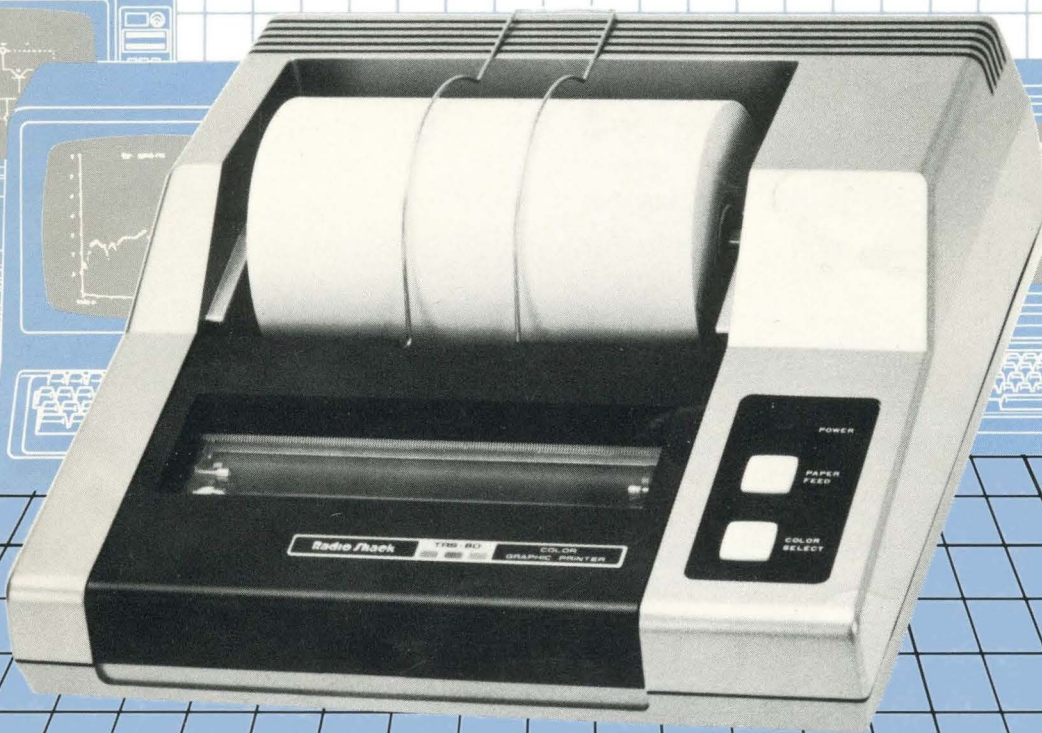


TRS-80[®]

CGP-115

OPERATION MANUAL

Catalog Number 26-1192



Radio Shack

TRS-80

**COMPUTER
PRODUCTS**

CUSTOM MANUFACTURED FOR RADIO SHACK, A DIVISION OF TANDY CORPORATION

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Introduction

Congratulations for selecting this high-quality, low-cost Color Graphic Printer! We feel this Printer is the ideal graphic printer for home or business use when you want to create anything from four-color pie charts to Computer generated “doodles.”

The TRS-80 Color Graphic Printer is unique among other graphic printers. Its special features include:

- Its own set of simple instructions that allow you to change colors, backspace the Pens, reverse “feed” the paper, and more!
- Four-color print-outs (black, red, green, and blue).
- “Standard” roll paper (4 1/2” wide by 180’ long).
- Serial or Parallel interface capabilities for use with any TRS-80 that has printer interface capabilities.
- Selectable 40-character or 80-character per line printing.

The Color Graphic Printer can be used with TRS-80:

- Model I
- Model II
- Model III
- Model 16
- DT-I Data Terminal
- Color Computer

This manual will:

- Describe the Color Graphic Printer to you.
- Detail you how to install paper and pens.
- Show you how to connect the Printer to your TRS-80.
- And illustrate how to use the Color Graphic Printer to print data or create beautiful, 4-color graphic print-outs.

1/Description of the Color Graphic Printer

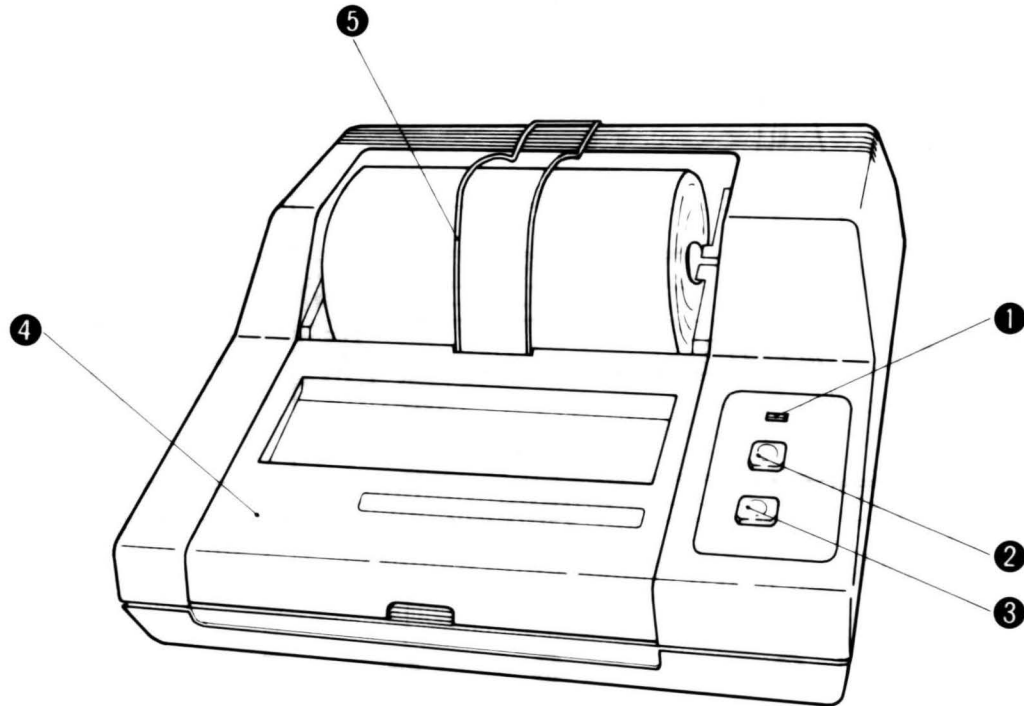


Figure 1. Graphic Printer (Front View)

- ① **POWER On Indicator.** This light will illuminate when you turn the Graphic Printer ON.
- ② **PAPER FEED Switch.** Press this button to move the paper forward.
- ③ **COLOR SELECT Switch.** Press the COLOR SELECT switch to change the pen color. The Pen Holder will rotate one quarter turn to the next pen. The Graphic Printer will return to Pen #1 on power-up.
- ④ **Top Cover.** Always keep the Cover closed when the Printer is operating. Raise the Cover from the front to change when changing paper or pens. Note the serrated edge for neat and easy paper tearing. Also note that the Printer will not print when the Cover is up.
- ⑤ **Paper Separator.** The Separator keeps "out-going" paper separated from "in-coming" paper during printing. When the Printer is printing, be sure to have the Paper Separator correctly in place or "out-going" paper may be fed back into the Printer causing a "paper jam" situation.

