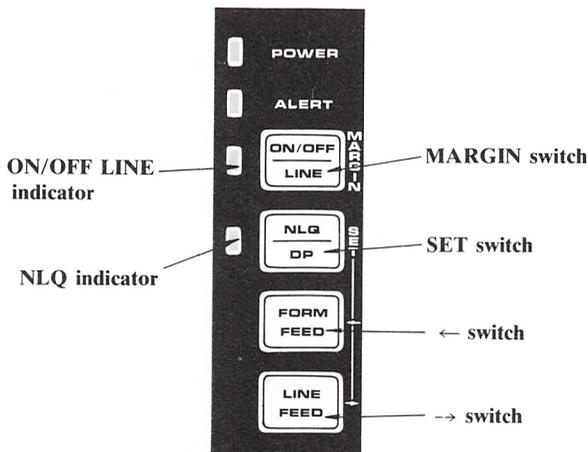
Figure 14. Front Panel

1. Be sure the ON LINE indicator is ON.

2. Press and hold the MARGIN (ON/OFF LINE) switch until the ON LINE indicator blinks.

3. Press the → (LINE FEED) and ← (FORM FEED) switches to move the print head to the position you wish to set as a left margin.

4. Press the SET (NLQ/DP) switch to set the left margin.

5. Press the → switch to move the print head to a desired position for a right margin.

6. Press the SET switch to set the right margin.

Note: Once the left and right margins are set, you cannot *manually* reset margins wider than the present ones unless the power is turned OFF and back ON again. You can change margins via software. (Refer to Chapter 5, *Left and Right Margins.*).
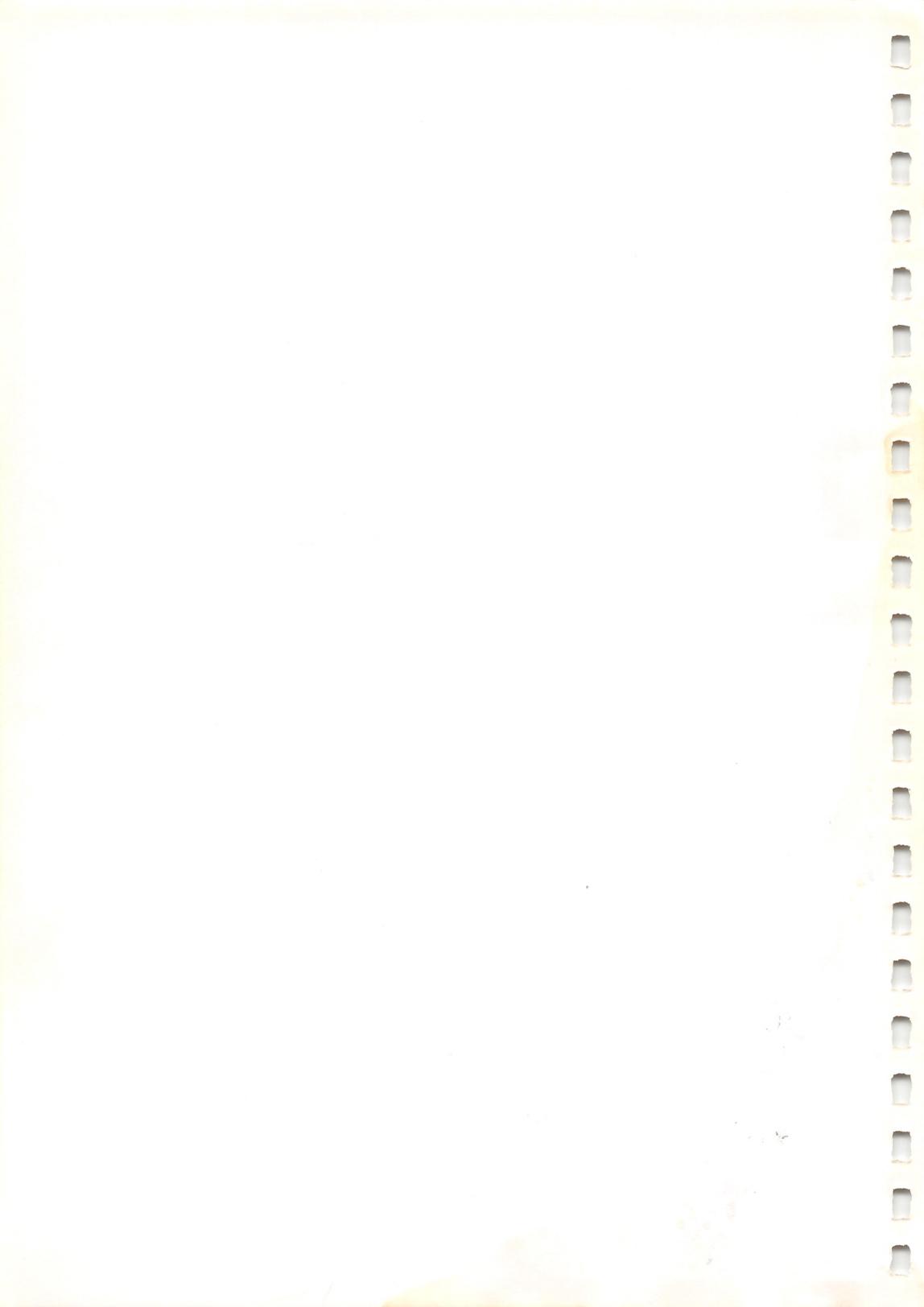
Using the DMP 130A 2

The DMP 130A is designed for three applications:

- Data Processing
- Word Processing
- Graphics Printing

This Printer responds to software codes from the computer in three ways – one for each application. These response patterns, or modes, have many similarities, but each has its own unique features.

Data and word processing modes, both used for printing characters, differ only in the way they handle line feed commands (commands that decide which direction and how far the paper is fed).

- In **word processing mode,** each line feed command causes immediate paper advancement. Word processing programs (such as SCRIPSIT) can use immediate line feeds for superscripts, subscripts, and the like.

- In **data processing mode,** line feed commands do not cause immediate printing. Instead, they are stored in the Printer's memory along with other data. When the current line is printed, the line feed commands stored in memory determine the direction and pitch of the paper feed.

Both data and word processing modes print in 2 print styles. One style is the proportionally spaced character set and the other is the monospaced character set.

- **Proportionally spaced characters** have variable widths: M takes up more space than an I. Proportionally spaced characters are used to create professional looking documents.

- **Monospaced characters** are so named because each character takes up the same width. This uniformity makes it preferable for tables and charts that require vertical alignment.

In **Graphics mode,** you have complete control of the print head. This mode can be used to create a custom letterhead, designs, special type fonts, etc.

However, with graphics operation, many control codes (which can be used with data and word processing) cannot be used. The DMP 130A does not return an error when you send such a code – it simply ignores the code. This includes codes that change line feed pitch and direction. Graphics mode has restricted numbers of line feed to ensure full coverage of the paper.

Control Codes

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

All information is sent to the Printer as numbers between 0 and 255 decimal (00 - FF hexadecimal). The Printer interprets these numbers according to the American Standard Code for Information Interchange, commonly referred to as the ASCII code. (See Appendix A 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, superscript, subscript, etc.

The control codes have different meanings, depending on the current print mode. If a code is not recognized by the Printer, it is printed as "**X**". The next few sections demonstrate how some of the control codes activate various printer functions. Read these sections carefully.

Control Codes from BASIC

Some Printer features are activated by a single code, but many functions require a sequence of 2 or more codes. Most multiple code sequences begin with decimal 27 (referred to as the *ESC*ape 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.

This section discusses Tandy codes (DIP switch 1-1 to OFF). To select IBM codes, turn off the Printer, set DIP switch 1-1 to ON and turn on the Printer, or send ESC + ! CHR$(27); CHR$(33). This will allow you to use the DMP 130A with Tandy's MS-DOS operating systems. Refer to Chapter 7, **IBM Emulation Mode,** for the IBM codes.

> *Note:* The command **LPRINT** will be used 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 130A as described earlier and enter BASIC in the normal way. Then type the following program:

24

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

and RUN it.

Roll the paper forward and look at the results. The world MODE printed over part of the word DATA. Why? The codes CHR$(27) and CHR$(56) are the guilty parties. Take a quick look at Appendix B. This chart shows the various code sequences understood by the DMP 130A. The control code sequence CHR$(27); CHR$(56) means "change the forward line feed to three-quarter of its normal distance."

Data Processing Mode

How can you tell which mode the DMP 130A uses when it is first turned on? A little reflection on the above program tells you all you need to know.

Line feed commands are executed immediately in word processing (WP) mode, but not in data processing (DP) mode. The (27, 56) sequence did not cause a 3/4-forward line feed until after the first line was printed. Thus, the Printer must be in DP mode. And, in case you missed it, this new line feed stays in effect until further notice (another characteristic of the DP mode). Type:

```
LLIST   [ENTER]
```

Sure enough. You still have that short line feed. To return to normal line feed pitch, type:

```
LPRINT CHR$(27);CHR$(54)
```

Word Processing Mode

When the same program is executed in WP mode, the line feed occurs immediately after the word DATA. Go into WP mode and try it. To enter WP mode, change line 10 to:

```
10 LPRINT CHR$(20):REM CHR$(20) selects WP Mode
```

and RUN the program.

Just as you suspected, the line feed is immediately executed.

Note that in WP mode, the new line feed is only temporary. Type **LLIST** and press ENTER to prove that the half-forward line feed occurs only once, then returns to normal.

Graphics Mode

Grahpics mode is different from the word and data processing modes. For one thing, code CHR$(10) in graphics mode feeds paper 7/72″ as opposed to the ordinary 1/6″ pitch in WP and DP modes. Furthermore, only a few of the WP and DP features are available in graphics mode. Standard letters and symbols, for example, are 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 printouts of high-resolution graphics for charts, logos, etc.

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

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

and RUN the program.

CHR$(18) puts the DMP 130A in graphics mode. The numbers 128 through 255 are interpreted as dot patterns.

Type **LPRINT CHR$(30)** and press ENTER to return the Printer to WP mode. Try LLISTing the program to be sure you're not stuck in graphics land.

Print Mode Selection

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)
DP	WP	20	14
	Graphics	18	12
WP	DP	19	13
	Graphics	18	12
Graphics	DP	30*	1E
	WP	30*	1E

*Returns to the last mode (WP or DP) used.

Hints and Tips about Print Modes

Data processing mode

- All commands which decide line feed pitch are stored in the Printer's memory. They are not executed until an LF code (10 Dec. or 138 Dec.) is received. Then, the paper advances according to the pitch and direction codes stored in the Printer's memory.

- Line feed commands stay in effect until replaced by a new command.

- All printable characters can be printed in this mode.

Word processing mode

- Line feed codes that determine pitch are executed immediately.

- Line feed pitch changes affect only the current print line.

- All printable characters can be printed in this mode.

Graphics mode

- The LF code causes the paper to move 7/72″ forward.

- Decimal numbers 128 – 255 sent via CHR$ in BASIC are interpreted as pin-firing patterns for the print head.

- Only a few control code sequences are recognized.

Print Font Styles and
Character Widths 3

The DMP 130A has four distinct print (character) font styles:

- Standard
- Correspondence quality (NLQ)
- Proportionally spaced
- Graphic characters

Each 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; the vertical ones do not.

Table 6 shows that there are 3 basic pitches: normal, compressed, and condensed.

Table 6. Character Widths and Densities

Style	Matrix Size	Width and Density
Standard	9×9	Normal 10 CPI / Elongated 5 CPI Compressed 12 CPI / Elongated 6 CPI Condensed 17 CPI / Elongated 8.5 CPI
Correspondence Quality (NLQ)	19×19	Normal 10 CPI / Elongated 5 CPI Compressed 12 CPI / Elongated 6 CPI
Proportionally Spaced	$n \times 18$	Variable character width (Condensed density)

Character Styles

Character styles can be selected by control codes from the computer.

Character styles stay in effect until another character style is selected. Even entering graphics mode does not change the character set. The DMP 130A returns to the last active set on leaving graphics mode.

Table 7 is a summary of the character style change commands.

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Table 7. Character Style Change Commands

Send CHR$( ) (Dec)		(Hex)		If you want:	Print Example
27	19	1B	13	Normal (10 CPI)	ABCijk
27	23	1B	17	Compressed (12 CPI)	ABCijk
27	20	1B	14	Condensed (17 CPI)	ABCijk
27	17	1B	11	Proportionally Spaced	ABCijk
27	18	1B	12	Correspondence Normal (10 CPI)	ABCijk
27	29	1B	1D	Correspondence Compressed (12CPI)	ABCijk
27	66 1	1B	42 1	Start Italics	*ABCijk*
27	66 0	1B	42 0	End Italics	ABCijk
27	83 1	1B	53 1	Start Subscript	ABCijk
27	83 0	1B	53 0	Start Superscript	ABCijk
27	88	1B	58	End sub-/superscript	ABCijk
27	77	1B	4D	Microfont	ABCijk
27	14	1B	0E	Start Elongation	ABCijk
27	15	1B	0F	End Elongation	ABCijk
27	31	1B	1F	Start Bold	ABCijk
27	32	1B	20	End Bold	ABCijk

Standard Characters

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

Each of the standard characters can be printed in 3 main character widths:

- Normal, 10 Characters-per-inch (CPI)
- Compressed, 12 CPI
- Condensed, 17 CPI

Condensed characters are printed in a 11 × 9 dot matrix for 17 CPI. This also can be elongated to double width. Each of these widths can be elongated (double width) which gives half as many characters per inch and a total of 6 different print widths.

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

NEW   ENTER

30

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

and RUN it.

```
STANDARD CHARACTERS   10CPI
COMPRESSED CHARACTERS   12CPI
CONDENSED CHARACTERS 17CPI
```

The subroutine in line 240 sends the required control codes to the DMP 130A. Line 230 returns to normal characters width and stops program execution.

Correspondence Quality Characters

Correspondence quality characters are printed in a 19 × 18 dot matrix for 10 CPI. The characters have the same total width as normal width characters, but they are printed with the condensed character density (19 dots wide fit in the same space as 9 dots wide). Correspondence quality print also has 12 CPI and can be elongated to 5 CPI/6 CPI.

Add these lines to the program, then compare the two styles.

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

and RUN the program.

```
STANDARD CHARACTERS   10CPI
COMPRESSED CHARACTERS   12CPI
CONDENSED CHARACTERS 17CPI
CORRESPONDENCE   CHARACTERS   10CPI
CORRESPONDENCE   CHARACTERS 12CPI
```

You'll find a great difference between the two styles.

Proportionally Spaced Characters

Proportionally spaced characters are the same as correspondence quality, but the characters matrix width varies from character to character. The characters are 18 dots high and the widths vary from 3 dots to 11 dots (including 2 columns of blank dots to allow space between the characters).

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

To see how this font looks, add:

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

and RUN the program.

```
STANDARD CHARACTERS  10CPI
COMPRESSED CHARACTERS  12CPI
CONDENSED CHARACTERS  17CPI
CORRESPONDENCE  CHARACTERS  10CPI
CORRESPONDENCE  CHARACTERS  12CPI
PROPORTIONAL  CHARACTERS
```

Graphics Characters

The graphics character set is used for block graphic printing. 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 Tandy computers: it is a unique character set. The graphics characters are not available with correspondence characters or proportional characters.

To see how the various character widths affect the graphic 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   10CPI
COMPRESSED CHARACTERS 12CPI
CONDENSED CHARACTERS 17CPI
CORRESPONDENCE   CHARACTERS   10CPI
CORRESPONDENCE   CHARACTERS   12CPI
PROPORTIONAL   CHARACTERS

GRAPHIC   CHARACTERS NORMAL

GRAPHIC   CHARACTERS COMPRESSED

GRAPHIC   CHARACTERS CONDENSED

Since the normal line-to-line spacing is 1/6″ or 12 dots high and the graphics characters are 6 dots high, you can create continuous vertical graphics by using the half 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
```

and RUN it.

STANDARD CHARACTERS   10CPI
COMPRESSED CHARACTERS 12CPI
CONDENSED CHARACTERS 17CPI
CORRESPONDENCE   CHARACTERS   10CPI
CORRESPONDENCE   CHARACTERS   12CPI
PROPORTIONAL   CHARACTERS

GRAPHIC   CHARACTERS NORMAL
GRAPHIC   CHARACTERS COMPRESSED
GRAPHIC   CHARACTERS CONDENSED

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

Right Justification

Proportionally spaced characters are designed to be used with word processing programs. They do not carry around all the wasted space between words as in monospaced print style. As a result, you can sneak in little slivers of space between characters to line up the right margin of text on a page without destroying character spacing. This process, called *right justification,* is usually handled by word processing software. The DMP 130A provides codes to allow you to insert spaces between characters, ranging from 1 dot to 9 dots wide. There codes are summarized in Table 8.

You can demonstrate the way these codes work by modifying the current program. When you add the following 2 lines, the DMP 130A will print 2 lines of proportionally spaced characters, then insert enough space to line up the right margins.