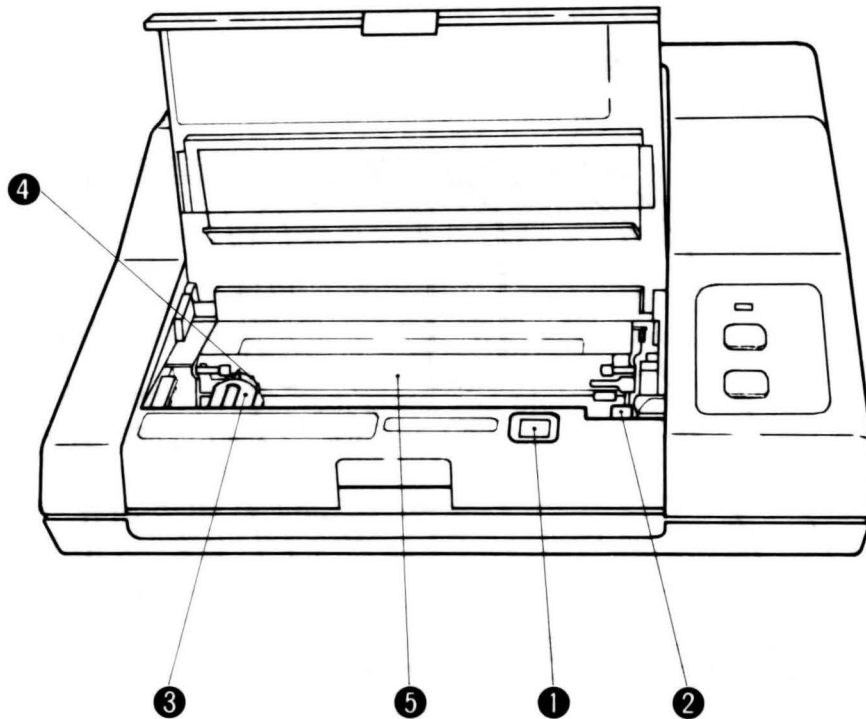


Figure 2. Graphic Printer (Inside View)

- ❶ **PEN CHANGE Switch.** Press this switch and the Pen Holder will move to the right and stop. Always press this switch before changing pens.
- ❷ **Pen Ejection Lever.** When you remove a pen from the Pen Holder, gently press this Lever.
- ❸ **Pen Holder.** This Holder contains the four pens. Press the **COLOR SELECT Switch** to move from one pen to the other. Press the **PEN CHANGE Switch** before changing pens. Do not move or rotate the Holder manually.
- ❹ **Pen Guide Wheel.** Insert the "ink" tips of the Pens into the guide holes of the wheel. Note that each hole is color coded for the appropriate pen color.
- ❺ **Paper Platen.** "Holds" the paper during printing. Never print on the platen; always be sure you have paper in the Printer before printing.

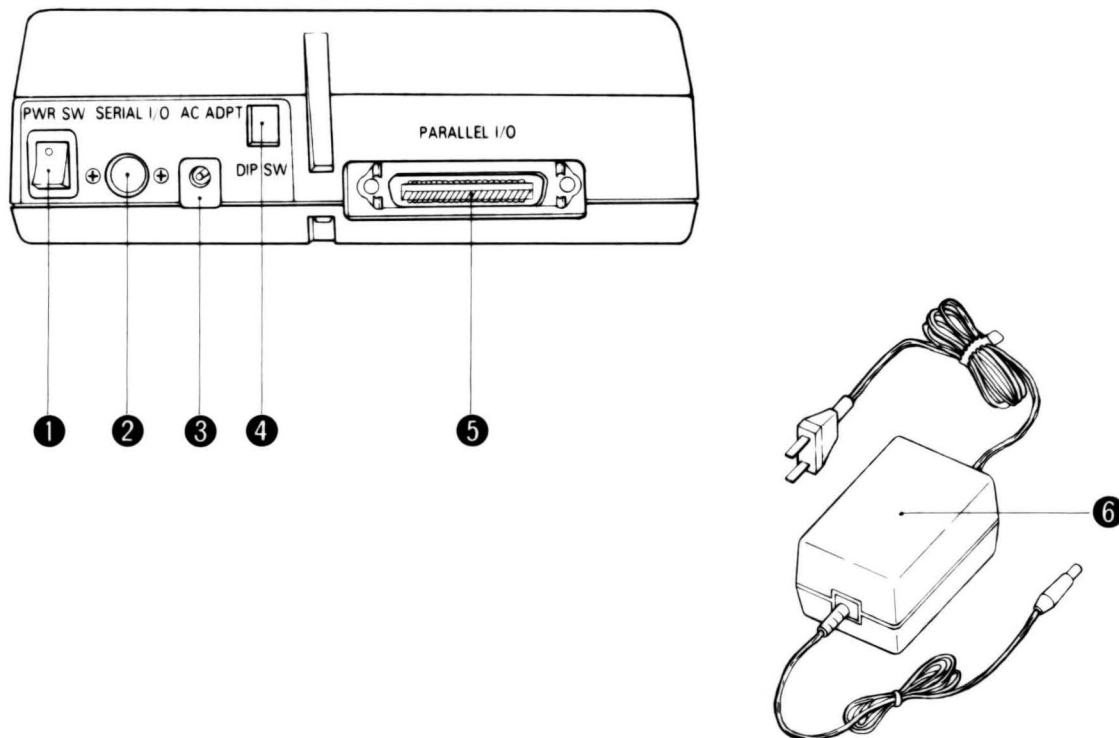


Figure 3. Graphic Printer (Rear View)

- ① **PWR SW**itch. Press the white dot to turn the power ON. Press again to turn the power OFF.
- ② **SERIAL I/O** Jack. Connect the Graphic Printer to a Color Computer via this jack. Use the 4-Pin DIN to 4-Pin Din Cable (Radio Shack Catalog Number 26-3020).
- ③ **AC ADPT** Jack. Connect the Graphic Printer to its Power Supply via this Jack.
- ④ **DIP SW**itch. The settings of this Switch will determine how the Printer will operate. For instance, whether you want 80 characters per line or 40 characters; whether the Computer connected to the Printer uses a serial interface (Color Computer) or parallel Interface.
- ⑤ **PARALLEL I/O** Jack. Connect the Graphic Printer to the Model I,II,III, 16 and the DT-I via this Jack. For Model I/III, use the 34-Pin Card Edge to 36-Pin plug (26-1401); for Model II/16/DT-I, use 34-Pin Header to 36-Pin Plug (26-4401).
- ⑥ **Power Supply**. Connect the Power Supply to the Printer via the Rear Panel. Do not use any Power Supply except for the one supplied with the Printer.

2/Setting Up the Color Graphic Printer

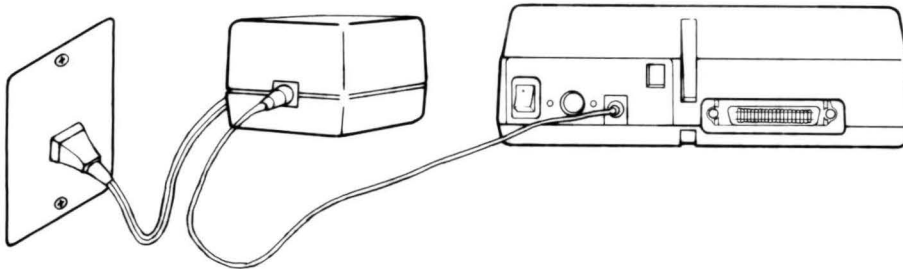


Figure 4. Power Supply Connections

Do not attempt to operate the Color Graphic Printer with any power supply other than the supplied one!

1. Connect the AC Adapter to a wall outlet.
2. Then connect the power cable from the AC Adapter to the Color Graphic Printer's power supply AC ADPT jack (see Figure 4).

Connecting the Color Graphic Printer to a Computer

When connecting the Color Graphic Printer to a TRS-80, be sure to use the correct cable. Table 1 details the proper cable to use with your TRS-80; Table 2 provides quick instructions on locating the printer connection location on TRS-80. See your TRS-80 owner's manual for complete details on connecting printers.

1. Connect one end of the appropriate cable (see Table 1) to the Color Graphic Printer.
 - If you're using a Color Computer, connect one end of the DIN cable to the round, 4-pin SERIAL I/O Jack on the rear panel of the Printer.

- If you're using a Model I/II/III/16 or DT-1, connect the cable connector to the PARALLEL I/O Jack on the rear panel of the Printer.

2. Connect the other end of the cable to the TRS-80 (see Table 2).

Note: Only one Printer Jack should have a cable connected to it at a time. That is, if you have a cable connected to the PARALLEL I/O Jack, do not have a cable connected to the SERIAL I/O Jack (and vice versa).

Printer-to-TRS-80 Cables	
TRS-80	Cable
Model I/III	26-1401
Model II/16/DT-1	26-4401
Color Computer	26-3020

Table 1

TRS-80 Connection Points	
Location	TRS-80
Model I	Left Side of Expansion Interface
Model II/16	Rear Panel
Model III/DT-1	Underneath

Table 2

Paper Loading

Be sure to use Radio Shack Color Graphic Printer paper (26-1428) with the Printer. When loading paper into the Printer, follow these steps:

1. With scissors, cut the end of the paper square. (See Figure 5.)
2. Insert the end of the paper into the slot in the bottom of the Printer (see Figure 6).
3. Insert the shaft into the roll and place the roll of paper into paper compartment.
4. Turn power on.
5. Raise the Top Cover so printing will not take place on the Platen.
6. Press the PAPER FEED button to get the paper through the slot and around the Platen.