```
70 DATA "THE PROPORTIONAL CHARACTER SET OF THE"
80 DATA "DMP 130A PRINTER CAN BE RIGHT JUSTIFIED"
```

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

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

Now RUN the program.

THE PROPORTIONAL CHARACTER SET OF THE
DMP 130A PRINTER CAN BE RIGHT JUSTIFIED

To line up the right edge, insert a single, blank dot-column between the
first 26 letters in the first print line. Add:

```
50 IF I=1 AND J>26 THEN LPRINT CHR$(27)CHR$(1);
```

then RUN the program.

THE PROPORTIONAL CHARACTER SET OF THE
DMP 130A PRINTER CAN BE RIGHT JUSTIFIED

The following table will help when inserting spaces.

Table 8. Proportional Spacing

Send CHR$( )			To insert:
(Dec)		**(Hex)**	
27	01	1B 01	1 Dot Space
27	02	1B 02	2 Dot Spaces
27	03	1B 03	3 Dot Spaces
27	04	1B 04	4 Dot Spaces
27	05	1B 05	5 Dot Spaces
27	06	1B 06	6 Dot Spaces
27	07	1B 07	7 Dot Spaces
27	08	1B 08	8 Dot Spaces
27	09	1B 09	9 Dot Spaces

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

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

Wraparound

The DMP 130A is a dot-addressable printer. Therefore, line length is not determined by the number of characters, but by the number of dots-per-line. The number of addressable dots-per-line in data processing or word processing mode follows:

Standard 10 CPI 960
Standard 12 CPI 1152
Standard 17 CPI 1918
Correspondence 10 CPI 1920
Correspondence 12 CPI 2304

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 called *wraparound*.

Elongated Characters

Any of the character styles can be elongated to twice their normal width.

Table 9. Elongated Printing

Send 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 can be entered any number of times within a line and 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    1OC
COMPRESSED  CHARACTERS    12CPI
CONDENSED CHARACTERS   17CPI
CORRESPONDENCE      CHARACTE
CORRESPONDENCE    CHARACTERS    1
PROPORTIONAL    CHARACTERS

GRAPHIC    CHARACTERS  NORM

GRAPHIC    CHARACTERS  COMPRESSE

GRAPHIC   CHARACTERS  CONDENSED
```

Bold Characters

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

Table 10. Bold Printing

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

When a (27 31) code sequence is received, the DMP 130A prints the current buffer contents, then 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
```

Now RUN the program.

```
STANDARD CHARACTERS  10CPI
COMPRESSED CHARACTERS  12CPI
CONDENSED CHARACTERS  17CPI
CORRESPONDENCE  CHARACTERS  10CPI
CORRESPONDENCE  CHARACTERS  12CPI
PROPORTIONAL  CHARACTERS
```

```
GRAPHIC  CHARACTERS NORMAL
```
▪ ▚ ▟▀▟ ▐▜▙▄▄ ▭┳┠╵ ╙┵╂╊▞▟

```
GRAPHIC  CHARACTERS COMPRESSED
```
▪ ▚ ▟▀▟ ▐▜▙▄▄ ▭┳┠╵ ╙┵╂╊▞▟

```
GRAPHIC  CHARACTERS CONDENSED
```
▪ ▚ ▟▀▟ ▐▜▙▄ ▭┳┠╙┵╂╊▞▟

Italics

Any of the character font styles can be printed on a slant.

Table 11. Italic Printing

Send CHR$ ( )		
(Dec)	(Hex)	To:
27 66 1	1B 42 1	Start Italic Printing
27 66 0	1B 42 0	End Italic Printing

When a (27 66 1) code sequence is received, the DMP 130A prints the current buffer contents, then it begins italic printing from the next character received.

When a super-/subscript command is received during italic character printing, the DMP 130A prints the current buffer contents; then it enters into the super-/subscript printing mode.

Change the following program lines to:

```
100 LPRINT CHR$(27);CHR$(66);CHR$(1)
230 LPRINT CHR$(27);CHR$(66);CHR$(0);CHR$(27)
;CHR$(19):STOP
```

and RUN.

STANDARD CHARACTERS 10CPI
COMPRESSED CHARACTERS 12CPI
CONDENSED CHARACTERS 17CPI
CORRESPONDENCE   CHARACTERS   10CPI
CORRESPONDENCE   CHARACTERS   12CPI
PROPORTIONAL   CHARACTERS

GRAPHIC   CHARACTERS NORMAL

GRAPHIC   CHARACTERS COMPRESSED

GRAPHIC   CHARACTERS CONDENSED

Superscript and Subscript

In superscript and subscript printing, character height is cut in half. In superscript character printing, a character is printed on the upper half of a line; and in subscript, a character is printed on the lower half of a line.

Table 12. Super-/Subscript Printing

Send CHR$ ( )		
(Dec)	(Hex)	To:
27 83 0	1B 53 0	Start Superscript Printing
27 83 1	1B 53 1	Start Subscript Printing
27 88	1B 58	End Super-/Subscript Printing

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) code sequence is received, the DMP 130A prints the current buffer contents; then it returns to the font style which prevailed before entering superscript or subscript character printing.

The printing speed or horizontal dot resolution is fixed at 17CPI. The underline position is not changed.

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 "CHARACTERS"
70 END
```

and RUN it.

SUPERSCRIPT SUBSCRIPT CHARACTERS

In this program, lines 10 and 30 start superscript and subscript and line 50 ends the super-/subscript.

Microfont

In microfont mode, all printouts will be in superscript with a half-forward line feed (1/12″) in WP mode and half of the designated line pitch in DP mode.

Table 13. Microfont Printing

Send CHR$ ( )		
(Dec)	**(Hex)**	**To:**
27 77	1B 4D	Start Microfont

When a (27 77) code sequence is received, the DMP 130A prints the current buffer contents; then it enters the microfont mode.

In this mode, the italic function is invalid, even if you send an italic code.

As with superscript, the printing pitch for the microfont mode is 17CPI.

Type in the following NEW program:

```
10 LPRINT CHR$(27);CHR$(19)
20 GOSUB 100
30 LPRINT CHR$(27);CHR$(23):GOSUB 100
40 LPRINT CHR$(27);CHR$(20):GOSUB 100
50 LPRINT CHR$(27);CHR$(29):GOSUB 100
60 END
100 LPRINT CHR$(27);CHR$(77);
110 LPRINT "THIS IS MICROFONT."
120 RETURN
```

and RUN it.

THIS IS MICROFONT.

THIS IS MICROFONT.

THIS IS MICROFONT.

THIS IS MICROFONT.

To exit microfont, send any other font select code.
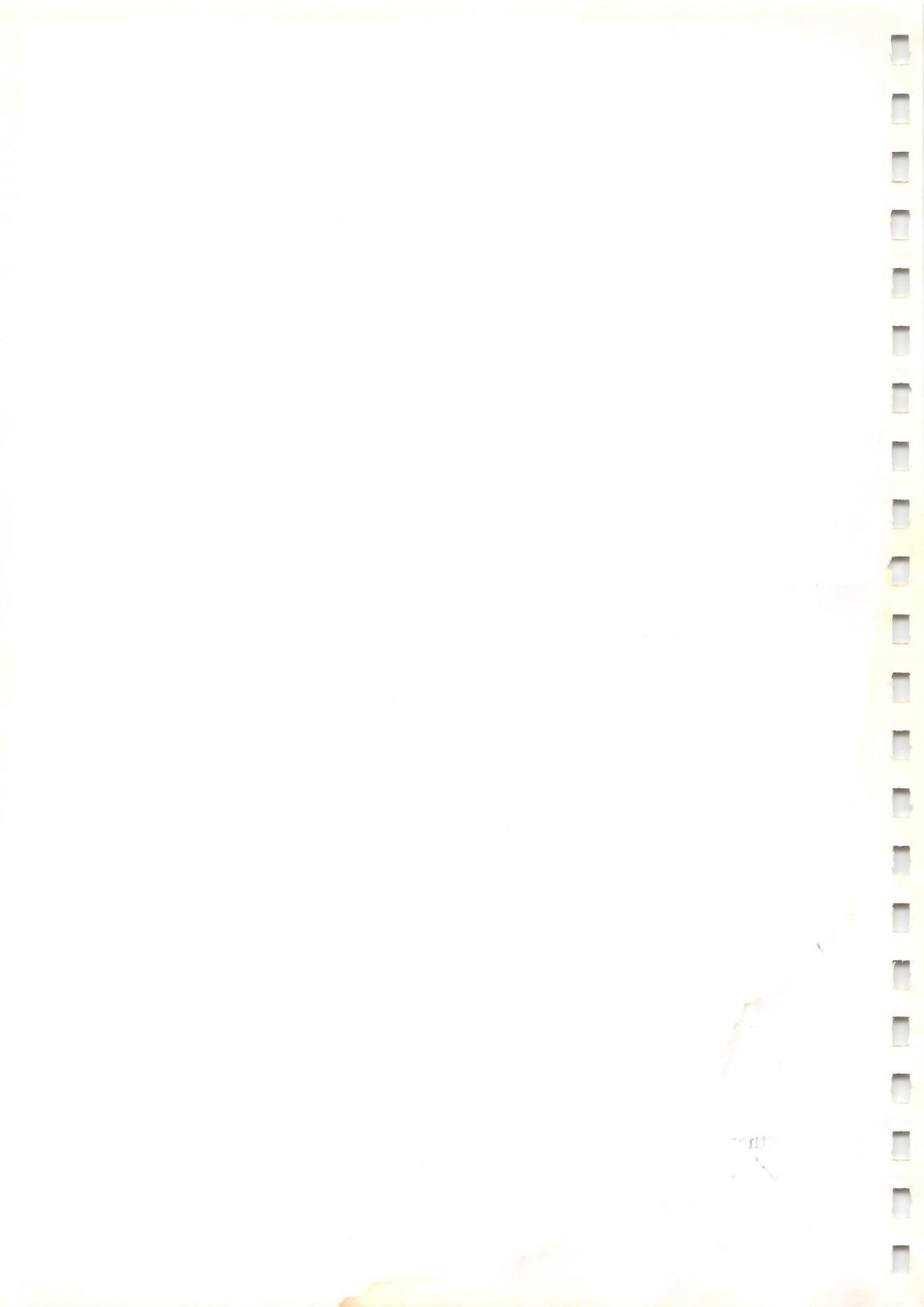
Line Feed Codes (LF)

When the DMP 130A receives an LF code (ASCII 10), all data in the Printer buffer is printed followed by a line feed. Unless you tell it otherwise, DMP 130A uses 1/6″ forward line feed when advancing paper. If you set DIP switch 1-6 to ON before turning on the power, the line feed pitch is set to 1/8″.

If DIP switch 1-3 is ON, a carriage return is also performed with the line feed, moving the print head to the start of the next print line. If DIP switch 1-3 is OFF, the print head stays in the current print column and moves down 1 line.

Other line feed codes control the pitch of the line feed. In DP mode, these codes can be stored in the buffer. In WP mode, they cause immediate printing.

Pitch setting is sent to the DMP 130A in a 2-code sequence. First, a control code 27 (CHR$(27)) is sent. This tells the DMP 130A that a special code sequence will follow. The next number determines the specific pitch. These control codes are listed in Table 14.

Table 14. Line Feed Control Codes

Send CHR$( )		To:
(Dec)	**(Hex)**	
27 10	1B 0A	Full-Reverse Line Feed (1/6″ or 1/8″)
27 28	1B 1C	Half-Forward Line Feed (1/12″ or 1/16″)
27 30	1B 1E	Half-Reverse Line Feed (1/12″ or 1/16″)
27 54	1B 36	Full-Forward Line Feed (1/6″ or 1/8″)
27 56	1B 38	Three-quarter Forward Line Feed (1/8″ or 3/32″)

Hints and Tips on Line Feed

- In data processing mode, codes are stored in the printer buffer. They are not activated until an LF code is sent. In word processing mode, these sequences cause the Printer to print the information in its buffer, then execute a line feed with the specified pitch and direction.

- CHR$(10) will not work from some BASIC with the CHR$ function. The LF code (10) is intercepted by BASIC and sent to the Printer as 13.

- All the codes in Table 14 are ignored in graphics mode.

- When DIP switch 1-3 is ON, a carriage return follows each line feed.

Special Line Feed Codes

There are 5 special forward line feed codes that operate in all 3 print modes.

Table 15. Special Line Feed Control Codes

Send CHR$( )			
(Dec)		(Hex)	To:
27 26		1B 1A	1/8 Forward Line Feed (1/48″)
27 50		1B 32	1/12 Forward Line Feed (1/72″)
27 51		1B 33	1/36 Forward Line Feed (1/216″)
27 57		1B 39	1/24 Forward Line Feed (1/144″)
27 64 n		1B 40 n	n/24 Forward Line Feed (n/144″)

1/8, 1/12, 1/36 and 1/24 Forward Line Feed

These line feed codes are unique for two reasons:

- They cause an immediate dump of the printer buffer followed by a line feed, regardless of the print mode.

- A carriage return is not performed, regardless of the setting of switch 1-3. These special line feed codes are useful for adjusting a print line or printing a dot-matrix picture.

Carriage Return (CR)

A CR (13 or 141) code tells the Printer to print the current buffer contents, and then perform a carriage return followed by a line feed or a carriage return only, depending on the following new line control code setting or on the setting of DIP switch 1-2.

Table 16. 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 130A with a CHR$(27); CHR$(21) already received, or with DIP switch 1-2 ON, only a carriage return is performed after printing the buffer contents.

- When a CR code is received with a CHR$(27); CHR$(22) already received, or with DIP switch 1-2 OFF, a carriage return followed by a line feed (NL) is carried out.

- At power-on, the Printer is set to a new line mode (provided DIP switch 1-2 is set to OFF).

Backspace

The DMP 130A can be backspaced from 1 to 255 dot columns when you send a 2-code sequence, of which the first code is CHR$(8). The second code is in the form of CHR$($n$), where n is a value from 1 to 255 and specifies how many dot columns to backspace from the current print head position. For example:

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

would backspace the print head 150 dot columns from the current position.

In general, backspacing should be done in multiples of the current character size. That is, backspacing for the standard character set should be 12 dots-per-character (9 dots plus 3 for spacing between characters). For instance, LPRINT CHR$(8); CHR$(24) would backspace 2 characters.

If n is 0, backspacing is not done. The repeat feature can be used to backspace more than 255 dot spaces.

If n is greater than the current dot position, printing starts at the beginning of the line. In graphics mode, the backspace code is ignored and n is treated as an independent character. Backspace works in both data and word processing modes.

Type in this program:

```
10 LPRINT TAB(30);"D P 1 O";
20 LPRINT CHR$(8);CHR$(72);"M   3 A"
```
and RUN the program.

Go ahead·and run it again. This time watch the action of the print head. The first string starts at position 30. The trailing semicolon holds the position right after the 0. CHR$(8); CHR$(72); backspaces 6 normal character widths (12 dots each, remember?) to place the M right between the D and P. You can imagine what would happen if the dot distance is miscalculated!

To backspace over elongated characters, simply double the number of dots. Try it. Change the program to:

```
10 LPRINT TAB(30);CHR$(27);CHR$(14);"D P 1 O";
20 LPRINT CHR$(8);CHR$(144);"M   3 A"
30 LPRINT CHR$(27);CHR$(15)
```
and RUN the program.

CHR$(27); CHR$(14) and CHR$(27); CHR$(15) get the DMP 130A in and out of elongated character width. Remember that you must compensate for the double-width characters by doubling the 72 in line 20 to 144.

The widths of the available character sets are shown in Table 17. The proportionally spaced character widths naturally vary from character to character.

Table 17. Character Set Width

Font Style		Dots/Character	To backspace:			
			1 Character		*n* Characters	
Standard	10 CPI	12	08	12	08	12 × n
	12 CPI	12	08	12	08	12 × n
	17 CPI	14	08	14	08	14 × n
NLQ	10 CPI	24	08	24	08	24 × n
	12 CPI	24	08	24	08	24 × n

The numbers in the dots/character column include blank dots between· characters.

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Top-of-Form and Form Length

The control code CHR$(27); CHR$(52); CHR$($n$) is used to set the form length in all 3 print modes. It resets the line feed count to 0 and sets the current line as the top-of-form position. The line length per page is set to n ($\times$ 1/6″) to be used with the form feed code. If n is 0 or 1, it is changed to 2. Whenever any line feed operation is activated, line feed pitch is counted up and compared with n ($\times$ 1/6″).

On initial power-up, the DMP 130A sets the top-of-form at the current paper position and the form length is set as follows, depending on the setting of DIP switches 1-4 and 1-6. Be sure the paper is properly positioned before you turn on the Printer.

Table 18. Form Length/Lines-per-Page

DIP Switch			
1-4	1-6	Form Length	Lines-per-Page
OFF	OFF	11 inches	66 lines
OFF	ON	11 inches	88 lines
ON	OFF	12 inches	72 lines
ON	ON	12 inches	96 lines

In single-sheet printing, the number of lines-per-page is 56.

Form Feed (FF)

When a CHR$(12) command is received, the print buffer contents are printed out completely, the paper is advanced to the next top-of-form position, and the line feed counter is reset to 0.

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

IBM mode

When a CHR$(27); CHR$(33) is received, the DMP 130A resets 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 1-1) are read again.

Ignored or Undefined Codes

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

There are several reasons a code can be unusable in a certain mode. Redundant codes that do not change the current printer status are usually ignored. For example, if the Printer is in DP mode, sending a CHR$(19) (used to enter DP mode) is useless. And there are many ASCII control codes in the range 0 to 31 that the DMP 130A simply does not recognize. ASCII 0, for example, is not used in any of the 3 print modes.

The following table summarizes the undefined print codes.

Table 19. Ignored Control Codes

All modes:
- Out of range on repeat sequence.
- Out of range on POS sequence.
- Redundant codes that do not change the current printer status. For example, if you send a CHR$(14) when underline is already set.

DP mode:	0, 1, 19, 30, 127, 255
WP mode:	0, 1, 20, 30, 127, 255
Graphics mode:	All codes in the range 0 – 127 are ignored, except (7), (10), (12), (13), (27 14), (27, 15), (27 16 $n1$ $n2$), (27, 21), (27 22), (27 26), (27 33), (27 50), (27 51), (27 52 n) (27, 57), (27 64 n), (27 72 n), (28 $n1$ $n2$), and (30).

Unprintable repeat sequence data $n2$ is also ignored.

Codes printed as $\overline{X}$
in DP and WP modes:
- All codes from 0 – 31 and 128 – 159, except the active function codes or the above ignored codes.
- Unprintable repeat data $n2$.

DMP 130A Buffer Operation

The DMP 130A's ability to temporarily store data is one its main advantages over a typewriter. Codes sent to a typewriter (that is, 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 (for example, 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 DP 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 if you wish to gain full control of the DMP 130A.

Hints and Tips on the DMP 130A Buffer

DP, WP, 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. Printing resumes at the start of the next line unless DIP switch 1-2 is set to ON (CR only). 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 last character received by the buffer is printed at the beginning of the next print line following an automatic line feed and carriage return.

- The form feed code (FF = 12 decimal) automatically activates printing (if the code makes it to the Printer). If LF only has been selected (DIP switch 1-3), then the buffer is printed and the print head moves to the next top-of-form line without a carriage return to the beginning of the line. Otherwise, the print head is positioned at the beginning of the next top-of-form line.

- The carriage return code (CR = 13 decimal) automatically activates printing (assuming at least 1 character code is already in the buffer). If carriage return only has been selected by the setting of DIP switch 1-2, the print head is moved to the beginning of the current line and the next buffer-full condition will result in printing over the current line. Otherwise, subsequent characters will be printed at the start of the next

print line.

- The line feed code (LF = 10 decimal) automatically activates printing. If LF only has been selected (DIP switch 1-3), then the buffer is printed and the print head moves to the next print line without a carriage return to the beginning of the line. Otherwise, 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 through the parallel interface, the buffer is printed. Printing continues from the current position.

- The head positioning sequence (27 16 *n*1 *n*2) prints the buffer. Printing continues in the current line at the dot address specified by the (27 16) command.

Data and word processing modes only

- The backspace command activates printing. Printing continues in the current line at the dot address specified by the command.

- If a character set of different dot density is selected, the data in the buffer is printed. Codes for changing character sets are: (27 17), (27 18), (27 19), (27 20), (27 23), (27 29), (27 31), and (27 32). Printing continues in the current line with the new character style.

- Dot graphics printing continues from the current character position.

- When a start bold or end bold command is received, the buffer is printed. Bold printing continues from the current character position.

- When a start super-/subscript, italics, microfont, compressed correspondence, proportional quality 12 CPI, or compressed code is received, the buffer is printed.

Graphics mode only

When the end graphics mode command is received, the Printer returns to the previous print mode and printing continues in the same line from the current print position.

> *Note 1:* In the description, *next line* means the new line performed by a line feed operation. In data processing mode, if a reverse line feed has been set in the memory, the line feed operation will cau : paper to move in the reverse direction.

> *Note 2:* Repeat data can cause a buffer-full condition, as well as an overflow by single characters.

Hex Print Mode

The DMP 130A is capable of printing hexadecimal values for data that are transmitted to it. This *hex print mode* is useful for checking exactly what information is being received by the Printer. To implement this function, turn ON the power to the Printer while simultaneously holding down the FORM FEED switch.

Before printing, be sure that 10-inch-wide paper is loaded in the Printer to avoid printing on the platen. Then press the ON-LINE switch and RUN the program that you want to check.

For example, the BASIC program line

```
10 LPRINT "NOW IS THE TIME FOR"
```

will normally print out as

```
NOW IS THE TIME FOR
```

If you enter hex print mode, the printout will look like this:

```
4E  4F  57  20  49  53  20  54  48  45  20
54  49  4D  45  20  46  4F  52  0D
```

To exit hex print mode, turn the Printer OFF and then ON again.

IBM Character Set

You can use the IBM character set 2 in Tandy mode by sending the code sequence CHR$(27) ; CHR$(58).

To return to the Tandy character set, send CHR$(27); CHR$(59). Only IBM character set 2 is applicable in Tandy mode.
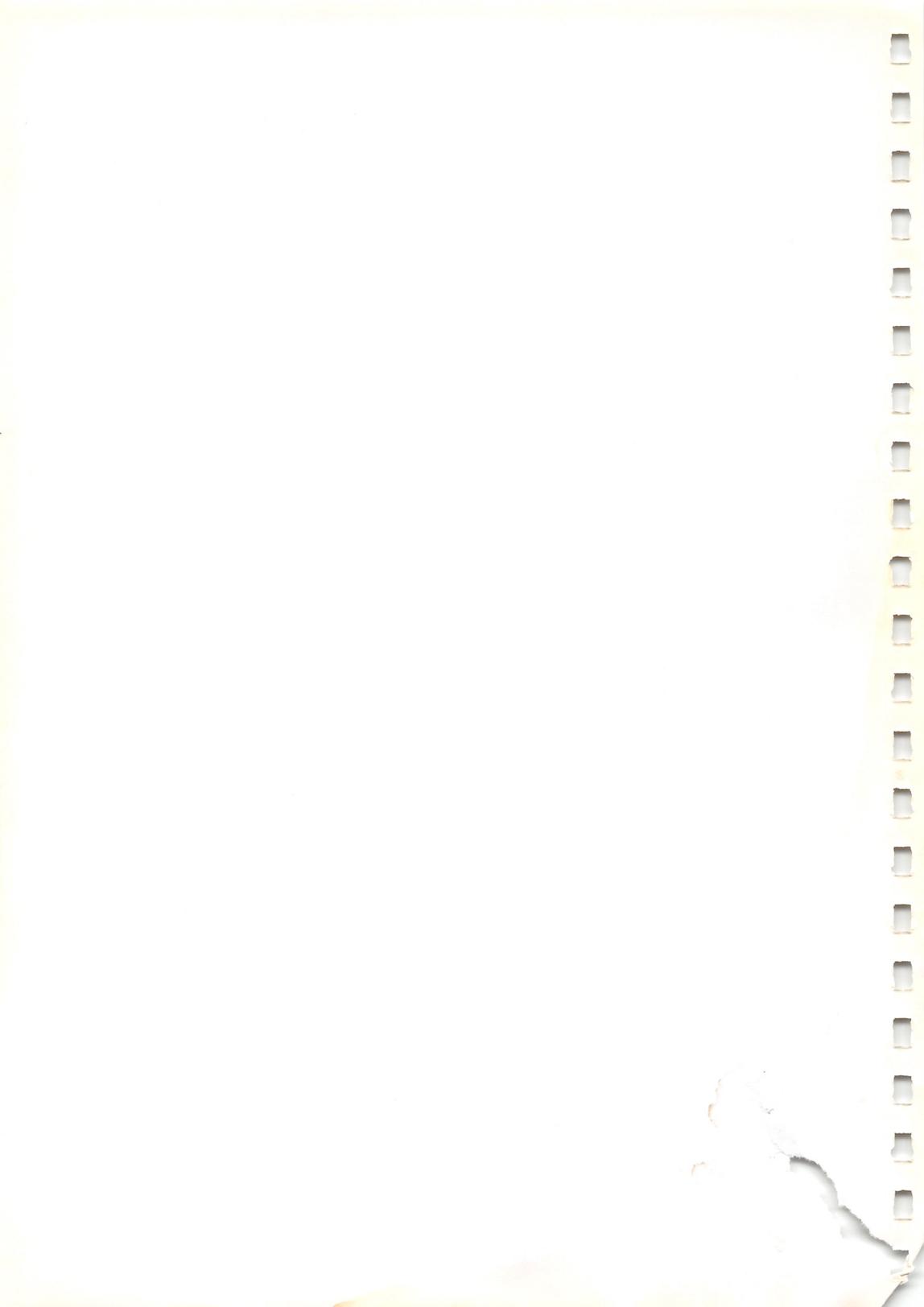
Word and Data
Processing Modes 5

Repeat Printing

The DMP 130A 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, block graphics, etc. The repeat feature uses a 3-code sequence:

- CHR$(28)
- Number of repetitions
- Code to be repeated

Type in this new program:

```
10 LPRINT "  /";REM 2 BLANK SPACES BEFORE TH
E /
20 LPRINT CHR$(27);CHR$(28);
30 LPRINT CHR$(28);CHR$(13);CHR$(241)
```

Code 241 is from the graphics character set.

```
40 LPRINT " ";REM 1 BLANK SPACE
50 LPRINT CHR$(8);CHR$(7);
60 LPRINT CHR$(92);"/(X"CHR$(27);"S";CHR$(0)
;"2";CHR$(27);"X";
70 LPRINT "+2X+1)"
80 END
```

Now RUN the program.

With a little fancy footwork, you were able to line up the 2 slashes and came up with a rough approximation of a square root sign. Brings back bad memories, doesn't it?

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

When you need to underline any text in either DP or WP mode, send the DMP 130A a CHR$(15). All text that follows this code will be underlined

until you send a CHR$(14) which stops underlining.

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 (leftmost 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 former character printing mode, the designation of underline is the same as it was before entering graphics mode.

Table 20. 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$(20);:REM WORD PROCESSING
20 LPRINT CHR$(15);:REM START UNDERLINE
30 LPRINT "LEEWAY BUSINESS PRODUCTS "
40 LPRINT CHR$(14);:REM STOP UNDERLINE
50 LPRINT "GIVES GOOD SERVICE"
60 END
```

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

Print Head Positioning

In either DP or WP mode, you can position the print head to a specific dot position. Every other print head position is accessible through the positioning sequence.

Using the normal character sets (10 CPI), there are 960 dot positions per line, but only half (480) are accessible by you. The following table indicates the available columns in each mode.

Table 21. Print Head Positioning by Font

Character Width	Dots-per-Line	Available Columns
Normal (10 CPI)	960	480
Compressed (12 CPI)	1152	576
Condensed (17 CPI)	1918	959
Correspondence (10 CPI)	1920	960
Correspondence (12 CPI)	2304	1152

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 2 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, or 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 2-code sequence which specifies the position. For instance:

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

where $n1$ is a value between 0-4 and $n2$ is a value between 0-255.

Table 22. Print Head Positioning

If you wish to specify dot column:	*n*1 must be:	*n*2 must be:
0-255	0	0-255
256-511	1	0-255
512-767	2	0-255
768-1023	3	0-255
1024-1152	4	0-128

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 dot columns up to 958 ($n1 = 3$, $n2 = 190$); correspondence 10 CPI printing allows you to access dot columns up to 959 ($n1 = 3$, $n2 = 191$); and correspondence 12 CPI allows you to access dot columns up to 1151 ($n1 = 4$, $n2 = 127$).

Why 2 numbers ($n1$ and $n2$)? The maximum value you can send to the DMP 130A with 1 number is 255, and clearly you have more than 255 dot positions available.

If you are a fan of binary math, you will recognize that the DMP 130A is interpreting these 2 numbers as a single 11-bit ($b(0) - b(10)$) value. The 3 lower bits of $n1$ are used as $b(8)$, $b(9)$, and $b(10)$.

Note: Use 10-inch-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
);"*"
```

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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 all 3 print modes, its potential is greatest in graphics mode.

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

```
10 LPRINT CHR$(27);CHR$(28);
20 FOR I=1 TO 100
30 LPRINT CHR$(27);CHR$(16);CHR$(1);CHR$(150
+I*SIN(I/5));
40 LPRINT "*"
50 NEXT I
```

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

Left and Right Margins

You can position the left or right margin to a specific character position designated by the current font pitch.

When you want to change the left or right margin to a new position, you must first send a CHR$(27); CHR$(81) to tell the Printer to change the margin. Follow this with another code which specifies the number of characters from the leftmost position.

Table 23. Left/Right Margin Set

Send CHR$( )		
(Dec)	(Hex)	To:
27 81 *n*	1B 51	Left Margin Set
27 82 *n*	1B 52	Right Margin Set

The value *n* indicates the number of characters counted by the current font pitch from the leftmost margin.

- Once the left/right margin position is set, this margin will not be changed even when the character mode is changed.

  Previously set tab-stop positions will not be affected by this command.

- When setting the left margin, the maximum value of *n* is limited to the maximum printable characters in the current printing mode minus 2

(for example, $137 - 2 = 135$ in normal printing mode); otherwise, this command will be ignored.

- When setting the right margin, the value of n must exceed the left margin value by 2; otherwise, this command will be ignored.

Skip Perforation

You can set a skip zone for a perforation at the bottom of the form.

Table 24. Skip Perforation Set

Send CHR$( )		
(Dec)	(Hex)	To:
27 72 *n*	1B 48 *n*	Set Skip Perforation

The skip zone is determined by the number of n times 1/6″ (or 1/8″ if DIP switch 1-6 is set to ON). n equals the number of full lines to leave blank at the bottom of the form.

- If the value is already set, the Printer automatically skips the designated area when printing.

- If n extends the form length, this sequence will be ignored.

- At power-on, DIP switch 1-5 determines whether 1-inch skip perforation will be performed.

Bidirectional and Unidirectional Printing

In DP or WP mode, either bidirectional or unidirectional printing is selectable.

Table 25. Bidirectional/Unidirectional Printing

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

If you need to select unidirectional printing, send a CHR$(27); CHR$(85); CHR$(1) and, to return to bidirectional printing, send a CHR$(27);

CHR$(85);CHR$(0). At power-up, bidirectional printing is selected.

International Characters

The (27 89 n) command is used to designate each country character. *n* must be within the range of $32 \leq n \leq 42$.