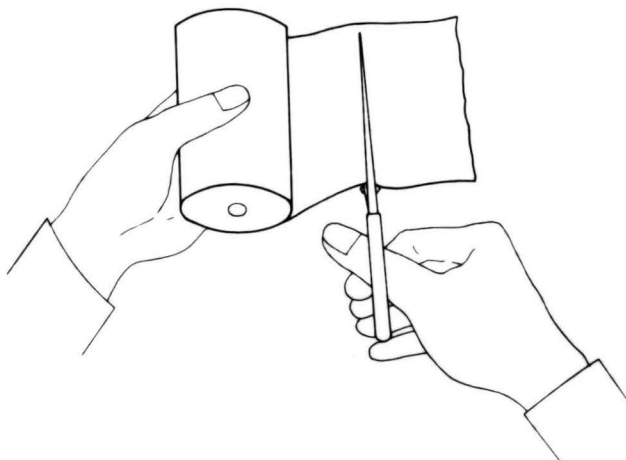


Figure 5. Cut Paper Square

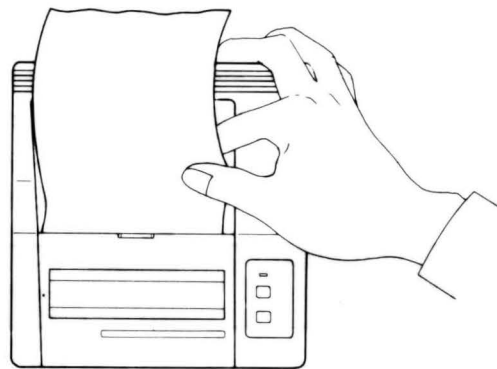


Figure 6. Inserting Paper

Paper Separator

Always be sure the Paper Separator is in place when you are using the Printer. The Separator keeps the “out-going” paper from re-entering the Printer. If out-going paper does re-enter the Printer, a paper-jam condition will occur which could damage the Printer. To install the Separator:

1. Gently squeeze the two ends of the Separator together.
2. Insert the ends of the Separator into the Separator slot.
3. Release the two end of the Separator. Be sure the Separator is properly seated.

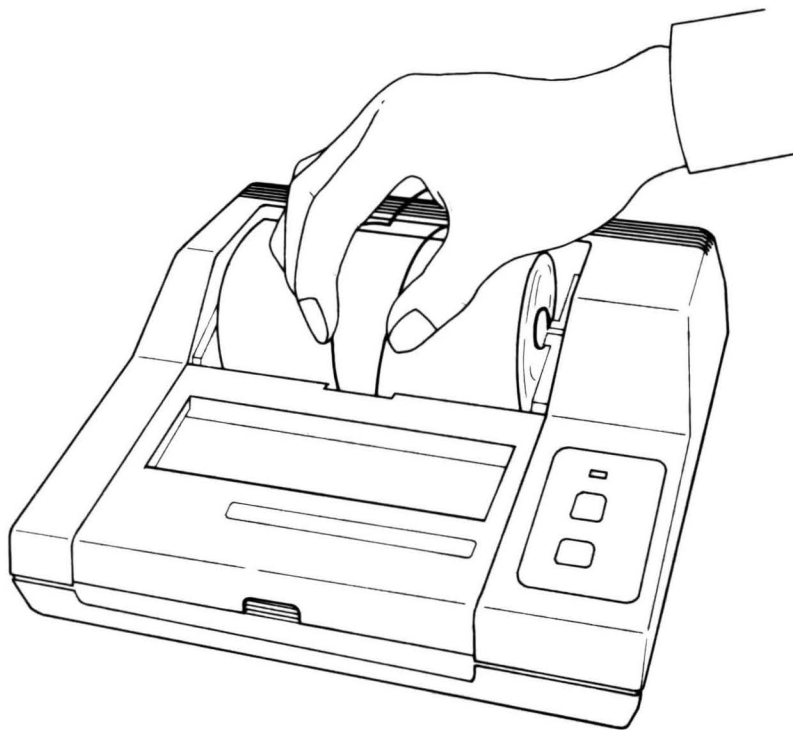


Figure 7. Installing the Paper Separator

Pen Installation

Be very careful when touching the Pen Holder. The Holder is delicate and can be easily damaged. Never rotate or move the Pen Holder manually. Use the Printer controls to move the Pen Holder.

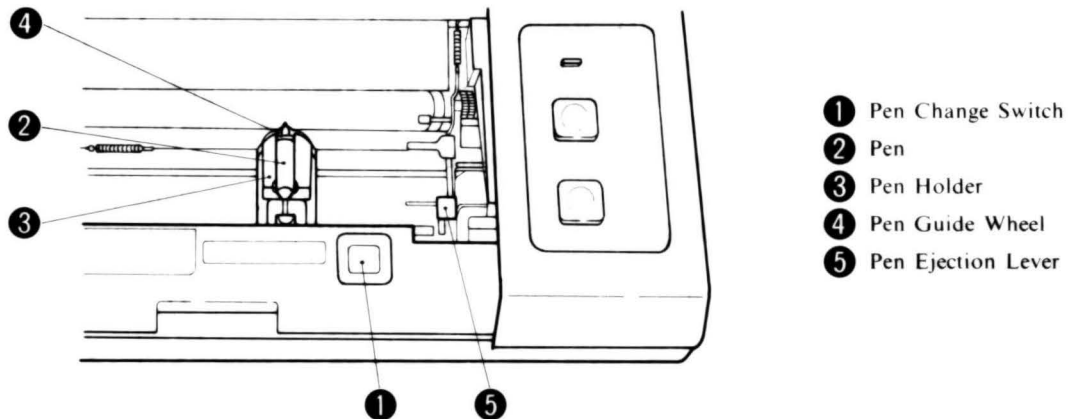


Figure 8. Pen Holder Mechanism

Pen Installation/Removal

Important Note: You must always use four pens. Using the Printer with only three (or fewer) pens may cause incorrect color changes when you are changing color.

Be sure to use only Radio Shack Color Graphic Printer Pens with your Printer. Using other pens may damage the Printer. Table 3 describes the Pens Radio Shack provides for the Color Graphic Printer.

Color Graphic Printer Pens	
Cat. No.	Description
26-1480	3 Black Pens
26-1481	1 each Red, Blue, Green

Table 3

You can install the Pens in any order you need. However, the Printer recognizes four specific Pen Positions--Pen # 1, Pen # 2, Pen # 3, and Pen # 4. We suggest you use the sequence detailed in Table 4 when installing pens. When referring to Pen Colors and Pen Positions in this manual, we'll be using this sequence:

Pen Positions vs. Pen Colors	
Pen #	Color
1	Black
2	Blue
3	Green
4	Red

Table 4

There are two ways to identify a particular Pen Position # :

- The Pen Guide Wheel is color-coded. Simply look carefully near the center of the Wheel and match up the color of the Pen with the color on the Wheel.
- Turn the Printer OFF, then turn it back ON. On power-up, Pen # 1 (color-coded Black) is always "on top." To get to Pen # 2, press COLOR SELECT; to get to Pen # 3, press COLOR SELECT again, etc.

We recommend that if you know that you won't be using the Printer for a while (e.g., more than a day or two), you remove the Pens from the Printer and "cap" them so the ink won't dry out. In the same sense, it's a good idea to rub the Pen Point back and forth on a piece of paper to get the ink flowing before you install it in the Printer.

Before you install, remove, or replace any Pens, take a look at (and become familiar with) what's "under the hood."

Raise the Top Cover and look at the right side printing area. You'll see a wire about 1/2" long pointing to the left. Above it, and to the right, there will be a small white lever--the Pen Ejection Lever. Gently press down on this lever and the wire will go up. When a Pen is in the Holder, this will "pop" the Pen out.

Remember! Never move or rotate the Pen Holder manually.

To install, remove, or change Pens:

1. Raise the Top Cover.
2. Press the COLOR SELECT Switch to rotate to the the Pen Position # you need.
3. Press the PEN CHANGE Switch.

The Pen Holder will move to the far right. Note that the Pen Ejection Lever wire will be under the Pen.