Table 26. Country Character Table

n	32 (20)H	33 (21)H	34 (22)H	35 (23)H	36 (24)H	37 (25)H	38 (26)H	39 (27)H	40 (28)H	41 (29)H	42 (2A)H
Country / ASCII Code	U.S.A.	Germany	France	Norway	Sweden	Denmark	Finland	Italy	Spain	England	Belgium
35 (23)H	#	#	£	#	#	#	#	£	£	£	#
36 (24)H	$	$	$	¤	¤	$	¤	$	$	$	$
64 (40)H	@	§	à	Ü	É	É	@	§	§	@	à
91 (5B)H	[	Ä	°	Æ	Ä	Æ	Ä	°	i	[	°
92 (5C)H	\	Ö	ç	Ø	Ö	Ø	Ö	ç	Ñ	\	ç
93 (5D)H	]	Ü	§	Å	Å	Å	Å	é	¿	]	§
94 (5E)H	^	^	^	Ä	Ü	Ü	^	^	^	^	^
96 (60)H	`	`	`	ü	é	é	´	ù	`	`	`
123 (7B)H	{	ä	é	æ	ä	æ	ä	à	°	{	é
124 (7C)H	¦	ö	ù	ø	ö	ø	ö	ò	ñ	|	ij
125 (7D)H	}	ü	è	å	å	å	å	è	ç	}	è
126 (7E)H	~	β	¨	ä	ü	ü	—	ì	~	—	—

When the DMP 130A receives this command, the ASCII codes that are input will print characters as specified above. USA is designated at power-on.
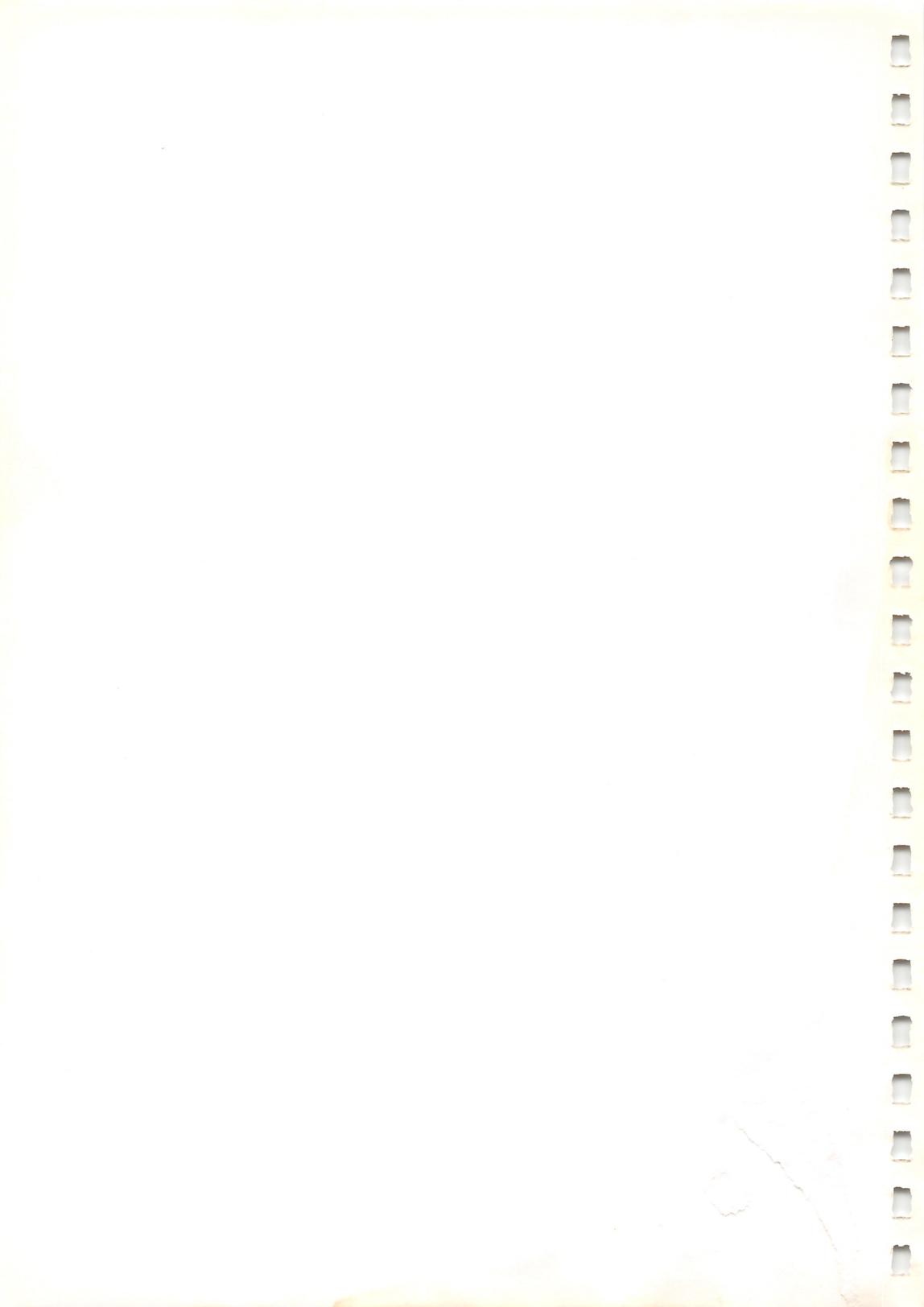
Graphics Mode 6

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 130A allows you to have direct, programmable control over all of the available graphic dots.

How many *across the paper* addressable dot columns are there? The correct answer is 480.

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 3,360 individual dots (7 × 480 = 3,360).

How do you print just 1 (or 2 or 3) of those dots in the dot column you want? For example, how can you print the third dot from the top in the 400th dot column?

Simple. Just follow this general procedure:

1. Send a CHR$(18) to put the DMP 130A in graphics mode.

2. Send a CHR$(27); CHR$(16) to tell the Printer you want to position the print head to print a specific dot.

3. 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.

4. 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 2-code sequence which specifies the position. For instance:

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

where *n1* is a value between 0-1 and *n2* is a value between 0-255.

Table 27. Graphic Dot Positioning

If you wish to specify the dot column:	*n*1 must be:	*n*2 must be:
0-255	0	0-255
256-479	1	0-223

Remember! Graphic printing allows you to access dot columns up to 479 ($n1 = 1$, $n2 = 223$).

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$(16);CHR$(0);CHR$(144
);CHR$(255)
```

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

In line 10, CHR$(18) puts the Printer in graphics mode and, in line 20, CHR$(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.

```
10 LPRINT CHR$(18);CHR$(27);CHR$(16);CHR$(1)
;CHR$(223);CHR$(255);
```

What happens is:

1. CHR$(18) puts the Printer into graphics mode.

2. CHR$(27); CHR$(16) tells the DMP 130A to get ready to position the print head.

3. CHR$(1) tells the Printer that the position will be greater than 255.

4. CHR$(223) specifies the last available dot column.

Note: If you use CHR$(224) in this line instead of CHR$(223), the DMP 130A would *wraparound* to the first dot column in the next line.

Graphics Patterns

By now, you should be adept at positioning the print head. Now you need to tell the DMP 130A what to print once the head is positioned.

Remember that there are 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 print head positioning was discussed. 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.

Try printing just the top dot of that last dot column (479).

```
10 LPRINT CHR$(18);CHR$(27);CHR$(16);CHR$(1)
;CHR$(223);CHR$(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 from 1 to 7. Table 28 describes the numbering system you must use with the DMP 130A when specifying an individual dot.

Table 28. 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. To print the bottom dot, change the program line to:

```
10 LPRINT CHR$(18);CHR$(27);CHR$(16);CHR$(1)
;CHR$(223);CHR$(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 28) that represents the individual dots you want to print.

2. Add those individual dot #'s together.

3. Add the sum of the combined dot #'s to 128.

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

```
10 LPRINT CHR$(18);CHR$(27);CHR$(16);CHR$(1)
;CHR$(223);CHR$(201);
```

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

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

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

```
10 LPRINT CHR$(18);CHR$(27);CHR$(16);CHR$(1)
;CHR$(3);CHR$(255);CHR$(201);CHR$(201);CHR$(
201);CHR$(201);CHR$(255);
```

Now to flex our muscles. Type in the following program:

NEW [ENTER]
```
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 2 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 a 7/72″ line feed. A single 7/72″ line feed advances the paper 7 dots or approximately 0.1 inch. This small paper advance allows for continuous printing without unwanted space between lines.

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

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

and RUN 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.

In addition to a 7/72″ line feed, the following 4 line feed codes are available:

- 1/72″ line feed — CHR$(27);CHR$(50)
- 1/144″ line feed — CHR$(27);CHR$(57)
- *n*/144″ line feed — CHR$(27);CHR$(64);CHR$(*n*)
  n should be a value between 1-255.
- 1/216″ line feed — CHR$(27);CHR$(51)

Repeat Function

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

The format for this 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.

Graphics Mode Exit

CHR$(30) is used to exit graphics mode. It returns the DMP 130A to the same mode (DP or WP) the Printer was in when it entered graphics mode. In addition, all the previous conditions, such as underline and character style, are restored. Change the sample program to:

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

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

and RUN it.

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

Freehand Drawing

The computer can do most of the work in drawing figures that can be described by a mathematical function. Freehand drawings, on the other hand, require translating the figure into a matrix of dots, then calculating the dot printing combinations for each print head position. Since there are 7 dots available for graphics, separate the matrix into rows 7 dots high.

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

```
NEW  [ENTER]
120 DATA 999
140 DATA 64,56,70,49,8,0,127,999
170 DATA 31,7,115,13,66,125,62,29,96,24,6,1,9
99
190 DATA 17,16,3,64,48,12,3,999
210 DATA 2,1,999
```

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$(18)
20 FOR R=1 TO 5
30 READ N:IF N=999 THEN 80
40 LPRINT CHR$(128+N);:GOTO 30
80 LPRINT:NEXT R
90 LPRINT CHR$(30)
100 LPRINT "DMP 130A"
```

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 -5,80,-7,32,-6,64,-5,32,96,999
130 DATA -3,0,96,16,72,116,59,8,96,112,-24,12
7,-6,126
180 DATA 3,12,-4,16,-7,33,-7,66,-8,4,-6,9,-3,
18
```

Don't RUN it yet!

In line 180, the sequence −4,16 is used to mean four 16's: 16,16,16,16. You must 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 does not look like much. Add the remaining DATA lines and see what you have been working on.

```
110 DATA -8,0,64,32,12,4,66,97,-4,113,97,110,
-4,104
150 DATA 120,6,65,68,71,75,8,10,-3,11,-2,19,-
4,23
160 DATA -2,39,-4,47,-2,79,-4,95,-2,31,-5,63
200 DATA -20,0,-8,1,-7,2,-4,4
```

RUN the program.

Now, that's worth the effort!

IBM Emulation Mode 7

The DMP 130A has 2 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.

When using the IBM mode, DIP switches 2-1 and 2-2 must be set to OFF. Serial interface selection is not supported while in the IBM mode.

Code Set Selection

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

If you send a CHR$(27); "!", it resets the Printer to the defaulted Tandy mode. (Refer to Appendix B.)

Character Set Selection

Three character sets (not character styles) are provided in the DMP130A; one is the Tandy character set and the other two are the IBM character sets (refer to Appendix A). In the IBM emulation mode, setting DIP switch 1-7 to OFF selects the IBM character set 1, while setting it ON selects the IBM character set 2. You can also designate character set 1 or character set 2 via software by sending the control codes CHR$(27); "7" (set 1) or CHR$(27); "6" (set 2).

Font Selection

The code CHR$(27);"I"; CHR$(1) selects the IBM high-speed font, and CHR$(27); "I"; CHR$(2) or CHR$(27); "I"; CHR$(3) selects the IBM letter-quality font.

When either of these commands is designated, the current buffer contents are printed and the Printer then enters the new font.

Carriage Return

The code 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 1-2 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 a carriage return and line feed are executed if CHR$(27); "5"; CHR$(1) is set. This command is given priority over the DIP switch 1-2 selection.

Vertical Formatting Control Codes

Line Feed Pitch

The LF pitch is set to 1/6 inch or 1/8 inch (designated by the setting of DIP switch 1-6) at power-on. You can change the pitch by sending the command CHR$(27); "0", CHR$(27); "1" 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 at 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.

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 1 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"
```

then RUN it. LF pitch is changed to 1/12 inch.

n/216" Variable Line Feed

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.

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.

Line Feed Execution Command

Line feed

The code CHR$(10) prints out the character and feeds the paper 1 line. The paper feed distance is specified by the DIP switch or the line spacing set commands as mentioned above. This command will terminate a double-width print mode set by code 14 or code sequence (27 14).

Reverse line feed

The code sequence (27 93) executes a 1/6" reverse line feed.

Top-of-Form and Form Length

The form length can be changed at any time if the friction 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$(*m*) sets the inches per page. *n* is a single-byte binary number and can represent any value between 1 and 127. *m* is also a single-byte binary number and can represent any value between 1 and 22. The top-of-form position is set at the current line after a form length setting command is executed. The form length is set to 11 or 12 inches (selected by DIP switch 1-4) at power-on. To set the current print position as the top-of-form, send CHR$(27); "4".

Form Feed

When a control code 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 1 and 127. This function is terminated by the CHR$(27); "O" command or the form length set command.

If the value for n exceeds the page length, the CHR$(27); "N"; CHR$(n) command is ignored.

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);
```

Line 61 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 28 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; 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) to skip to the next right TAB position.

- When TAB stops are not set, control code CHR$(9) is ignored.

- All the previously set TABs are cleared by designating new TAB stop positions.

• Horizontal TAB stops are set at every eighth column when the Printer is powered ON.

TAB Reset

The code CHR$(27); "R" restores all TAB columns to the default value of every eighth column.

Backspace

CHR$(8) causes the print head to backspace the length of 1 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 home position to print a line. This will occur for 1 line only.

Left and Right Margins

You can position the left and right margins to a specific character position designated by the current font pitch. Send control codes (27 88 n1 n2), where n1 is the left margin position and n2 is the right margin position ($1 < n1 < n2 < 233$). Both values n1 and n2 indicate the number of characters counted by the current font pitch from the leftmost margin. If the current font is proportionally spaced, the width of space (ASCII 32) is used.

Once set, the margin positions do not change even if you change the character font pitch.

The minimum distance between the left and right margins is 1/5″. If you give values that result in less than 1/5″, the Printer sets to minimum 1/5″.

The command is a print start command. When this command is received, the Printer prints out the current buffer contents and subsequent data will be printed from the designated left margin.

Variable Forward/Backward Space

You can move the print head forward or backward in increments of 1/120″. Use the code sequence (27 100 n1 n2) for forward spacing and

(27 101 n1 n2) for backward spacing. In either case, n1 and n2 are the number of print head motions in the unit of 1/120″. Each 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 × n2 (× 1/120″).

If the position you specify is beyond the right margin in forward spacing, the next print position is set to the left margin position. If the specified position is beyond the left margin in backward spacing, the Printer sets the next print position to the left margin.

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 pitch space is 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$(20) or a line feed. When it is established with CHR$(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"
```

and RUN it. **TITLE** is printed in double-width character mode, but **TEXT PRINTING** is not since an 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"
```

Compressed Printing

In the compressed printing mode, 10 CPI is changed to 17 CPI. Compressed printing can be selected with CHR$(15) or CHR$(27); CHR$(15), and released with CHR$(18).

Notes: 1. Condensed printing is suspended in bit image or emphasized printing mode. When the Printer exits either of these modes, condensed printing is restored.

      2. Condensed printing is available only in standard font; it is ignored when the correspondence font is selected.

Type in the following program:

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

and RUN it. Data can be printed with up to 137 characters in a line.

12 CPI Selection

If the current font is one of the high-speed character sets when code CHR$(27);":" is sent to the Printer, 12 CPI will be selected. If the current font is a letter-quality character set, correspondence 12 CPI characters will be selected. To return to 10 CPI, send CHR$(27); "M".

Proportional Spacing ON/OFF

Proportional Spacing OFF

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

This command only resets the proportional spacing condition.

Proportional Spacing ON

When the code CHR$(27); "P"; CHR$(1) is sent to the DMP 130A, the current buffer contents are printed and the font is changed to a proportional spacing font.

This command sets the character font to proportional spacing.

Emphasized Printing

In the emphasized printing mode, each character is printed once on the normal printing line, and again with a small shift horizontally. This emphasized printing mode is established by the control code CHR$(27); "E" and cancelled by CHR$(27); "F".

Enter the following program:

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

and RUN it. The word **Emphasized** is printed in boldfaced characters.

Double-Strike Printing

In the double-strike printing mode, characters are printed once on the normal printing line, and again with a small shift vertically; therefore, highlighted characters can be printed not only by emphasized printing, but also by the double-strike printing mode. This mode is established by CHR$(27); "G"; and cancelled by CHR$(27); "H".