4. If you're removing or changing a Pen:
 - Gently hold the Pen down with one finger.
 - Gently press down on the Pen Ejection Lever.

If the Pen "pops" into the Printer, hold the Paper Roll (if installed), turn the Printer upside-down, and gently shake Printer until the Pen falls out. Do not operate the Printer with a Pen loose in the printing mechanism or damage to the Printer may result.

- Remove the Pen.

To install a new Pen, insert the "ink" tip of Pen into the Pen Wheel Guide hole. (Match up the color on the pen with the color on the Wheel.) Gently "snap" the other end of the Pen into place.

5. To rotate the Pen Holder to the next Pen Position #2, press the COLOR SELECT Switch.

The Pen Holder will move to the left, rotate to Pen Position #2, and return to the right most position.

To select Pen Position #3, repeat the above procedure.

6. Close the Top Cover.
7. Press the PAPER FEED Switch and the Pen Holder will return to the left margin and will be ready to begin printing.

Setting the Print Parameters (DIP Switch)

The settings of the DIP Switch (on the Rear Panel) of the Graphic Printer determine how the Printer will print. They must also be appropriately adjusted for the Computer the Printer is connected to. Figure 9 describes the settings of the DIP Switch.

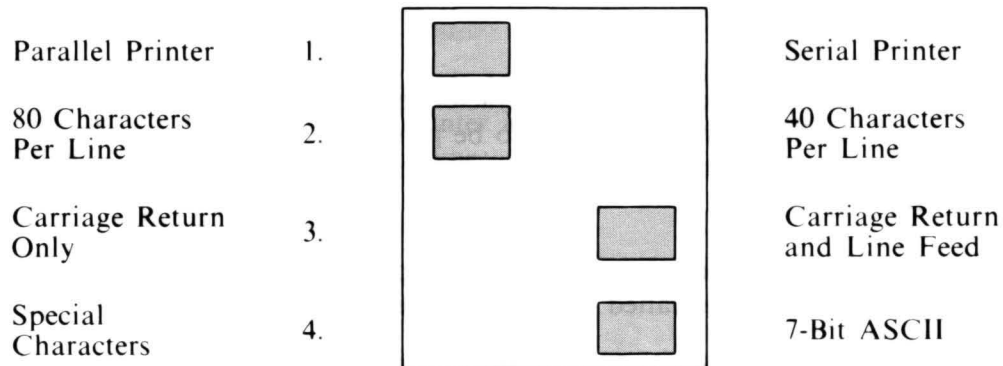


Figure 9. The DIP Switches

Set each Switch to either right or left using a tool such as a pencil point or ball-point pen with the pen-point retracted.

For instance, if you're using a TRS-80 Color Computer and the Computer is connected to the Printer via the SERIAL I/O Jack, set DIP Switch #1 to the right (Serial Printer).

Or, if you're in Text Mode (see **Text Mode vs. Graphic Mode**), and you want to print 80 characters per line (small print), set DIP Switch #2 to the left.

Print parameter settings must be set when the CPG-115 is turned off. If you need to change a setting, set the Switch to the OFF position, change the setting and turn the power back on.

3/A Little Background Information

The BASIC command to send information to the printer is LPRINT. The same command for the Color Computer is PRINT #2. For example:

LPRINT "V" **ENTER**
or
PRINT#-2, "V" **ENTER**

Before printing, the Printer checks to see if the character sent is an instruction (on how to print) instead of data (to be printed). An instruction, for example, might tell the Printer to backspace or change to a different Pen.

Consequently, some ASCII codes were created as instructions to control printers (and therefore are called "Control Codes").

How do we send instructions to the Printer?

To send instructions to the Printer, you must use "control codes." To do this, use the BASIC function CHR\$(). For example, to tell the Printer to backspace (ASCII Code 08), use the command:

LPRINT CHR\$(08) **ENTER**

in a program line (or in the "immediate mode") and the Printer will backspace.

Any ASCII code (control codes as well as data) can be sent to the Printer this way. Appendix D lists the ASCII codes the Color Graphic Printer recognizes. For instance, Appendix D will tell you that the ASCII code for the letter Z is 90 (decimal). If you use the command:

LPRINT CHR\$(90) **ENTER**

The Printer will print the letter Z.

Text Mode vs. Graphic Mode

The Graphic Printer has two modes of operation:

- Text Mode for word processing, note writing, program listings and program output.
- Graphic Mode for generating graphs, pictures and other visual creations.

Text Mode. On initial power-up, the Color Graphic printer is in Text Mode. However, if the Printer is in Graphic Mode and you want to return to Text Mode, type:

```
LPRINT CHR$(17) (ENTER)
```

or

```
PRINT#-2, CHR$(17) (ENTER)
```

In Text Mode, the Printer will use whatever settings the DIP Switch is currently set to. For instance, if DIP Switch #2 is set to 80 characters per line, the Printer will print in small print.

Graphic Mode. In this mode, you can generate graphs, pictures and other visual creations. To put the Printer in Graphic Mode, send a Control Code 18 (decimal) to the Printer using LPRINT or PRINT #-2. For instance:

```
LPRINT CHR$(18) (ENTER)
```

or

```
PRINT#-2, CHR$(18) (ENTER)
```

In Graphic Mode, you can move the Pen to any point on the paper and draw a line to any other point.

You must think of the Pen as being on a Cartesian coordinate plane, with the X-axis running left and right (horizontal) and the Y-axis going up and down (vertical).

Positive is up and to the right, negative is to the left and down the paper. See Figure 10.

The origin may be set anywhere on the paper. When you first enter Graphic Mode, the origin is at the left margin and under the Pen.

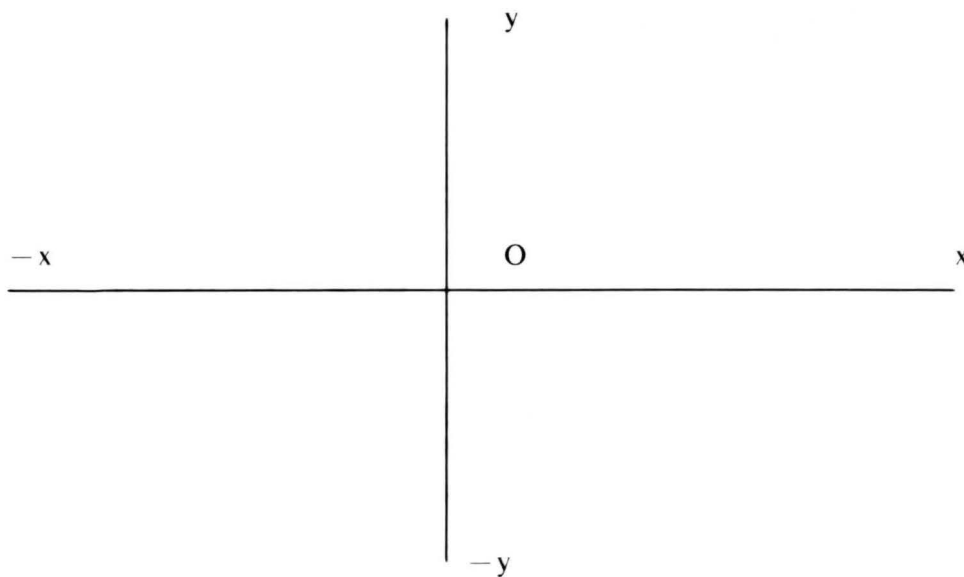


Figure 10. Coordinate (X-Y) Axis

Generally speaking, you can tell the Pen to do two things:

- MOVE (with the Pen up)
- DRAW (with the Pen down).

The Pen can move (or draw) two different ways:

- RELATIVE Movement (from the current Pen position to a point relative to the pen location.)
- ABSOLUTE Movement (from the current Pen position to a point relative to the Origin.)

There are times when one or the other way of moving will be more convenient to use.

How far does the Pen move?

In both horizontal and vertical directions, Pen movement is measured in “steps.” Each step is 0.2 mm long (about the size of a period) and there are 480 of them across the paper.

4/Using the Graphic Printer

Automatic Start-up Sequence

Once the Printer is properly connected, it will execute a short, built-in routine that resets the Pen Holder and draws four small boxes in each available pen color on power-up.

This allows you to be sure that each Pen has enough ink and is drawing correctly before you begin using the Printer.

If the Top Cover is open on power-up, the Printer will execute the routine but the Pens will not touch the paper. This will prevent the Pens from drawing on the Platen when paper is not being loaded.