Superscript and Subscript

With your DMP 130A, 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"
```

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).

Enter 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.

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

Bit Image Mode

There are four kinds of bit image modes in the DMP 130A. 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.

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 number of the horizontal dot positions. Each 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.

$v1$ 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. A dot pattern which corresponds with 1 bit is composed of 3 vertical dots × 3 horizontal dots in 1/360-inch dot pitch. 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$(27);"Y";CHR$(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 horizontal line should not be printed continuously 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) clears the *data* in the print buffer that was received prior to this command. Other *control codes* that were received prior to this control code remain in effect.

Unidirectional printing

Usually the DMP 130A executes bidirectional printing, but it allows you to print using a unidirectional printing method to avoid slight vertical misalignment. But 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 is to be printed unidirectionally, printing all the characters on a page in the unidirectional mode decreases the efficiency of the DMP 130A. Use the code CHR$(27); "<" to print only specific characters in the unidirectional mode. This code is cancelled by CHR$(13): only 1 line following this code is printed unidirectionally.

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.

Bell

When the code CHR$(07) is received, the Printer's buzzer sounds for 1 second. If DIP switch 2-2 is OFF, the buzzer does not sound.

Appendices

Tandy Character Set Table

Upper Bit Hex.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Lower Bit Hex. / Binary	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0 / 0000	POS (0)	SP (16)	0 (32)	@ (48)	P (64)	` (80)	p (96)	(112)	(128)	(144)	' (160)	¥ (176)	â (192)	Æ (208)	(224)	⌐ (240)
1 / 0001	DC1 (1)	! (17)	1 (33)	A (49)	Q (65)	a (81)	q (97)	(113)	(129)	(145)	à (161)	Ä (177)	ê (193)	æ (209)	■ (225)	─ (241)
2 / 0010	DC2 (2)	" (18)	2 (34)	B (50)	R (66)	b (82)	r (98)	(114)	(130)	(146)	ç (162)	Ö (178)	î (194)	Å (210)	■ (226)	¬ (242)
3 / 0011	DC3 (3)	# (19)	3 (35)	C (51)	S (67)	c (83)	s (99)	(115)	(131)	(147)	Ü (163)	ô (179)	å (195)	(211)	■ (227)	⊤ (243)
4 / 0100	DC4 (4)	$ (20)	4 (36)	D (52)	T (68)	d (84)	t (100)	(116)	(132)	(148)	` (164)	¢ (180)	û (196)	Ø (212)	▪ (228)	├ (244)
5 / 0101	(5)	% (21)	5 (37)	E (53)	U (69)	e (85)	u (101)	(117)	(133)	(149)	µ (165)	~ (181)	^ (197)	ø (213)	▪ (229)	│ (245)
6 / 0110	(6)	& (22)	6 (38)	F (54)	V (70)	f (86)	v (102)	(118)	(134)	(150)	° (166)	ä (182)	ë (198)	Ñ (214)	▪ (230)	└ (246)
7 / 0111	BEL (7)	ETB (23)	' (39)	7 (55)	G (71)	W (87)	g (103)	w (119)	(135)	(151)	▼ (167)	ö (183)	ï (199)	É (215)	■ (231)	┘ (247)
8 / 1000	BS (8)	(24)	((40)	8 (56)	H (72)	X (88)	h (104)	x (120)	(136)	(152)	† (168)	ü (184)	á (200)	Á (216)	▬ (232)	⊥ (248)
9 / 1001	(9)	(25)	) (41)	9 (57)	I (73)	Y (89)	i (105)	y (121)	(137)	(153)	§ (169)	β (185)	í (201)	Í (217)	▮ (233)	┤ (249)
A / 1010	LF (10)	SUB (26)	✳ (42)	: (58)	J (74)	Z (90)	j (106)	z (122)	LF (138)	(154)	® (170)	TM (186)	ó (202)	Ó (218)	■ (234)	+ (250)
B / 1011	(11)	ESC (27)	+ (43)	; (59)	K (75)	[(91)	k (107)	{ (123)	(139)	(155)	© (171)	é (187)	ú (203)	Ú (219)	◀ (235)	▶ (251)
C / 1100	FF (12)	FS (28)	, (44)	< (60)	L (76)	\ (92)	l (108)	| (124)	(140)	(156)	¼ (172)	ù (188)	¡ (204)	¿ (220)	◥ (236)	▲ (252)
D / 1101	CR (13)	GS (29)	- (45)	= (61)	M (77)	] (93)	m (109)	} (125)	CR (141)	(157)	¾ (173)	è (189)	ñ (205)	Ù (221)	◣ (237)	◥ (253)
E / 1110	SO (14)	RS (30)	. (46)	> (62)	N (78)	^ (94)	n (110)	~ (126)	(142)	(158)	½ (174)	¨ (190)	ã (206)	È (222)	◢ (238)	◤ (254)
F / 1111	SI (15)	US (31)	/ (47)	? (63)	O (79)	_ (95)	o (111)	(127)	(146)	(159)	¶ (175)	ƒ (191)	ö (207)	Å (223)	(239)	(255)

!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[
\]^_`abcdefghijklmnopqrstuvwxyz{|}~¯àç£`µ°˙†§®‡‡‖¶¥ÄÜÇ~äßÜ
ßÆéüè¨ƒæîôû^ëÏáÍóüì ñãõÆæÅåØøÑÉáÍóÚùèÀ ■ ▬ ▭▬ ▬▬ ▭┬┬
┴┴┤┼╱╲

Dot Column Width of Tandy Characters

Standard and Proportional Characters

Upper Bit → Hex.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Lower Bit Hex. / Binary	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0 / 0000			12	11	11	11	8	11			8	11	11	11	12	12
1 / 0001			9	9	11	11	11	11			11	11	11	11	12	12
2 / 0010			9	11	11	11	11	10			9	11	9	11	12	12
3 / 0011			11	11	11	11	9	11			11	11	11	11	12	12
4 / 0100			11	11	11	11	11	11			8	10	11	11	12	12
5 / 0101			11	11	11	11	11	11			12	10	9	11	12	12
6 / 0110			11	11	11	11	9	11			9	11	11	11	12	12
7 / 0111			9	11	11	11	11	11			9	11	11	11	12	12
8 / 1000			8	11	11	10	11	11			12	11	11	11	12	12
9 / 1001			9	11	9	11	9	11			11	11	9	9	12	12
A / 1010			11	9	11	11	8	11			12	12	11	11	12	12
B / 1011			11	9	11	9	9	9			12	11	11	11	12	12
C / 1100			9	10	11	10	9	9			12	11	9	10	12	12
D / 1101			11	11	11	9	11	9			12	11	11	11	12	12
E / 1110			9	10	11	9	11	10			12	9	11	11	12	12
F / 1111			10	10	11	11	11				9	10	11	11	12	

Decimal codes (bottom-right of each cell), reading left-to-right, top-to-bottom: 0,16,32,48,64,80,96,112,128,144,160,176,192,208,224,240 / 1,17,33,49,65,81,97,113,129,145,161,177,193,209,225,241 / 2,18,34,50,66,82,98,114,130,146,162,178,194,210,226,242 / 3,19,35,51,67,83,99,115,131,147,163,179,195,211,227,243 / 4,20,36,52,68,84,100,116,132,148,164,180,196,212,228,244 / 5,21,37,53,69,85,101,117,133,149,165,181,197,213,229,245 / 6,22,38,54,70,86,102,118,134,150,166,182,198,214,230,246 / 7,23,39,55,71,87,103,119,135,151,167,183,199,215,231,247 / 8,24,40,56,72,88,104,120,136,152,168,184,200,216,232,248 / 9,25,41,57,73,89,105,121,137,153,169,185,201,217,233,249 / 10,26,42,58,74,90,106,122,138,154,170,186,202,218,234,250 / 11,27,43,59,75,91,107,123,139,155,171,187,203,219,235,251 / 12,28,44,60,76,92,108,124,140,156,172,188,204,220,236,252 / 13,29,45,61,77,93,109,125,141,157,173,189,205,221,237,253 / 14,30,46,62,78,94,110,126,142,158,174,190,206,222,238,254 / 15,31,47,63,79,95,111,127,143,159,175,191,207,223,239,255

GRAPHICS

⊠	¤	—	ò	ì	│	lj
11	11	12	11	9	9	11

Correspondence and Proportional Characters

Upper Bit Hex. / Lower Bit Hex.	Binary	0 0000	1 0001	2 0010	3 0011	4 0100	5 0101	6 0110	7 0111	8 1000	9 1001	A 1010	B 1011	C 1100	D 1101	E 1110	F 1111
0	0000	[0]	[16]	24 [32]	21 [48]	21 [64]	22 [80]	17 [96]	23 [112]	[128]	[144]	19 [160]	23 [176]	22 [192]	24 [208]	24 [224]	24 [240]
1	0001	[1]	[17]	13 [33]	20 [49]	23 [65]	23 [81]	22 [97]	23 [113]	[129]	[145]	22 [161]	23 [177]	21 [193]	24 [209]	24 [225]	24 [241]
2	0010	[2]	[18]	17 [34]	21 [50]	23 [66]	23 [82]	23 [98]	22 [114]	[130]	[146]	22 [162]	23 [178]	20 [194]	23 [210]	24 [226]	24 [242]
3	0011	[3]	[19]	23 [35]	21 [51]	23 [67]	23 [83]	22 [99]	23 [115]	[131]	[147]	21 [163]	23 [179]	22 [195]	22 [211]	24 [227]	24 [243]
4	0100	[4]	[20]	21 [36]	21 [52]	23 [68]	23 [84]	23 [100]	21 [116]	[132]	[148]	17 [164]	21 [180]	23 [196]	23 [212]	24 [228]	24 [244]
5	0101	[5]	[21]	23 [37]	21 [53]	23 [69]	23 [85]	21 [101]	23 [117]	[133]	[149]	23 [165]	21 [181]	16 [197]	19 [213]	24 [229]	24 [245]
6	0110	[6]	[22]	23 [38]	21 [54]	23 [70]	23 [86]	21 [102]	23 [118]	[134]	[150]	19 [166]	22 [182]	21 [198]	24 [214]	24 [230]	24 [246]
7	0111	[7]	[23]	13 [39]	21 [55]	23 [71]	24 [87]	23 [103]	24 [119]	[135]	[151]	17 [167]	22 [183]	21 [199]	23 [215]	24 [231]	24 [247]
8	1000	[8]	[24]	20 [40]	21 [56]	23 [72]	23 [88]	23 [104]	23 [120]	[136]	[152]	22 [168]	23 [184]	22 [200]	23 [216]	24 [232]	24 [248]
9	1001	[9]	[25]	16 [41]	21 [57]	18 [73]	23 [89]	20 [105]	23 [121]	[137]	[153]	21 [169]	21 [185]	20 [201]	19 [217]	24 [233]	24 [249]
A	1010	[10]	[26]	22 [42]	13 [58]	19 [74]	22 [90]	16 [106]	21 [122]	[138]	[154]	21 [170]	24 [186]	22 [202]	23 [218]	24 [234]	24 [250]
B	1011	[11]	[27]	22 [43]	13 [59]	23 [75]	13 [91]	23 [107]	21 [123]	[139]	[155]	21 [171]	21 [187]	23 [203]	23 [219]	24 [235]	24 [251]
C	1100	[12]	[28]	13 [44]	19 [60]	22 [76]	23 [92]	20 [108]	13 [124]	[140]	[156]	19 [172]	23 [188]	13 [204]	21 [220]	24 [236]	24 [252]
D	1101	[13]	[29]	21 [45]	21 [61]	24 [77]	13 [93]	24 [109]	16 [125]	[141]	[157]	21 [173]	21 [189]	23 [205]	23 [221]	24 [237]	24 [253]
E	1110	[14]	[30]	13 [46]	19 [62]	24 [78]	19 [94]	23 [110]	21 [126]	[142]	[158]	19 [174]	20 [190]	22 [206]	23 [222]	24 [238]	24 [254]
F	1111	[15]	[31]	23 [47]	21 [63]	23 [79]	24 [95]	22 [111]	[127]	[143]	[159]	20 [175]	21 [191]	22 [207]	23 [223]	24 [239]	[255]

GRAPHICS

⊠	⌻	—	ò	ì	|	lj
23	23	24	22	20	13	24

85

IBM Character Set 1

Upper Bit Hex / Lower Bit Hex (Binary)	0 (0000)	1 (0001)	2 (0010)	3 (0011)	4 (0100)	5 (0101)	6 (0110)	7 (0111)	8 (1000)	9 (1001)	A (1010)	B (1011)	C (1100)	D (1101)	E (1110)	F (1111)
0 (0000)	NUL (0)	(16)	SP (32)	0 (48)	@ (64)	P (80)	` (96)	p (112)	(128)	, (144)	á (160)	▌ (176)	└ (192)	⊥ (208)	α (224)	≡ (240)
1 (0001)	(1)	(17)	! (33)	1 (49)	A (65)	Q (81)	a (97)	q (113)	(129)	(145)	í (161)	▓ (177)	⊥ (193)	┬ (209)	β (225)	± (241)
2 (0010)	DC2 (2)	(18)	" (34)	2 (50)	B (66)	R (82)	b (98)	r (114)	DC2 (130)	(146)	ó (162)	▓ (178)	┬ (194)	┬ (210)	Γ (226)	≥ (242)
3 (0011)	(3)	(19)	# (35)	3 (51)	C (67)	S (83)	c (99)	s (115)	(131)	(147)	ú (163)	│ (179)	├ (195)	└ (211)	π (227)	≤ (243)
4 (0100)	DC4 (4)	(20)	$ (36)	4 (52)	D (68)	T (84)	d (100)	t (116)	DC4 (132)	(148)	ñ (164)	┤ (180)	─ (196)	└ (212)	Σ (228)	∫ (244)
5 (0101)	(5)	(21)	% (37)	5 (53)	E (69)	U (85)	e (101)	u (117)	(133)	(149)	Ñ (165)	┤ (181)	+ (197)	┌ (213)	σ (229)	∫ (245)
6 (0110)	(6)	(22)	& (38)	6 (54)	F (70)	V (86)	f (102)	v (118)	(134)	(150)	ª (166)	┤ (182)	├ (198)	┌ (214)	µ (230)	÷ (246)
7 (0111)	BEL (7)	(23)	' (39)	7 (55)	G (71)	W (87)	g (103)	w (119)	BEL (135)	(151)	º (167)	┐ (183)	├ (199)	+ (215)	τ (231)	≈ (247)
8 (1000)	BS (8)	CAN (24)	((40)	8 (56)	H (72)	X (88)	h (104)	x (120)	BS (136)	CAN (152)	¿ (168)	┤ (184)	└ (200)	+ (216)	Φ (232)	° (248)
9 (1001)	HT (9)	(25)	) (41)	9 (57)	I (73)	Y (89)	i (105)	y (121)	HT (137)	(153)	┌ (169)	┤ (185)	┌ (201)	┘ (217)	θ (233)	∙ (249)
A (1010)	LF (10)	✳ (26)	* (42)	: (58)	J (74)	Z (90)	j (106)	z (122)	LF (138)	(154)	¬ (170)	│ (186)	⊥ (202)	┌ (218)	Ω (234)	─ (250)
B (1011)	VT (11)	ESC (27)	+ (43)	; (59)	K (75)	[(91)	k (107)	{ (123)	VT (139)	ESC (155)	½ (171)	┐ (187)	┬ (203)	■ (219)	δ (235)	√ (251)
C (1100)	FF (12)	(28)	, (44)	< (60)	L (76)	\ (92)	l (108)	| (124)	FF (140)	(156)	¼ (172)	┘ (188)	├ (204)	▄ (220)	∞ (236)	∩ (252)
D (1101)	CR (13)	─ (29)	- (45)	= (61)	M (77)	] (93)	m (109)	} (125)	CR (141)	(157)	¡ (173)	┘ (189)	─ (205)	▌ (221)	Ø (237)	² (253)
E (1110)	SO (14)	∙ (30)	. (46)	> (62)	N (78)	^ (94)	n (110)	~ (126)	SO (142)	(158)	« (174)	┘ (190)	+ (206)	▐ (222)	∈ (238)	■ (254)
F (1111)	SI (15)	(31)	/ (47)	? (63)	O (79)	_ (95)	o (111)	(127)	SI (143)	(159)	» (175)	┐ (191)	⊥ (207)	▀ (223)	∩ (239)	SP (255)

Note: When using the ESC· ∧ ·n command, codes 3, 4, 5, 6, 19, 20 and 21 are printed as ♥, ♦, ♣, ♠, ‼, ¶ and §, respectively.

!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ
[\]^_`abcdefghijklmnopqrstuvwxyz{|}~áíóúñÑªº¿⌐¬½¼¡«»▓▒░│┤╡╢╖╕
╣║╗╝╜╛┐└┴┬├─┼╞╟╚╔╩╦╠═╬╧╨╤╥╙╘╒╓╫╪┘┌█▄▌▐▀αβΓπΣσµτΦΘΩδ∞φε∩≡±≥≤⌠⌡÷≈°∙·√ⁿ²■

86

IBM Character Set 2

Upper Bit Hex. → Lower Bit Hex. / Binary	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0 / 0000	NUL (0)	(16)	SP (32)	0 (48)	@ (64)	P (80)	` (96)	p (112)	Ç (128)	É (144)	á (160)	▓ (176)	└ (192)	┴ (208)	α (224)	≡ (240)
1 / 0001	(1)	(17)	! (33)	1 (49)	A (65)	Q (81)	a (97)	q (113)	ü (129)	æ (145)	í (161)	▒ (177)	┴ (193)	┬ (209)	β (225)	± (241)
2 / 0010	(2)	DC2 (18)	" (34)	2 (50)	B (66)	R (82)	b (98)	r (114)	é (130)	Æ (146)	ó (162)	█ (178)	┬ (194)	┬ (210)	Γ (226)	≥ (242)
3 / 0011	♥ (3)	(19)	# (35)	3 (51)	C (67)	S (83)	c (99)	s (115)	â (131)	ô (147)	ú (163)	│ (179)	├ (195)	└ (211)	π (227)	≤ (243)
4 / 0100	♦ (4)	DC4 (20)	$ (36)	4 (52)	D (68)	T (84)	d (100)	t (116)	ä (132)	ö (148)	ñ (164)	┤ (180)	├ (196)	┌ (212)	Σ (228)	⌠ (244)
5 / 0101	♣ (5)	§ (21)	% (37)	5 (53)	E (69)	U (85)	e (101)	u (117)	à (133)	ò (149)	Ñ (165)	┤ (181)	┼ (197)	┌ (213)	σ (229)	⌡ (245)
6 / 0110	♠ (6)	§ (22)	& (38)	6 (54)	F (70)	V (86)	f (102)	v (118)	å (134)	û (150)	a̲ (166)	┤ (182)	├ (198)	┌ (214)	µ (230)	÷ (246)
7 / 0111	BEL (7)	(23)	' (39)	7 (55)	G (71)	W (87)	g (103)	w (119)	ç (135)	ù (151)	o̲ (167)	┐ (183)	├ (199)	┼ (215)	τ (231)	≈ (247)
8 / 1000	BS (8)	CAN (24)	((40)	8 (56)	H (72)	X (88)	h (104)	x (120)	ê (136)	ÿ (152)	¿ (168)	┐ (184)	└ (200)	┼ (216)	Φ (232)	° (248)
9 / 1001	HT (9)	(25)	) (41)	9 (57)	I (73)	Y (89)	i (105)	y (121)	ë (137)	Ö (153)	┌ (169)	┤ (185)	┌ (201)	┘ (217)	θ (233)	∙ (249)
A / 1010	LF (10)	(26)	* (42)	: (58)	J (74)	Z (90)	j (106)	z (122)	è (138)	Ü (154)	¬ (170)	│ (186)	┴ (202)	┌ (218)	Ω (234)	— (250)