Figure 11. Automatic Start-Up Sequence

After the four boxes are drawn, the Pen will return to the left margin. The Graphic Printer will then be in Text Mode and ready for operation.

Manual Operation

You can change Pen color with the COLOR SELECT key and advance the paper using the PAPER FEED key.

Program Control

You can use all the Power of your Graphic Printer from within a BASIC program. Note that you can use Control Codes (CHR\$()) to send instructions to the Printer as well as data to be printed. In this section, we'll describe the Control Codes sequentially starting with CHR\$(08) through CHR\$(29). Then we'll describe the Graphic Commands listed alphabetically.

With each code or command, we've included a short example. The examples serve two purposes. First, they show how to use the command being discussed. Second, they show how to use combinations of commands to draw with the Graphic Printer. Once you see how

simple it is to program the Graphic Printer, you can write your own graphic programs. (For more involved programs, see Appendix A.)

Control Codes

CHR\$ (8)

Backspace (Text Mode)

This command backspaces the Pen one character at a time. You'll find CHR\$ (8) very useful when you need to underline.

Example

```
10 LPRINT "A";  
20 LPRINT CHR$(8);  
30 LPRINT CHR$(95)
```

This program will print the letter A, then backspace (line 20) and print an underline.

CHR\$ (11)

Reverse Line Feed (Text Mode)

CHR\$ (11) moves the paper backwards (reverse) one line at a time. This is often used for superscripting characters.

Example

```
10 REM SUPERSCRIPT DEMONSTRATION  
20 PRINT#-2, "2";  
30 PRINT#-2, CHR$(11);  
40 PRINT#-2, "2";  
50 PRINT#-2, CHR$(10) : REM LINEFEED  
60 END
```

CHRS (18)

Select Graphic Mode

When the Printer is in Text Mode, this command will put it into Graphic Mode.

Example

```
10 LPRINT CHR$(18)

10 PRINT#-2, CHR$(18)
```

CHR\$ (17)

Select Text Mode

This command is used when text material is to be printed. There are other commands that allow you to print words in Graphic Mode, but CHR\$ (17) is the easiest way to change to Text Mode and print text between graphic material.

Example

```
20 PRINT#-2, CHR$(17)

20 LPRINT CHR$(17)
```

CHR\$ (29)

Rotate Pen Holder (Text Mode)

This command advances the Pen Holder one color. CHR\$ (29) is used to change color from Text Mode and you must keep track of what color is next. If you want the color beyond the next Position, you may use the command more than once.

Example

```
10 LPRINT CHR$(29)

10 PRINT#-2, CHR$(29)
```

Graphic Commands

The following commands can be used in Graphic Mode only.

A

Return to Text Mode (Reset)

A

This command moves the Pen Holder to the left margin (without drawing a line and without vertical movement) and returns the Printer to Text Mode. In this case, the Origin is also re-defined (reset) as the left margin.

Example

```
10 LPRINT CHR$(18)
20 LPRINT "A"
30 LPRINT "A"
```

This example will put the Printer into Graphic Mode (line 10). Line 20 will return the Printer to Text Mode. Line 30 will print the letter A.

C

Change Color

C color

color is a numeric expression from 0 to 3. color is optional; if omitted, 0 is used.

If you installed the Pens according to the suggested sequence earlier, then 0 = Black, 1 = Blue, 2 = Green, and 3 = Red.

If not, then the Pen you installed in Pen Position #1 will determine the color you get when you send the Color command to the Printer.

Example

```
10 LPRINT "C1"

10 PRINT #-2, "C1"
```

The following sample program illustrates how the C command works. It also illustrates CHR\$(18) which is the Graphics Select command. Note that this program is written for the TRS-80 Color Computer. If you want to run it on another TRS-80, change PRINT #-2, to LPRINT. The program also assumes that the Pens are installed as described in Table 3.

```
10 REM COLOR SELECT
20 PRINT#-2,
30 PRINT#-2,CHR$(18):PRINT#-2,"C0"
40 PRINT#-2,CHR$(17);:PRINT#-2,"I LOVE YOU"
50 PRINT#-2,CHR$(18):PRINT#-2,"C1"
60 PRINT#-2,CHR$(17);:PRINT#-2,"JE T'AIME"
70 PRINT#-2,CHR$(18):PRINT#-2,"C2"
80 PRINT#-2,CHR$(17);:PRINT#-2,"YO TE AMO"
90 PRINT#-2,CHR$(18):PRINT#-2,"C3"
100 PRINT#-2,CHR$(17);:PRINT#-2,"ICH LIEBE DICH"
110 PRINT#-2,CHR$(18):PRINT#-2,"C0"
120 PRINT#-2,"A"
130 END
```

RUNing this program will result in:

```
ILOVE YOU
JE T'AIME
YO TE AMO
ICH LIEBE DICH
```

D

Draw (Absolute)

D destination....

destination specifies the endpoint of the point you wish and is a X-Y coordinate. (The startpoint of the line is the current Pen position.) **destination** may be repeated to draw more than one line.

D draws a line from the current pen position to a destination point. The destination point (e.g., the point where the line ends) is in the form x,y where X and Y are a coordinate pair with respect to the Origin.

If more than one pair of coordinates are specified then the line will be continued to the second point, then to the third point, etc. X and Y are values between -999 and 999.

Example

```
10 REM DRAWING EXAMPLE
20 LPRINT CHR$(18) : REM TURN ON GRAPHICS
30 LPRINT "D0,100,100,100,100,0,0,0"
40 LPRINT "A"
50 END
```

The example will draw a box. Remember that the paper is 480 steps accross and as deep as you wish (up to 999 steps).

Since you didn't specify a different Origin, the Pen started at 0,0. The corners of the box are at 0,0 0,100 100,100 and 100,0.

H

Return to Origin (Home)

H

The H command will move the Pen to the Origin without drawing a line.

Example

```
10 LPRINT "H"

10 PRINT #-2, "H"
```

I

Set Origin (Initialize)

I

This command resets the Origin to the current location of the Pen point.

Example

```
10 REM RELOCATE ORIGIN
20 PRINT#-2,CHR$(18)
30 PRINT#-2,"D240,0"
40 PRINT#-2,"I"
50 END
```

This short routine draws a line to the center of the paper, then defines the center of the paper as the Origin.

J

Draw (Relative)

J *destination...*

destination specifies the endpoint of the point you wish to draw to and is a X-Y coordinate. (The startpoint of the line is the current Pen position.) *destination* may be repeated to draw more than one line.

The J command draws a line from the current Pen position to an end point. The end point is determined by measuring up X units and right Y units. (or left and down if X and Y are negative).

Once the Pen is at this new position, the line can be continued to another point by supplying another pair of X-Y values. The new point is measured from the previous point, and not from the original pen position. X and Y must be in the range -999 to 999.

Example

```
10 REM RELETIVE DRAWING
20 LPRINT CHR$(18)
30 LPRINT "J0,100,100,0,0,-100,-100,0"
40 END
```

This draws the same box as the sample for the D command, but specifies the corners differently. Read line 30 like this:

“From where you are, draw a line to the point that is 0 steps to the right (in the X-direction) and 100 steps up (in the Y-direction). Then from that point, draw a line that is 100 steps to the right and 0 steps up, then a line from that point that is 0 steps to the right and 100 steps down. Finally draw a line that is 100 steps to the left and 0 steps up.”

M

Move (Absolute)

Mx,y

- x*** specifies a position on the X-axis and is a numeric expression between -999 and 999.
- y*** specifies a position on the Y-axis and is a numeric expression between -999 and 999.

The M command moves the Pen from its present location to the point specified by x,y without drawing a line. x and y must be in the range -999 to 999.

Example

```
10 PRINT#-2, "M100,-100"
```

```
10 LPRINT "M100,-100"
```






L

Line Type

L type

- type*** specifies the "type" of line you wish to draw and is a numeric expression from 0 to 15. ***type*** is optional; if omitted, 0 is used. 0 is a solid line.
- 1 through 15 generate different types of dash lines; the greater the number, the farther apart the dashes are.

The L command lets you specify different line types. You can specify a solid line or 15 different types of dashed (or dotted) lines. The following table illustrates the line types available:

Line Types	
Line Specified	Line Drawn
0	
1	
2	
3	
4	

5	-----
6	-----
7	-----
8	-----
9	-----
10	-----
11	-----
12	-----
13	-----
14	-----
15	-----

Example

```

10 REM LINE SAMPLE PROGRAM
20 PRINT#-2,CHR$(18)
30 PRINT#-2,"L3"
40 PRINT#-2,"J480,0"
50 PRINT#-2,"A"
60 END

```

Line 30 sets the line type to 3. The program will draw a dotted line across the paper. Add an instruction to change the color if you wish.

P

Print Text Characters

P *characters*

characters is either a alpha-character (A-Z) or a numeric-character.

The P command lets you print either alpha- or numeric-characters while in Graphic Mode without first returning to Text Mode. Characters may be any string of letters or numerals.

After the command is executed, the Printer will still be in Graphic Mode.

Example

10 LPRINT "PGRAPHIC PRINTER"

Will print the string GRAPHIC PRINTER while the Graphic Printer is in Graphic Mode.

S Character Size

S size

size specifies the size of the printed characters and is a numeric expression between 0-63. **size** is optional; if omitted, 0 is used.

The S command lets you specify the size of the character drawn with the P command. **size** may be a numeric expression between 0-63; 0 draws the smallest characters size (80 characters per line), 63 the largest (1 character per line).

Use this formula to determine the size of printed character in relation to the numeric value you specify:

$$cpl = 80 / (size + 1)$$

where cpl is the number of characters per line and size is the numeric value you specify with the S command.

Once the character size is set with the S command in Graphic mode, the size remains in effect when you enter text mode.

Q Rotate Print Direction

Q direction

direction specifies which direction you wish printing to be and is a numeric expression from 0 to 3. **direction** is optional; if omitted, 0 is used.

On power-up (in Text Mode), Q0 is used.

However, when you enter Graphic Mode, you can specify one of four directions for character printing. See Table 5.

Printing Direction	
Direction specified	Print Direction
0	Left-to-Right
1	Top-to- Bottom
2	Right-to-Left (Upside down)
3	Bottom-to-Top

Table 5.

For instance, using the word JON as an example:

- Q0 (left-to-right) would produce JON.
- Q1 (top-to-bottom) would print $\begin{smallmatrix} J \\ O \\ N \end{smallmatrix}$

- Q2 (right-to-left) would produce NOJ
- Q3 (bottom-to-top) would print $\begin{smallmatrix} N \\ O \\ J \end{smallmatrix}$

Example

```

10 REM WRITING SIDEWAYS
20 PRINT#-2,CHR$(18)
22 PRINT#-2,"M50,0" : REM ALLOW LEFT MARGIN
30 INPUT"TYPE YOUR NAME " ;N$
40 PRINT#-2,"P";N$ : REM WRITE YOUR NAME
50 PRINT#-2,"Q1" : REM CHANGE DIRECTION
60 PRINT#-2,"P";N$ : REM WRITE YOUR NAME
70 PRINT#-2,"Q2" : REM NOW UPSIDE DOWN
80 PRINT#-2,"P";N$ : REM WRITE YOUR NAME
90 PRINT#-2,"Q3" : REM CHANGE DIRECTION
100 PRINT#-2,"P";N$ : REM WRITE YOUR NAME
110 PRINT#-2,"Q0" : REM BACK TO RIGHTSIDE UP
120 PRINT#-2,"A" : REM BACK TO TEXT MODE
130 END

```

R

Move (Relative)

R*x,y*

x specifies a point on the X-axis and is a numeric expression between -999 and 999.
y specifies a point on the Y-axis and is a numeric expression between -999 and 999.

This command moves the Pen from the current location to the point that is *x* steps away to the right (or left if *x* is negative) and *y* steps up (down if *y* is negative).

Example

```
10 REM SAMPLE OF RELATIVE MOVE
20 LPRINT CHR$(18) : REM TURN ON GRAPHICS MODE
30 LPRINT "R100,0" : REM MOVE TO RIGHT 100 STEPS
40 LPRINT "R0,-100" : REM NOW MOVE 100 STEPS DOWN
50 LPRINT "J-100,100" : REM NOW DRAW A LINE BACK TO THE
  BEGINNING
60 LPRINT "A" : REM AND QUIT
70 END
```

1. Line 30 moves the point 100 steps to the right and 0 steps up.
2. Line 40 moves the point 100 steps down and 0 steps to the right.
3. Line 50 draws relative back to the origin, undoing the moves of lines 30 and 40.

X

Draw X-Y Axis

X *axis, step, interval*

axis specifies axis to be drawn drawn and is a numeric expression of either 1 (X-axis) or 0 (Y-axis).

step specifies the graduation (distance) between measurement marks on the axis and is a numeric expression between -999 and 999.

interval specifies the number of times that *step* is to be repeated and is a numeric expression between 1 and 255.

The X command lets you draw Coordinate (X-Y) Axis, divide the axis into specified units of measurements (graduations), and designate how many units of measurements are to be drawn on the axis.

If axis is 0, a vertical (Y) axis will be drawn. If axis is 1, a horizontal (X) axis will be drawn.

The axis can also be divided into segments. Since each step is 0.2 mm, the exact distance between segment marks can be easily set. You may have 1 to 255 intervals, each one 1 to 999 steps long. If interval is negative, the axis will be drawn from the left, or down depending on the choice for axis.

Example

```
10 LPRINT "X0,6,20"
```

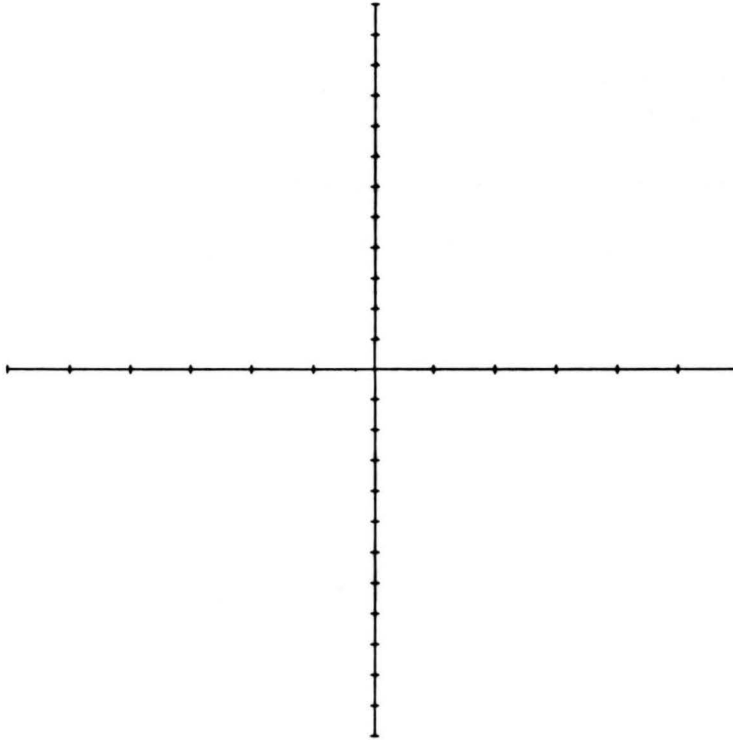
will draw a vertical axis up from the present location.
There will be a small dash (grad) every 6 steps (20 dashes altogether).

```
10 PRINT#-2, "X1,-10,16"
```

This command will produce a horizontal axis left of the current Pen location, with 16 sections each 10 steps apart.

```
10 REM X-Y AXIS TO BE DRAWN
20 LPRINT: LPRINT CHR$(18) :REM GO INTO GRAPHIC MODE
30 LPRINT "M240,-240" :REM MOVE TO SPECIFIED POINT
40 LPRINT "I" :REM SET NEW ORIGIN
50 LPRINT "X1,40,6" :REM HALF OF X-AXIS
60 LPRINT "H" :REM MOVE PEN TO ORIGIN
70 LPRINT "X1,-40,6" :REM OTHER HALF OF X-AXIS
80 LPRINT "H" :REM MOVE PEN TO ORIGIN
90 LPRINT "X0,20,12" :REM HALF OF Y-AXIS
100 LPRINT "H" :REM MOVE PEN TO ORIGIN
110 LPRINT "X0,-20,12" :REM OTHER HALF OF Y-AXIS
120 LPRINT "A" :REM RESET, MOVE PEN TO LEFT
130 END
```

This program will produce a Coordinate Axis such as this:



5/Care and Maintenance

The Graphic Printer is a very reliable unit that should give years of satisfactory service. However, there are some definite Do's and Dont's:

- Do not manipulate the Pen Holder by hand. You can very easily cause damage to the Printer. Be especially careful when inserting and removing the pens.
- The Pen Holder is self-propelled. Do not move it manually. To move it to the right, press the Pen Change Switch (under the cover). To move it to the left, press PAPER FEED. To rotate the Pen Holder press COLOR SELECT.
- Do not operate the Graphic Printer without Pens.
Leave a dry or broken pen in the Holder until you can replace it.