B / 1011	VT (11)	ESC (27)	+ (43)	; (59)	K (75)	[(91)	k (107)	{ (123)	ï (139)	¢ (155)	½ (171)	┐ (187)	┬ (203)	█ (219)	δ (235)	√ (251)
C / 1100	FF (12)	(28)	, (44)	< (60)	L (76)	\ (92)	l (108)		(124)	î (140)	£ (156)	¼ (172)	┘ (188)	├ (204)	▬ (220)	∞ (236)	∩ (252)
D / 1101	CR (13)	(29)	- (45)	= (61)	M (77)	] (93)	m (109)	} (125)	ì (141)	¥ (157)	¡ (173)	┘ (189)	┴ (205)	▮ (221)	Ø (237)	² (253)
E / 1110	SO (14)	(30)	. (46)	> (62)	N (78)	^ (94)	n (110)	~ (126)	Ä (142)	Pt (158)	« (174)	┘ (190)	┼ (206)	▮ (222)	∈ (238)	■ (254)
F / 1111	SI (15)	(31)	/ (47)	? (63)	O (79)	_ (95)	o (111)	(127)	Å (143)	f (159)	» (175)	┐ (191)	┴ (207)	▬ (223)	∩ (239)	SP (255)

Note: When using the ESC· ∧ ·n command, codes 19 and 20 are printed as !! and ¶, respectively.

♥♦♣♠§ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTU
VWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ÇüéâäàåçêëèïîìÄÅéæ
ÆôöòûùÿÖÜ¢£¥₧ƒáíóúñÑªº¿⌐¬½¼¡«»▓▒█││┤╡╢╖╕╣║╗╝╜╛┐└┴┬├─┼╞╟
╚╔╩╦╠═╬╧╨╤╥╙╘╒╓╫╪┘┌█▄▌▐▀αßΓπΣσµτΦΘΩδ∞φε∩≡±≥≤⌠⌡÷≈°∙·√ⁿ²■

87

Dot Column Width of IBM Characters

Standard and Proportional Characters

Upper Bit Hex. / Lower Bit Hex. Binary	0 / 0000	1 / 0001	2 / 0010	3 / 0011	4 / 0100	5 / 0101	6 / 0110	7 / 0111	8 / 1000	9 / 1001	A / 1010	B / 1011	C / 1100	D / 1101	E / 1110	F / 1111
0 / 0000	(0)	(16)	12 (32)	11 (48)	11 (64)	11 (80)	8 (96)	11 (112)	11 (128)	11 (144)	11 (160)	12 (176)	12 (192)	12 (208)	11 (224)	11 (240)
1 / 0001	(1)	(17)	9 (33)	9 (49)	11 (65)	11 (81)	11 (97)	11 (113)	11 (129)	11 (145)	9 (161)	12 (177)	12 (193)	12 (209)	11 (225)	11 (241)
2 / 0010	(2)	(18)	9 (34)	11 (50)	11 (66)	11 (82)	10 (98)	11 (114)	11 (130)	11 (146)	11 (162)	12 (178)	12 (194)	12 (210)	10 (226)	10 (242)
3 / 0011	11 (3)	9 (19)	11 (35)	11 (51)	11 (67)	11 (83)	9 (99)	11 (115)	11 (131)	11 (147)	11 (163)	12 (179)	12 (195)	12 (211)	11 (227)	10 (243)
4 / 0100	11 (4)	9 (20)	11 (36)	11 (52)	11 (68)	11 (84)	11 (100)	11 (116)	11 (132)	11 (148)	11 (164)	12 (180)	12 (196)	12 (212)	10 (228)	12 (244)
5 / 0101	11 (5)	11 (21)	11 (37)	11 (53)	11 (69)	11 (85)	11 (101)	11 (117)	11 (133)	11 (149)	11 (165)	12 (181)	12 (197)	12 (213)	11 (229)	12 (245)
6 / 0110	11 (6)	(22)	11 (38)	11 (54)	11 (70)	9 (86)	11 (102)	11 (118)	11 (134)	11 (150)	11 (166)	12 (182)	12 (198)	12 (214)	12 (230)	11 (246)
7 / 0111	(7)	(23)	9 (39)	11 (55)	11 (71)	11 (87)	11 (103)	11 (119)	9 (135)	11 (151)	11 (167)	12 (183)	12 (199)	12 (215)	11 (231)	11 (247)
8 / 1000	(8)	(24)	8 (40)	11 (56)	11 (72)	10 (88)	11 (104)	11 (120)	11 (136)	11 (152)	10 (168)	12 (184)	12 (200)	12 (216)	10 (232)	9 (248)
9 / 1001	(9)	(25)	9 (41)	11 (57)	9 (73)	11 (89)	9 (105)	11 (121)	11 (137)	11 (153)	11 (169)	12 (185)	12 (201)	12 (217)	11 (233)	9 (249)
A / 1010	(10)	(26)	11 (42)	9 (58)	11 (74)	11 (90)	8 (106)	11 (122)	11 (138)	11 (154)	11 (170)	12 (186)	12 (202)	12 (218)	11 (234)	9 (250)
B / 1011	(11)	(27)	11 (43)	9 (59)	11 (75)	9 (91)	9 (107)	9 (123)	9 (139)	10 (155)	11 (171)	12 (187)	12 (203)	12 (219)	11 (235)	11 (251)
C / 1100	(12)	(28)	9 (44)	10 (60)	11 (76)	10 (92)	9 (108)	9 (124)	9 (140)	11 (156)	11 (172)	12 (188)	12 (204)	12 (220)	11 (236)	9 (252)
D / 1101	(13)	(29)	11 (45)	11 (61)	11 (77)	9 (93)	11 (109)	9 (125)	9 (141)	11 (157)	9 (173)	12 (189)	12 (205)	12 (221)	11 (237)	8 (253)
E / 1110	(14)	(30)	9 (46)	10 (62)	11 (78)	9 (94)	11 (110)	10 (126)	11 (142)	11 (158)	11 (174)	12 (190)	12 (206)	12 (222)	10 (238)	9 (254)
F / 1111	(15)	(31)	10 (47)	10 (63)	11 (79)	11 (95)	11 (111)	(127)	11 (143)	10 (159)	11 (175)	12 (191)	12 (207)	12 (223)	10 (239)	12 (255)

GRAPHICS

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11	11	12	9	8	9	11	11

Correspondence and Proportional Characters

Upper Bit → Hex columns; Lower Bit → Hex rows. Each cell shows the proportional-character width value (top) and the decimal code (bottom‑right).

Lower Hex	Binary	0 (0000)	1 (0001)	2 (0010)	3 (0011)	4 (0100)	5 (0101)	6 (0110)	7 (0111)	8 (1000)	9 (1001)	A (1010)	B (1011)	C (1100)	D (1101)	E (1110)	F (1111)
0	0000	(0)	(16)	24 (32)	21 (48)	21 (64)	22 (80)	17 (96)	23 (112)	23 (128)	23 (144)	22 (160)	24 (176)	24 (192)	24 (208)	24 (224)	24 (240)
1	0001	(1)	(17)	13 (33)	20 (49)	23 (65)	23 (81)	22 (97)	23 (113)	23 (129)	24 (145)	20 (161)	24 (177)	24 (193)	24 (209)	21 (225)	24 (241)
2	0010	(2)	(18)	17 (34)	21 (50)	23 (66)	23 (82)	23 (98)	22 (114)	21 (130)	24 (146)	22 (162)	24 (178)	24 (194)	24 (210)	19 (226)	24 (242)
3	0011	24 (3)	19 (19)	23 (35)	21 (51)	23 (67)	23 (83)	22 (99)	23 (115)	22 (131)	22 (147)	23 (163)	24 (179)	24 (195)	24 (211)	23 (227)	24 (243)
4	0100	24 (4)	20 (20)	21 (36)	21 (52)	23 (68)	23 (84)	23 (100)	21 (116)	22 (132)	22 (148)	23 (164)	24 (180)	24 (196)	24 (212)	17 (228)	24 (244)
5	0101	24 (5)	21 (21)	23 (37)	21 (53)	23 (69)	23 (85)	21 (101)	23 (117)	22 (133)	22 (149)	24 (165)	24 (181)	24 (197)	24 (213)	20 (229)	24 (245)
6	0110	24 (6)	(22)	23 (38)	21 (54)	23 (70)	23 (86)	21 (102)	23 (118)	22 (134)	23 (150)	23 (166)	24 (182)	24 (198)	24 (214)	23 (230)	23 (246)
7	0111	(7)	(23)	13 (39)	21 (55)	23 (71)	24 (87)	23 (103)	24 (119)	22 (135)	23 (151)	23 (167)	24 (183)	24 (199)	24 (215)	19 (231)	24 (247)
8	1000	(8)	(24)	20 (40)	21 (56)	23 (72)	23 (88)	23 (104)	23 (120)	21 (136)	23 (152)	21 (168)	24 (184)	24 (200)	24 (216)	23 (232)	19 (248)
9	1001	(9)	(25)	16 (41)	21 (57)	18 (73)	23 (89)	20 (105)	23 (121)	21 (137)	23 (153)	24 (169)	24 (185)	24 (201)	24 (217)	19 (233)	13 (249)
A	1010	(10)	(26)	22 (42)	13 (58)	19 (74)	22 (90)	16 (106)	21 (122)	21 (138)	23 (154)	24 (170)	24 (186)	24 (202)	24 (218)	23 (234)	13 (250)
B	1011	(11)	(27)	22 (43)	13 (59)	23 (75)	13 (91)	23 (107)	21 (123)	21 (139)	21 (155)	23 (171)	24 (187)	24 (203)	24 (219)	21 (235)	24 (251)
C	1100	(12)	(28)	13 (44)	19 (60)	22 (76)	23 (92)	20 (108)	13 (124)	20 (140)	21 (156)	23 (172)	24 (188)	24 (204)	24 (220)	23 (236)	18 (252)
D	1101	(13)	(29)	21 (45)	21 (61)	24 (77)	13 (93)	24 (109)	16 (125)	20 (141)	23 (157)	13 (173)	24 (189)	24 (205)	24 (221)	23 (237)	15 (253)
E	1110	(14)	(30)	13 (46)	19 (62)	24 (78)	19 (94)	23 (110)	21 (126)	23 (142)	24 (158)	22 (174)	24 (190)	24 (206)	24 (222)	18 (238)	17 (254)
F	1111	(15)	(31)	23 (47)	21 (63)	23 (79)	24 (95)	22 (111)	(127)	23 (143)	21 (159)	22 (175)	24 (191)	24 (207)	24 (223)	19 (239)	24 (255)

GRAPHICS (columns B–D)

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19	23	24	20	19	13	24	23

Tandy Control Codes

Code Dec.	Hex	Symbol	DP Mode	WP Mode	BI Mode	Remarks
0	(00)	NUL	Ignored	Ignored	Ignored	
1	(01)	SOH				
7	(07)	BEL	Sound buzzer	Sound buzzer	Sound buzzer	
8 *n*	(08)	BS *n*	Dot column backspace *n*: dot number	Dot column backspace *n*: dot number	Ignored Receive *n* as character data	$1 \leq n \leq 255$
10 or 138	(0A) or (8A)	LF	Execute LF according to latched information	1/6″ LF 1/12″ LF in Micro font	7/72″ LF Receive 138 as a print data	
12	(0C)	FF	Form Feed	Form Feed	Form Feed	Page length is selectable
13 or 141	(0D) or (8D)	CR	Carriage Return only or plus Line Feed	Carriage Return only or plus Line Feed	Carriage Return only or plus Line Feed	DIP switch selects CR or CR+LF.
14	(0E)	SO	End Underline	End Underline	Ignored	
15	(0F)	SI	Start Underline	Start Underline	Ignored	
18	(12)	DC2	Select Graphics Mode	Select Graphics Mode	Ignored	
19	(13)	DC3	Ignored	Select DP Mode	Ignored	
20	(14)	DC4	Select WP Mode	Ignored	Ignored	
27 *n*	(1B)	ESC *n*	Microspacing	Microspacing	Ignored	2nd byte is dot column number. $1 \leq n \leq 9$
27 10	(1B) (0A)	ESC LF	Set 1/6″ Reverse LF	Perform 1/6″ Reverse LF	Ignored	
27 14	(1B) (0E)	ESC SO	Start Elongation	Start Elongation	Start Elongation	
27 15	(1B) (0F)	ESC SI	End Elongation	End Elongation	End Elongation	

Code Dec.	Hex	Symbol	DP Mode	WP Mode	BI Mode	Remarks
27 16 n_1 n_2	(1B) (10) n_1 n_2	ESC POS n_1 n_2	Positioning	Positioning	Positioning	n_1 n_2 indicate dot position from home position.
27 17	(1B) (11)	ESC DC1	Select NLQ Proportional Character	Select NLQ Proportional Character	Ignored	
27 18	(1B) (12)	ESC DC2	Select NLQ Standard Character	Select NLQ Standard Character	Ignored	10 CPI
27 19	(1B) (13)	ESC DC3	Select Standard Standard Character	Select Standard Standard Character	Ignored	10 CPI
27 20	(1B) (14)	ESC DC4	Select Condensed Character	Select Condensed Character	Ignored	17 CPI
27 21	(1B) (15)	ESC NAK	Set only CR for CR Code	Set only CR for CR Code	Set only CR for CR Code	Reset DIP Switch 1-7.
27 22	(1B) (16)	ESC SYN	Set CR and LF for CR Code	Set CR and LF for CR Code	Set CR and LF CR Code	Reset DIP Switch 1-7.
27 23	(1B) (17)	ESC ETB	Select Standard Compressed Character	Select Sandard Compressed Character	Ignored	12 CPI
27 26	(1B) (1A)	ESC SUB	Perform 1/8 LF	Perform 1/8 LF	Perform 1/8 LF	1/48 Inch
27 28	(1B) (1C)	ESC FS	Set 1/2 LF	Perform 1/2 LF	Ignored	1/12 Inch
27 29	(1B) (1D)	ESC GS	Select NLQ Compressed Character	Select NLQ Compressed Character	Ignored	12 CPI
27 30	(1B) (1E)	ESC RS	Select 1/12″ Reverse LF	Perform 1/12″ Reverse LF	Ignored	
27 31	(1B) (1F)	ESC US	Select Bold Character	Select Bold Character	Ignored	Invalid in condensed, microfont, superscript

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Code		Symbol	DP Mode	WP Mode	BI Mode	Remarks
Dec.	Hex					
27 32	(1B) (20)	ESC SP	End Bold Character	End Bold Character	Ignored	
27 33	(1B) (21)	ESC !	Select IBM Mode	Select IBM Mode	Select IBM Mode	
27 50	(1B) (32)	ESC 2	Perform 1/12 LF	Perform 1/12 LF	Perform 1/12 LF	1/72 Inch
27 51	(1B) (33)	ESC 3	Perform 1/36 LF	Perform 1/36 LF	Perform 1/36 LF	1/216 Inch
27 52 n	(1B) (34) n	ESC 4 n	Specify Page Length	Specify Page Length	Specify Page Length	$n \times 1/6$ Inch
27 54	(1B) (36)	ESC 6	Set 1 LF	Perform 1 LF	Ignored	1/6 Inch
27 56	(1B) (38)	ESC 8	Set 3/4 LF	Perform 3/4 LF	Ignored	1/8 Inch
27 57	(1B) (39)	ESC 9	Perform 1/144″ LF	Perform 1/144″ LF	Perform 1/144″ LF	
27 58	(1B) (3A)	ESC :	Select IBM Character Set 2	Select IBM Character Set 2	Ignored	
27 59	(1B) (3B)	ESC ;	Select Tandy Character Set	Select Tandy Character Set	Ignored	
27 64 n	(1B) (40) n	ESC @ n	Set n/144″ LF	Perform n/144″ LF	Perform n/144″ LF	
27 66 n	(1B) (42) n	ESC B n	Select Italic Character	Select Italic Character	Ignored	$n=1$: Start Italic $n=0$: End Italic
27 72 n	(1B) (48) n	ESC H n	Set n/6″ Skikp Perforation	Set n/6″ Skip Perforation	Set n/6″ Skip Perforation	$n=0$: End Skip Perforation

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Code Dec.	Hex	Symbol	DP Mode	WP Mode	BI Mode	Remarks
27	(1B)	ESC	Select Micro Font	Select Micro Font	Ignored	1/2 LF(1/12″) is set.
77	(4D)	M				
27	(1B)	ESC	Set Left Margin	Set Left Margin	Ignored	Set at position ($n\times$ character width).
81	(51)	Q				
n		*n*				
27	(1B)	ESC	Set Right Margin	Set Right Margin	Ignored	Set at position ($n\times$ character width).
81	(52)	R				
n		*n*				
27	(1B)	ESC	$n=0$ Set Superscript	$n=0$ Set Superscript	Ignored	ESC·X ends this selection.
83	(53)	S	$n=1$ Set Subscript	$n=1$ Set Subscript		
n		*n*				
27	(1B)	ESC	$n=1$ Set Unidirectional	$n=1$ Set Unidirectional	Ignored	
85	(55)	U	$n=0$ Set Bidirectional	$n=0$ Set Bidirectional		
27	(1B)	ESC	End Superscript and Subscript	End Superscript and Subscript	Ignored	
88	(58)	X				
27	(1B)	ESC	Select Country Character	Select Country Character	Ignored	$n=32\sim42$
89	(59)	Y				
n		*n*				
28	(1C)	FS	Repeat Character (Undefined code is ignored.)	Repeat Character (Undefined code is ignored.)	Repeat Print Data	n_1: Repeat number n_2: Char. or print data
n_1		n_1				
n_2		n_2				
30	(1E)	RS	Ignored	Ignored	End Bit Image	
127	(7F)	DEL	Ignored	Ignored	Ignored	
255	(FF)	DEL	Ignored	Ignored	Ignored	
Other undefined codes in function area, 2 to 31 (02 to 1F hex)			Print X	Print X	Ignored	
Other undefined codes in function area, 128 to 159 (80 to 9F hex)			Print X	Print X	Printing Data	

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IBM Control Codes

Decimal	Hex	Symbol	Function
7 135	(07) (87)	BELL	Sound buzzer for 1 second
27 7 27 135	(1B) (07) (1B) (87)	ESC BEL	Same as BEL
8 136	(08) (88)	BS	Move 1 character position to the left
27 8 27 136	(1B) (08) (1B) (88)	ESC BS	Same as BS
9 137	(09) (89)	HT	Move to next horizontal tab position
27 9 27 137	(1B) (09) (1B) (89)	ESC HT	Same as HT
10 138	(0A) (8A)	LF	Print and Line Feed according to latched information with or without Carriage Return (DIP switch 1-3)
27 10 27 138	(1B) (0A) (1B) (8A)	ESC LF	Same as LF
11 139	(0B) (8B)	VT	Same as LF

Decimal	Hex	Symbol	Function
27 11	(1B) (0B)	ESC VT	Same as LF
27 139	(1B) (8B)		
12 140	(0C) (8C)	FF	Form Feed after printing
27 12	(1B) (0C)	ESC FF	Same as FF
27 140	(1B) (8C)		
13 141	(0D) (8D)	CR	Printing and Carriage Return with or without Line Feed (DIP switch 1-2)
27 13	(1B) (0D)	ESC CR	Same as CR
27 141	(1B) (8D)		
14 142	(0E) (8E)	SO	Printing and Double-Width Mode designation (print command terminates this mode)
27 14	(1B) (0E)	ESC SO	Same as SO
27 142	(1B) (8E)		
15 143	(0F) (8F)	SI	Printing and Condensed Mode designation
27 15	(1B) (0F)	ESC SI	Same as SI
27 143	(1B) (8F)		

Decimal	Hex	Symbol	Function