-
- Cap the pens and return them to their case when the Graphic Printer is not in use.
 - Do not attempt to use any power supply other than the one specified.
 - Do not attempt to use Pens or paper not designed for this Printer.

The Graphic Printer contains a self-test routine. To see all the characters in the size specified by the DIP Switch, turn the Power Switch on while holding down the PAPER FEED Switch. You will see:

```
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGH  
IJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz  
~
```

Figure 12. Self Test

6/Specifications

Plotting/Printing System	Ball Point Pen, 4 color
Plotting Speed (Horizontal) (Vertical)	52 mm/sec (2.05 ips) 73 mm/sec (3.8 ips)
Printing Speed	12 characters per second
Resolution	0.2 mm/step (0.00787 inch)
Effective Plotting Range	96 mm (3.804 inch) x axis Divided into 480 steps (No limit in y direction)
Characters per Line	80 or 40 (Text Mode) (Determined by Software in Graphics Mode)
Characters Per Line = $\text{INT} (480/(n+1) * 6)$ for $0 \leq n \leq 15$	
Accuracy (repetition) (Movement) (Distance)	0.2 mm max 0.3 mm max 0.5% max (X-axis) 1 % (Y-axis)
Dimensions	210 mm wide (8.4 in) 216 mm deep (8.64 in) 75 mm high (3 in)
Weight	0.8 kg (1.76 lbs) (Printer only)
Pens	
3 Black Pens	Radio Shack 26-1480
1 each Blue, Green, Red	Radio Shack 26-1481
Pen Life	250 meters (825 feet)
Paper	Radio Shack 26-1428

Parallel Interface	8-bit parallel. Uses BUSY handshaking, STROBE, and ACKNOWLEDGE
Serial Interface	RS-232-C Using DATA and BUSY. 600 Baud, 7-bit character, no parity, two stop bits.
Selectable Modes	
Self Test	Prints 96 ASCII character set in 4 colors
Text Mode	Normal Serial and Parallel Printing
Graphics Mode	Image Plotting using the Various commands
Temperature Range	18.3 to 35C° (65 to 96F°)
Storage	-40 to 71C° (-40 to 160 F°)
Humidity Range	10% to 80% relative non-condensing
Power Supply (AC adapter)	
Input	120 VAC, 60 Hz
Output	9.8 VDC, @ 1.2 A
Power Consumption	23 W

Appendix A/Using the Color Graphic Printer with the TRS-80 Model II/16

If the Graphic Printer is connected to a Model II or Model 16 and stays BUSY for longer than a few seconds, the Computer will generate an I/O error message and halt a BASIC program. This may happen when the Graphic Printer is executing a long series of graphics instructions.

To avoid this situation, the following error routine may be useful:

1. At the beginning of the program, insert the line:

```
12 ON ERROR GOTO 1600
```

Any errors will then send program execution to line 1600.

2. Then, starting at line 1600, type:

```
1600 IF ERR = 56 THEN RESUME  
1610 ON ERROR GOTO 0
```

The instruction at line 1600 simply says "if the error is PRINTER BUSY FOR TOO LONG " then keep waiting. If there is any other error the program will continue with line 1610.

Line 1610 says "Turn off the error routine and display the error message". This restores the normal error checking routine.

Of course, you may use any line numbers you like instead of 1600. See your Computer owner's manual for more details.

Appendix B/Sample Programs

Several sample programs have been included here as examples of software which can be used with the Graphic Printer. These programs are not intended to be "Applications Software" but they may help you understand how the Graphic Printer works and give you somewhere to start when writing your own programs. You will quickly find ways to modify the programs for your own individual uses.

Remember! If you're using a TRS-80 Color Computer, simply substitute PRINT #-2, for LPRINT.

Line Graph

This program will draw a small line graph. You can change the line by changing the DATA statements. The horizontal component can be any value from 0 to 250 and the vertical component must be from 0 to 100 (if it is to stay within the coordinates).

```

10 REM LINE GRAPH
20 LPRINT CHR$(18)
30 LPRINT "R80,-200" : REM MAKE ROOM FOR GRAPH
40 LPRINT "I" : REM THIS IS THE ORIGIN
50 LPRINT "X0,10,10 : REM DRAW VERTICAL AXIS
60 LPRINT "HX1,25,10" : REM DRAW HORIZONTAL AXIS
70 LPRINT "S2" : REM CHARACTER SIZE SET
80 LPRINT "Q3" : REM WRITE ON LEFT SIDE
90 LPRINT "M-10,10 : REM POSITION PEN TO WRITE
92 LPRINT "PSALE" : REM WRITE VERTICALLY
94 LPRINT "M10,-40 : REM POSITION PEN
96 LPRINT "Q0" : REM WRITE RIGHTSIDE UP
98 LPRINT "P      1982" : REM WRITE TITLE
100 REM DATA CONTAINS POINTS TO DRAW
110 DATA 0,0
120 DATA 20,75
130 DATA 50,50
140 DATA 100,100
150 LPRINT "C1" : REM CHANGE COLOR
160 READ X,Y
170 LPRINT "M";X",";Y : REM MOVE TO FIRST POINT
180 READ X,Y : REM READ SECOND POINT
190 LPRINT "D";X",";Y : REM DRAW FROM 1 TO 2
200 READ X,Y : REM READ THIRD POINT
210 LPRINT "D";X",";Y : REM DRAW FROM 2 TO 3
220 READ X,Y : REM READ LAST POINT
230 LPRINT "D";X",";Y : REM DRAW TO LAST POINT
240 LPRINT "M0,-200" : REM MOVE PEN OUT OF WAY
250 LPRINT "A" : REM RETURN TO TEXT
260 END

```

Color Change During Program Execution

This program illustrates the power of the Graphic Printer in Text Mode. Program listing and output from programs can be much more colorful, and colors can be used to separate sections of a program from each other for easier identification.

```

10 REM SAMPLE PROGRAM THAT CHANGES COLORS
20 LPRINT CHR$(17) : REM MAKE SURE WE ARE IN TEXT
30 LPRINT "THIS LINE COMES IN BLACK"
40 GOSUB 100 : REM SUBROUTINES IN GREEN, PLEASE
50 LPRINT "AND BACK TO THE MAIN PROGRAM"
70 END
100 LPRINT CHR$(29) : LPRINT CHR$(29)
110 REM SKIP BLUE, GO TO GREEN
120 LPRINT "THIS IS A GREEN SUBROUTINE"
130 RETURN

```

You may want to use a program like this one to list a program you have finished so you won't forget how it all worked when you look at it some time later. Identify different parts of the program with colors.

If your version of Scrispit allows imbedded printer commands (Model II Scrispit does) you can change colors during a print-out to emphasize a word or a paragraph.

Underlining

Most printers that underline do so by first printing a letter, then backspacing one character and printing _ (underline). Here is a short program demonstrating the procedure.

```

10 REM BACKSPACE DEMONSTRATION
12 LPRINT CHR$(17) : REM TEXT MODE
20 LINEINPUT "STRING TO BE UNDERLINED " : N$
30 FOR I = 1 TO LEN(N$)
40 A$ = MID$(N$, I, 1)
50 LPRINT A$;
60 LPRINT CHR$(8);
70 LPRINT "_";
80 NEXT I
90 END

```

A\$ is a single character from N\$. Lines 50, 60, and 70 print the character, backspace one time and print the underline character. The ; at the end of each LPRINT command prevents a linefeed.