18 146	(12) (92)	DC2	Printing and Condensed Mode termination
27 18 27 146	(1B) (12) (1B) (92)	ESC DC2	Same as DC2
20 148	(14) (94)	DC4	Printing and Double-Width Mode termination
27 20 27 148	(1B) (14) (1B) (94)	ESC DC4	Same as DC4
27 33	(1B) (21)	ESC !	Select TANDY Mode
24 152	(18) (98)	CAN	Clear all print data in the internal buffer
27 24 27 152	(1B) (18) (1B) (98)	ESC CAN	Same as CAN
27 45 n	(1B) (2D) n	ESC — n	$n = 1$ Starts Underline $n = 0$ Ends Underline
27 48	(1B) (30)	ESC 0	Line Feed pitch is set to 1/8 inch
27 49	(1B) (31)	ESC 1	Line Feed pitch is set to 7/72 inch
27 50	(1B) (32)	ESC 2	Perform ESC·A or set Line Feed pitch to 1/6 inch

Decimal	Hex	Symbol	Function
27	(1B)	ESC	Set page length in inch units with m ranging from 1 to 22
67	(43)	C	
0	(00)	NULL	
m	m	m	
27	(1B)	ESC	Specify page length in line units with n ranging from 1 to 127
67	(43)	C	
n	n	n	
27	(1B)	ESC	Set Line Feed pitch to $n/72$ inch when ESC.2 inch is input. $0 \leq n \leq 85$
65	(41)	A	
n	n	n	
27	(1B)	ESC	Move print head to home position
60	(3C)	>	
27	(1B)	ESC	Select 12 CPI
58	(3A)	:	
27	(1B)	ESC	Cancel ESC.8
57	(39)	9	
27	(1B)	ESC	Ignore paper out
56	(38)	8	
27	(1B)	ESC	Select Character Set 1
55	(37)	7	
27	(1B)	ESC	Select Character Set 2
54	(36)	6	
27	(1B)	ESC	Print and Carriage Return with or without Line Feed
53	(35)	5	
n	n	n	
27	(1B)	ESC	Current position is set as top-of-form
52	(34)	4	
27	(1B)	ESC	Set Line Feed pitch to $n/216$ inch $0 \leq n \leq 255$
51	(33)	3	
n	n	n	

Decimal	Hex	Symbol	Function
27	(1B)	ESC	
68	(44)	D	Horizontal Tab position setting
n_1 n_2... n_k		n_1 n_2... n_k	$1 \leq K \leq 28$, $1 \leq n \leq 80$ or 137
0	(00)	NULL	
27	(1B)	ESC	Print and set Bold Character Mode
69	(45)	E	
27	(1B)	ESC	End Bold Character Mode
70	(46)	F	
27	(1B)	ESC	Print and set Double-Strike Character Mode
71	(47)	G	
27	(1B)	ESC	End Double-Strike Character Mode
72	(48)	H	
27	(1B)	ESC	$n = 1$ selects standard font and $n = 2$ or 3 selects
73	(49)	I	NLQ font
n		n	
27	(1B)	ESC	
74	(4A)	J	Set Line Feed pitch to $n/216$ inch
n		n	
27	(1B)	ESC	Select 60 DPI (dot/inch) Bit Image
75	(4B)	K	$K = n_1(\text{LSB}) + 256 \times n_2(\text{MSB})$
n_1 n_2 D_1... D_k		$n_1 n_2 D_1...D_k$	
27	(1B)	ESC	Select 120 DPI Bit Image, Half Speed
76	(4C)	L	$K = n_1 + 256 \times n_2$
n_1 n_2 D_1... D_k		$n_1 n_2 D_1...D_k$	
27	(1B)	ESC	Select 10 CPI character mode
77	(4D)	M	
27	(1B)	ESC	Set skip over perforation in line feed unit
78	(4E)	N	$1 \leq n \leq 127$
n		n	
27	(1B)	ESC	End skip over perforation
79	(4F)	0	

Decimal	Hex	Symbol	Function
27 80 n	(1B) (50)	ESC P n	Proportional character mode designation $n = 1$: ON, $n = 0$: OFF
27 82	(1B) (52)	ESC R	Set horizontal tabs at every 8th character column
27 83 n	(1B) (53)	ESC S n	$n = 1$ selects subscript $n = 0$ selects superscript
27 84	(1B) (54)	ESC T	End Subscript and Superscript
27 85 n	(1B) (55)	ESC U n	$n = 1$ selects Unidirectional print $n = 0$ selects Bidirectional print
27 87 n	(1B) (57)	ESC W n	$n = 1$ selects Double-Width Mode $n = 0$ cancels Double-Width Mode
27 88 m n	(1B) (58)	ESC X m n	Set left and right margins in present character columns. Left margin is specified by m and right margin, n. $1 \leq m < n \leq$ maximum character column
27 89 n_1 n_2 $D_1 \ldots D_k$	(1B) (59)	ESC Y $n_1 n_2 D_1 \ldots D_k$	Select 120 DPI Bit Image, Normal Speed $K = n_1 (\text{LSB}) + n_2 (\text{MSB}) \times 256$ Horizontally aligned dots cannot be printed.
27 90 n_1 n_2 $D_1 \ldots D_k$	(1B) (5A)	ESC Z $n_1 n_2 D_1 \ldots D_k$	Select 240 DPI Bit Image $K = n_1 (\text{LSB}) + n_2 (\text{MSB}) \times 256$
27 93	(1B) (5D)	ESC]	Perform printing and 1/6-inch Reverse Line Feed
27 94 n	(1B) (5E)	ESC ∧ n	Print characters of codes 3, 4, 5, 6, 19, 20 and 21 specified by n

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Decimal	Hex	Symbol	Function
27	(1B)	ESC	
100	(64)	d	Move print position toward right by $1/120 \times (Ln+Hn\times256)$
Ln		Ln	inches. If right margin is exceeded, this command is ignored.
Hn		Hn	
27	(1B)	ESC	
101	(65)	e	Move print position toward left by $1/120 \times (Ln+Hn\times256)$
Ln		Ln	inches. Ignored if exceeds left margin.
Hn		Hn	

Character Category
Priority Table C

In print mode, the following priorities exist:

1. Compressed > Proportional > Bold > Condensed > Normal
2. Superscript/Subscript > Correspondence (NLQ) > Double Strike

a. If the Compressed, Condensed, Superscript, and Double-Strike modes are designated according to priority chart No. 84, Compressed Superscript characters will be printed.

b. If the compressed mode is terminated from the above example, condensed, superscript characters will be printed according to No. 20.

c. If the superscript mode is terminated from example a., compressed, double-strike characters will be printed according to No. 83.

Character Category Prior Table

Prop: Proportional   Cond: Condensed   NLQ: Near Letter Quality
D.S.: Double Strike   Sup/Sub: Superscript/Subscript   Comp: Compressed

NO.	Command Combination							Character Mode Printed								Printed Ex.
	Comp.	Prop.	Cond.	Bold	NLQ	D.S.	Sup/Sub	Normal	Comp.	Prop.	Cond.	Bold	NLQ	D.S.	Sup/Sub	ABChijk
1								○								ABChijk
2							○	○								○	ABChijk
3					○			○						○			ABChijk
4					○	○		○								○	ABChijk
5				○				○					○				ABChijk
6				○		○		○								○	ABChijk
7				○	○			○						○			ABChijk
8				○	○	○		○								○	ABChijk
9			○					○				○					ABChijk
10			○			○		○				○				○	ABChijk
11			○		○			○				○		○			ABChijk
12			○		○	○		○				○				○	ABChijk
13			○	○				○				○	○				ABChijk
14			○	○		○		○				○				○	ABChijk
15			○	○	○			○				○		○			ABChijk
16			○	○	○	○		○				○				○	ABChijk
17		○									○						ABChijk
18		○				○					○					○	ABChijk
19		○			○						○				○		ABChijk
20		○			○	○					○					○	ABChijk
21		○		○							○						ABChijk
22		○		○		○					○					○	ABChijk
23		○		○	○						○				○		ABChijk
24		○		○	○	○					○					○	ABChijk
25		○	○					○				○					ABChijk
26		○	○			○		○				○				○	ABChijk
27		○	○		○			○				○		○			ABChijk
28		○	○		○	○		○				○				○	ABChijk
29		○	○	○				○				○					ABChijk
30		○	○	○		○		○				○				○	ABChijk
31		○	○	○	○			○				○		○			ABChijk
32		○	○	○	○	○		○				○				○	ABChijk
33	○									○							ABChijk
34	○					○				○						○	ABChijk

Prop: Proportional   Cond: Condensed   NLQ: Near Letter Quality
D.S.: Double Strike   Sup/Sub: Superscript/Subscript   Comp: Compressed

	Command Combination							Character Mode Printed								Printed Ex.
NO.	Comp.	Prop.	Cond.	Bold	NLQ	D.S.	Sup/Sub	Normal	Comp.	Prop.	Cond.	Bold	NLQ	D.S.	Sup/Sub	ABChijk
35		○				○				○					○	ABChijk
36		○				○	○			○					○	ABChijk
37		○			○					○			○			ABChijk
38		○			○		○			○					○	ABChijk
39		○			○	○				○			○			ABChijk
40		○			○	○	○			○					○	ABChijk
41		○		○						○		○				ABChijk
42		○		○			○			○		○			○	ABChijk
43		○		○		○				○		○		○		ABChijk
44		○		○		○	○			○		○			○	ABChijk
45		○		○	○					○		○	○			ABChijk
46		○		○	○		○			○		○			○	ABChijk
47		○		○	○	○				○		○	○			ABChijk
48		○		○	○	○	○			○		○			○	ABChijk
49		○	○							○	○					ABChijk
50		○	○				○			○	○				○	ABChijk
51		○	○			○				○	○			○		ABChijk
52		○	○			○	○			○	○				○	ABChijk
53		○	○		○					○	○		○			ABChijk
54		○	○		○		○			○	○				○	ABChijk
55		○	○		○	○				○	○		○			ABChijk
56		○	○		○	○	○			○	○				○	ABChijk
57		○	○	○						○	○	○				ABChijk
58		○	○	○			○			○	○	○			○	ABChijk
59		○	○	○		○				○	○	○		○		ABChijk
60		○	○	○		○	○			○	○	○			○	ABChijk
61		○	○	○	○					○	○	○	○			ABChijk
62		○	○	○	○		○			○	○	○			○	ABChijk
63		○	○	○	○	○				○	○	○	○			ABChijk
64		○	○	○	○	○	○			○	○	○			○	ABChijk
65	○							○								ABChijk
66	○						○	○							○	ABChijk
67	○				○			○					○			ABChijk
68	○				○		○	○							○	ABChijk

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Prop: Proportional   Cond: Condensed   NLQ: Near Letter Quality
D.S.: Double Strike   Sup/Sub: Superscript/Subscript   Comp: Compressed

NO.	\ Command Combination Comp.	Prop.	Cond.	Bold	NLQ	D.S.	Sup/Sub	Character Mode Printed Normal	Comp.	Prop.	Cond.	Bold	NLQ	D.S.	Sup/Sub	Printed Ex. ABChijk
69	○				○			○					○			ABChijk
70	○				○		○	○							○	ABChijk
71	○				○	○		○					○			ABChijk
72	○				○	○	○	○							○	ABChijk
73	○			○				○				○				ABChijk
74	○			○			○	○				○			○	ABChijk
75	○			○		○		○				○		○		ABChijk
76	○			○		○	○	○				○			○	ABChijk
77	○			○	○			○				○	○			ABChijk
78	○			○	○		○	○				○			○	ABChijk
79	○			○	○	○		○				○	○			ABChijk
80	○			○	○	○	○	○				○			○	ABChijk
81	○		○					○			○					ABChijk
82	○		○				○	○			○				○	ABChijk
83	○		○			○		○			○			○		ABChijk
84	○		○			○	○	○			○				○	ABChijk
85	○		○		○			○			○		○			ABChijk
86	○		○		○		○	○			○				○	ABChijk
87	○		○		○	○		○			○		○			ABChijk
88	○		○		○	○	○	○			○				○	ABChijk
89	○		○	○				○			○	○				ABChijk
90	○		○	○			○	○			○	○			○	ABChijk
91	○		○	○		○		○			○	○		○		ABChijk
92	○		○	○		○	○	○			○	○			○	ABChijk
93	○		○	○	○			○			○	○	○			ABChijk
94	○		○	○	○		○	○			○	○			○	ABChijk
95	○		○	○	○	○		○			○	○	○			ABChijk
96	○		○	○	○	○	○	○			○	○			○	ABChijk
97	○	○						○		○						ABChijk
98	○	○					○	○		○					○	ABChijk
99	○	○				○		○		○				○		ABChijk
100	○	○				○	○	○		○					○	ABChijk
101	○	○			○			○		○			○			ABChijk
102	○	○			○		○	○		○					○	ABChijk

Prop: Proportional   Cond: Condensed   NLQ: Near Letter Quality
D.S.: Double Strike   Sup/Sub: Superscript/Subscript   Comp: Compressed

NO.	Comp.	Prop.	Cond.	Bold	NLQ	D.S.	Sup/Sub	Normal	Comp.	Prop.	Cond.	Bold	NLQ	D.S.	Sup/Sub	Printed Ex. ABChijk
103	○	○			○	○		○					○			ABChijk
104	○	○			○	○	○	○							○	ABChijk
105	○	○		○				○				○				ABChijk
106	○	○		○			○	○				○			○	ABChijk
107	○	○		○		○		○				○		○		ABChijk
108	○	○		○		○	○	○				○			○	ABChijk
109	○	○		○	○			○				○	○			ABChijk
110	○	○		○	○		○	○				○			○	ABChijk
111	○	○		○	○	○		○				○	○			ABChijk
112	○	○		○	○	○	○	○				○			○	ABChijk
113	○	○	○					○								ABChijk
114	○	○	○				○	○							○	ABChijk
115	○	○	○			○		○						○		ABChijk
116	○	○	○			○	○	○							○	ABChijk
117	○	○	○		○			○					○			ABChijk
118	○	○	○		○		○	○							○	ABChijk
119	○	○	○		○	○		○					○			ABChijk
120	○	○	○		○	○	○	○							○	ABChijk
121	○	○	○	○				○				○				ABChijk
122	○	○	○	○			○	○				○			○	ABChijk
123	○	○	○	○		○		○				○		○		ABChijk
124	○	○	○	○		○	○	○				○			○	ABChijk
125	○	○	○	○	○			○				○	○			ABChijk
126	○	○	○	○	○		○	○				○			○	ABChijk
127	○	○	○	○	○	○		○				○	○			ABChijk
128	○	○	○	○	○	○	○	○				○			○	ABChijk

Note: the two header groups above the NO./data columns are "Command Combination" (spanning Comp. through Sup/Sub) and "Character Mode Printed" (spanning Normal through Sup/Sub).
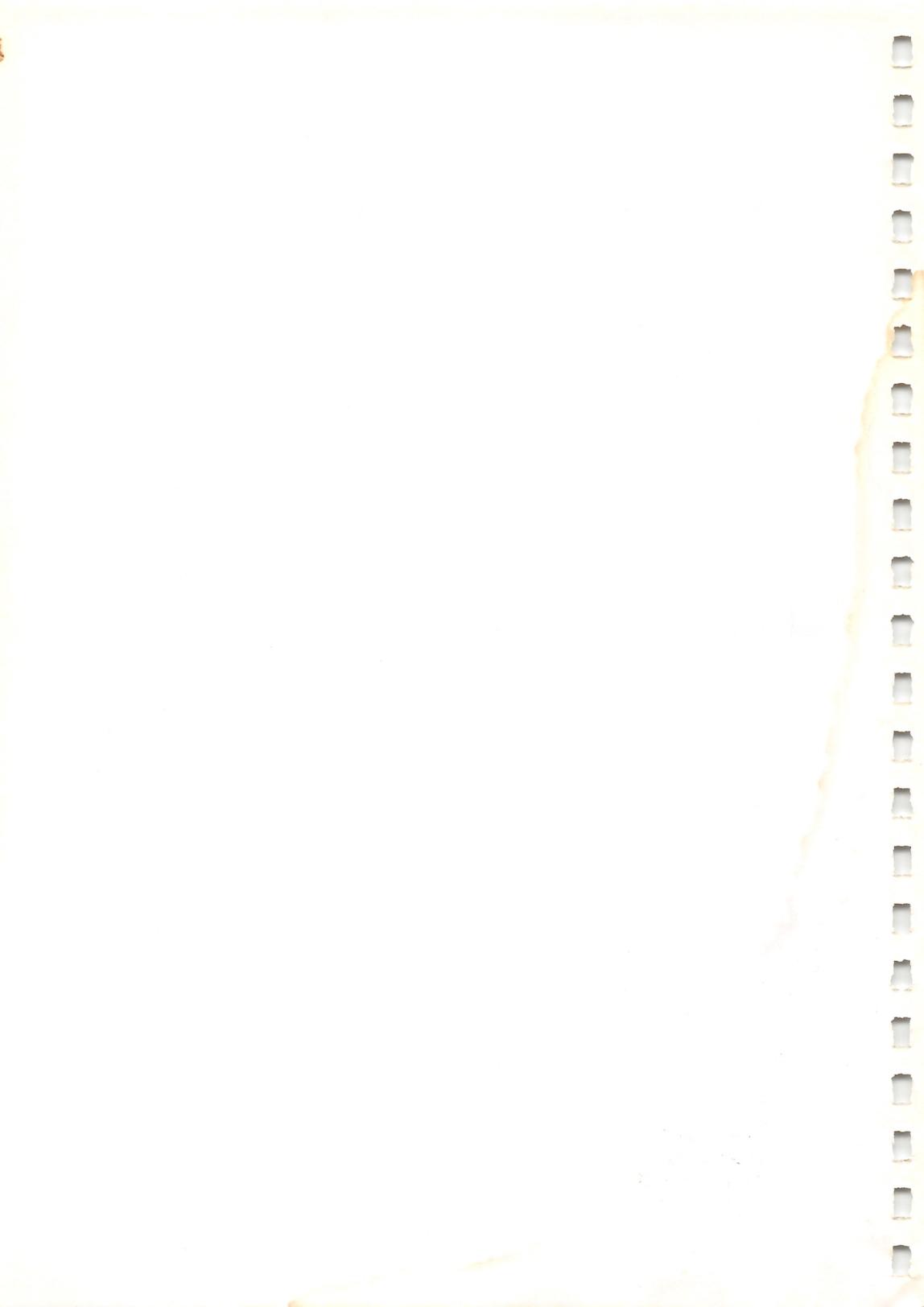
Programming Information D

The following items should be considered when you program the computer:

1. When the Printer's power is turned on:
   - Optional functions are selected according to the setting of the function selection switches.
   - Full-forward line feed is set when the data processing mode is selected.
   - Underline is not set.
   - Standard character is set (not elongated and not bold).
   - Buffer memory is completely cleared.
   - Page length is set as 56 lines.

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

3. Since a proportional spacing command can be used in any character set condition, right-justification can be performed. You must consider that proportional spacing commands can indicate up to 9-dot spacing; normal (10 or 5 CPI), compressed (12 or 6 CPI), or condensed (17 or 8.5 CPI) characters (normal space = 20 hex or 32 dec) give 12 or 24 dot spaces.

4. Elongated (double-width) characters and underline are not terminated at the end of a line, and such printing continues until a terminating command is received.

   Note: In IBM mode, elongation is set by sending a (27 14) command and terminated by sending a CR/LF command.

5. You should avoid wraparound. A wraparound will disturb the dot count of the text in a line.

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

7. In the repeat data commands, printable characters can be repeated as many times as provided in the count number. If any function code is received for repetition, it is ignored.

8. POS commands can be used at any carriage position. If a designated dot-column address is in the current text which is already printed, overprint will occur.

9. In block graphic printing, half-forward line feed should be used for printing diagrams.

10. Line feed in graphics mode is different from line feed pitches in data processing or word processing mode.

11. Graphic printing can be intermixed with character printing in the same line.

12. 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 can 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 semi-colon). 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$(27);CHR$(47);"COMPRESSED
PROPORTIONAL" CHR$(27);CHR$(29);
"CORRESPONDENCE 12 CPI";CHR$(27);CHR$(17);
"PROPORTIONAL";CHR$(27);CHR$(18);
"CORRESPONDENCE 10 CPI";CHR$(27);
CHR$(20);"CONDENSED";CHR$(27);CHR$(23);
"COMPRESSED";CHR$(27);CHR$(19);"NORMAL"
```

> Prints proportional, correspondence, condensed, compressed, and normal characters in the same line.

```
LPRINT CHR$(19);"START";CHR$(27);CHR$(56);
CHR$(138);"LINE ONE";CHR$(138);"LINE TWO"
```

> Prints these letters at 3/4-line pitch.

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

> Prints both messages in the same line: one underlined and the other not underlined.

```
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 the above message from the 300th column address.

```
LPRINT CHR$(27);CHR$(17);"A";CHR$(27);
CHR$(09);"B";CHR$(27);CHR$(06);
"C";CHR$(27);CHR$(03);"DE"
```

> Prints **ABCDE** by using proportional spacing.

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

Prints a special symbol in graphics mode.

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

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

```
LPRINT "X";CHR$(27);CHR$(83);CHR$(0);
"2";CHR$(27);CHR$(88);" + X = Y"
```

Prints an algebraic function expression $X^2 + X = Y$.

```
LPRINT "H";CHR$(27);CHR$(83);CHR$(1);
"2";CHR$(27);CHR$(88);"0"
```

Prints the formula of water H_2O.

```
LPRINT CHR$(27);CHR$(66);CHR$(1);
"ITALIC";CHR$(27);CHR$(66);CHR$(0);"NORMAL"
```

Prints italicized letters and non-italicized letters in the same line.

```
LPRINT CHR$(27);CHR$(77);"MICROFONT"
```

Prints microfont letters.

Care and Maintenance E

General

- Never operate the Printer without paper. Be sure that printing does not exceed the paper width.

- If any object is accidentally dropped into the machine, turn off the power and carefully remove the object.

- When you turn off the power, 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.

- Use only a lint-free cloth to clean the Printer's surface. Do not use solvents or harsh cleaning agents. A mild detergent solution or desk top cleanser may be used sparingly.

- The Printer must be kept dry. If water is accidentally spilled on the machine, turn off the power immediately and wipe it dry. Do not turn on the power again until the Printer is completely dry.

- When printed material is too light or too dark, check to see if the print head is positioned properly.

Care

- Do not use organic solvents or alcohol when cleaning the cover.
- 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 may be damaged.

  When you must print graphics continuously, be sure to pause the printing for at least a few minutes after printing about 50 lines.

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).
- A print head's life expectancy is approximately 80 million characters. When poor print quality, sticking ribbon, or bent character printing occurs, you should have the print head replaced by a Radio Shack service technician.

If you have problems...

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

PROBLEM	CAUSE AND REMEDY
The Printer does not print. The POWER lamp does not light.	1) Power is not getting to the Printer. • Check the power cord and power switch.
The Printer does not print. The POWER lamp is lit.	1) The connection to the computer is not correct. • Check that the cable connecting the Printer and computer is correctly connected. 2) The ribbon cassette is not properly installed. • Install it properly.
The Printer is operating properly, but the paper is not feeding through properly.	1) The paper is jammed in the Printer. • Remove the paper and reinsert it properly.
The print is light or smeared.	1) The print head position is not correct. • Move the head adjustment lever to match the paper being used. 2) The ribbon cassette is not properly installed. • Properly install the cassette. 3) The ink ribbon is old or is worn out. • Replace the old ribbon cassette with a new one.
The ALERT lamp is blinking.	1) An error condition has been detected. • Turn the power OFF and then back ON again.

If the trouble cannot be corrected after making the above check-up and
adjustment, check for secure contacts on all connectors. If you cannot
eliminate the problem, take the unit to your Radio Shack Computer
Center or store for repair.

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Specifications F

Print Speed	120 CPS
Paper Feed Type	Pin feed and friction feed
Line Pitch	1/6″, 1/8″, 1/9″, 1/12″, 1/36″, 1/48″, 1/72″, 1/144″ and n/216″. Reverse: 1/6″ and 1/12″
Paper Feed Speed	10 lines/sec. when continuously feeding by 1/9″ unit.
Print Method	Impact dot matrix
Print Direction	Bidirectional logic seeking in draft printing. Unidirectional in NLQ and graphics printing.
Ink Ribbon	Special cassette-type
Paper Weight	15 lbs. to 20 lbs. (45 kg. to 65 kg.)
Paper Thickness **Single Sheet**	0.06 – 0.1mm (2.5 – 3.8 mils)
Multiple Copies	Original plus 2, max. 0.2mm (7.7 mils)
Paper Width	4″ to 10″ wide
Power Requirements	120 ± 15 V AC, 60 Hz in USA and Canada 220/240 V AC, 50 Hz in Europe and Australia
Power Consumption	30 Watts (self-test printing) 15 Watts (standby)
Temperature **Operation** **Storage**	55°F to 85°F (13°C to 29°C) −40°F to 160°F (−40°C to 71°C)
Humidity	20% to 80% (non-condensing)
Dimensions	15″W × 5″H × 10″D (390mm × 119mm × 266mm)
Weight	11 lbs. (5 kg)
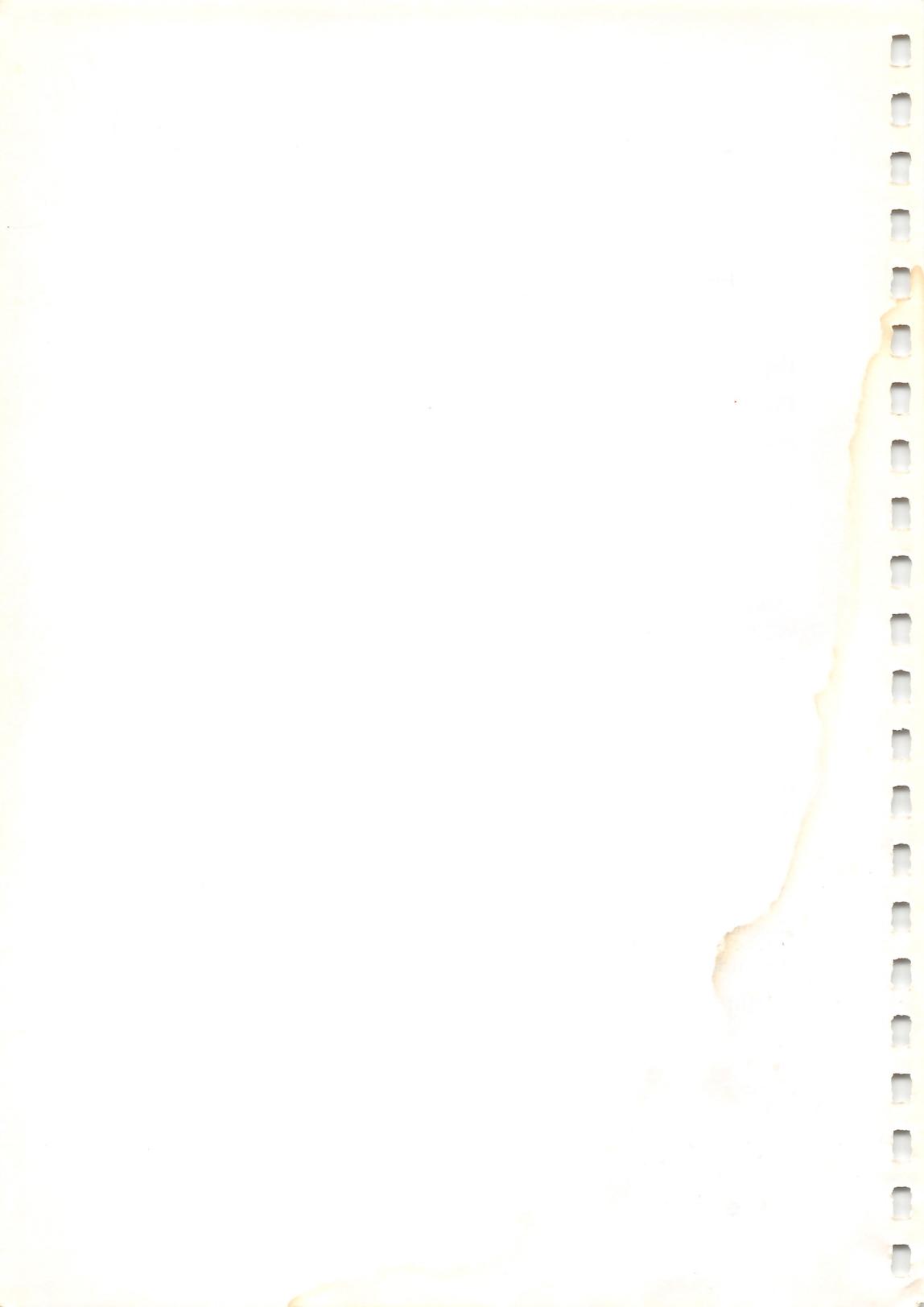
Pin Configuration of the Serial RS-232C DIN Jack

Pin 1	NOT USED
Pin 2	STATUS
Pin 3	GROUND
Pin 4	DATA

Time Chart of Serial Input

Baud rate selectable to 600 bps, 1200 bps, or 2400 bps.
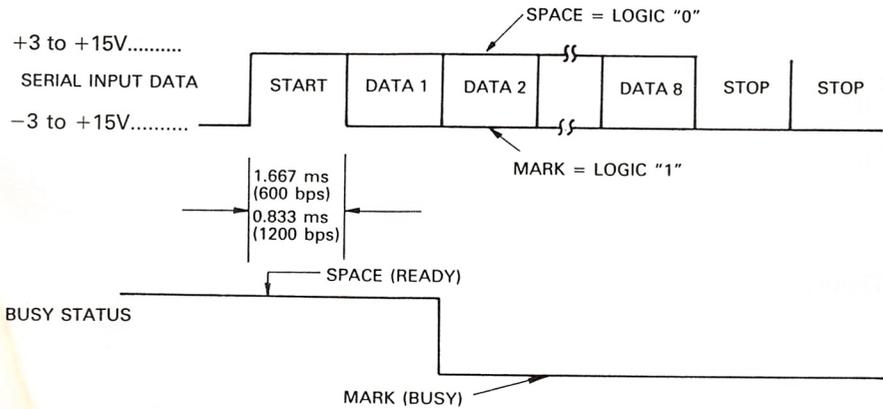
- One start bit, 8-bit data, no parity, 2 stop bits

Pin Configuration of the PARALLEL Connector

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

Timing Diagram

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Power Supply and Driver Logic Circuit

[NOTE]
RESISTOR VALUES ARE IN [Ω] UNLESS OTHER-
WISE SPECIFIED.
CONDENSER VALUES ARE IN [μ] UNLESS OTEHR-
WISE SPECIFIED.
※ WITH HEAT SINK.
※※ FUSIBLE RESISTOR

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