The following program will show you how to print as many lines of text as you wish, then go back over the page underlining entire words, sentences or paragraphs. This is much faster than using Backspace after each character.

```
10 REM UNDERLINE EXAMPLE
20 LPRINT CHR$(17):REM TEXT MODE
30 A$="THIS IS SO IMPORTANT WE ARE"
40 B$="UNDERLINING IT IN BLUE!"
50 LPRINT A$;
60 LPRINT STRING$(LEN(A$),8);
70 LPRINT CHR$(29):REM CHANGE PEN
80 LPRINT STRING$(LEN(A$),95):REM UNDERLINE
90 LPRINT STRING$(3,29);
100 LPRINT B$;
110 LPRINT STRING$(LEN(B$),8);
120 LPRINT CHR$(29):REM CHANGE PEN
130 LPRINT STRING$(LEN(B$),95):REM UNDERLINE
140 LPRINT STRING$(3,29)
150 END
```

The following program demonstrates superscripting. You must have at least a half-second delay before entering graphics mode before executing any graphics command. This is done in the loop at the end of the program.

```
10 REM SUPERScript
20 GRF$ = CHR$(18)
30 TXT$ = CHR$(17)
40 PRINT#-2,"100";
50 GOSUB 190
60 PRINT#-2,GRF$
70 PRINT#-2,"S0"
80 PRINT#-2,TXT$;
90 PRINT#-2,CHR$(11);
100 PRINT#-2,"2";
110 PRINT#-2,CHR$(10);
120 GOSUB 190
130 PRINT#-2,GRF$
140 PRINT#-2,"S1"
150 PRINT#-2,TXT$;
160 PRINT#-2," = 10000"
170 STOP
180 REM HALF SECOND PAUSE
190 FOR J=1 TO 250 : NEXT J
200 RETURN
```

The short program below will put a border along each side of a page. Then you can write a note in the middle, longhand or in Scriptit. The program is quite simple and you can probably improve it into something really nice. If you wish, you may use larger letters by changing lines 250 and 260. Experiment!

```
10 REM WRITING A BORDER FOR A NOTE
20 ON ERROR GOTO 340: REM ONLY ON MODEL II
30 LPRINT CHR$(18)
40 LPRINT "M10,0" : REM ALLOW FOR LEFT MARGIN
50 INPUT "COLOR ";C$
60 GOSUB 160: REM DECODE COLOR
70 INPUT"TYPE YOUR BORDER " ;N$
80 GOSUB 230: REM FIND CONSTANTS FOR THIS BORDER
90 FOR K = 0 TO 3 : REM ONE FOR EACH SIDE
100 LPRINT "Q";K
110 GOSUB 290: REM WRITE BORDER
120 NEXT K
130 LPRINT "Q0" : REM BACK TO RIGHTSIDE UP
140 LPRINT "A" : REM BACK TO TEXT MODE
150 END
160 REM SUBROUTINE TO DECODE COLOR
170 C = 0
180 IF LEFT$(C$,1) = "R" THEN C = 1
190 IF LEFT$(C$,1) = "G" THEN C = 2
200 IF LEFT$(C$,3) = "BLU" THEN C = 3
210 LPRINT "C";C
220 RETURN
230 REM SUBROUTINE TO FILL PAGE WITH BORDER
240 N$ = N$ + " "
250 S = 14 : REM SIZE OF LETTER 3 MM WIDE
260 N = INT(78/LEN(N$)) : REM 1.2 MM WIDE LETTERS + BORDER
270 IF N * LEN(N$) > 76 THEN N = N - 1
280 RETURN
290 REM GOSUB TO WRITE BORDER N TIMES
300 FOR I = 1 TO N
310 LPRINT "P";N$
320 NEXT I
330 RETURN
340 REM ERROR ROUTINE
350 IF ERR = 56 THEN RESUME : REM GO WAIT SOME MORE
360 ON ERROR GOTO 0 : REM SOME OTHER ERROR
```

Graphics Demonstration

The program below will demonstrate the graphing power of the Graphic Printer. Data for the pie chart comes from the DATA statements near the end of the listing. You may change those to make a different graph. Feel free to use sections of this program in your own software. The section that draws the sine and cosine waves could give you a Fourier analysis graph rather easily.

```

10 REM *****
20 REM      TRS-80 C. G. P. DEMONSTRATION
30 REM *****
32 ON ERROR GOTO 1600 : REM MODEL II ONLY
40 LPRINT CHR$(19)
50 LPRINT CHR$(18);"S4" : LPRINT "C0"
60 LPRINT "L0" : LPRINT "M0,-50"
70 LPRINT "IP TRS-80" : LPRINT "S1"
80 LPRINT "M0,-20" : LPRINT "S1"
90 LPRINT CHR$(17)
100 LPRINT CHR$(29); "      COLOR";CHR$(29); "
GRAPHIC";CHR$(29); " PRINTER";CHR$(29)
110 A$ = CHR$(10) : LPRINT A$;A$
120 REM *** PLOT CIRCLE GRAPH ***
130 LPRINT "-----PIE GRAPH-----"
150 LPRINT A$
160 LPRINT CHR$(18); "M0,-120,120,-120"
170 LPRINT "I"
180 GOSUB 650
190 LPRINT "M130,0,130,";(N-1)*15
200 FOR I = 1 TO N
210 LPRINT "I"
220 LPRINT "C";COLOR(I)
230 LPRINT "J0,20,30,0,0,-20,-30,0"
240 J = 0
250 LPRINT "M0,"J:LPRINT "J30,0"
260 J = J + PITCH(I) : IF J < 20 THEN 250
270 LPRINT "M40,0" : LPRINT "P"; NA$(I)
280 FOR K = 1 TO 11 - LEN(NA$(I))
290 LPRINT "P" : NEXT K
300 LPRINT "P"; U(I) : UNIT$
310 LPRINT "M0,0,0,-30"
320 NEXT I
330 LPRINT "M0,-100" : LPRINT "A"
340 REM *** SINE AND COSINE CURVES ***
350 LPRINT "-----SINE AND COSINE CURVES-----"
360 LPRINT CHR$(18);"R0,-150,240,0"
370 LPRINT "I"
380 LPRINT "X1,-20,10"
390 LPRINT "HX1,20,10"
400 LPRINT "HX0,16,5"
410 LPRINT "HX0,-16,5"
420 LPRINT "C0" : LPRINT "L0"
430 B=30:H=15:C=0:GOSUB 550
440 LPRINT "C1" : LPRINT "L3"
450 B=-100:H=80:C=0:GOSUB 550
460 LPRINT "C2" : LPRINT "L5"
470 B=100:H=80:C=1 : GOSUB 550

```

```

480 LPRINT "C3" : LPRINT "L0"
490 B=100:H=80:C=0:GOSUB 550
500 LPRINT "M0,-150" : LPRINT "C0"
510 LPRINT "A" : LPRINT "---THE END---"
520 LPRINT : LPRINT
530 END
550 REM **: DRAW SINE OR COSINE CURVE **:
560 A$ = "M"
570 FOR I = -200 TO 200 STEP 4
580 S = I / B * PI
590 IF C = 0 THEN Y = INT(SIN(S) * H)
600 IF C = 1 THEN Y = INT(COS(S) * H)
610 LPRINT A$;I;",";Y : A$ = "D"
620 NEXT I
630 RETURN
640 REM
650 REM *****
660 REM * PIE CHART SUBROUTINE *
670 REM *****
680 READ R,N,M,UNIT$
690 FOR I = 1 TO N
700 READ NA$(I),U(I),COLOR(I),PITCH(I)
710 NEXT I
720 PI = 3.1416 : P2 = 2 * PI
730 A$ = "M"
740 FOR I = 0 TO 100 STEP 2
750 S = 1 / 100 * P2
760 X = INT(SIN(S)*R) : Y = INT(COS(S)*R)
770 LPRINT A$;X;",";Y:A$ = "D"
780 NEXT I
790 S = 0
800 FOR I = 1 TO N
810 S = S + U(I) * P2 / M
820 X = INT(SIN(S)*R) : Y = INT(COS(S)*R)
830 LPRINT "HD";X;",";Y
840 NEXT I
850 P = 0
860 FOR I = 1 TO N
870 LPRINT "C";COLOR(I)
880 Q = P : P = P + U(I)
890 QS = Q * P2/M : PS = P * P2/M
900 QX = INT(SIN(QS) * R) : QY = INT(COS(QS) * R)
910 PX = INT(SIN(PS) * R) : PY = INT(COS(PS) * R)
920 ST = R : EN = -R
930 IF QY >= 0 AND PY >= 0 THEN EN = 0
940 IF QY <= 0 AND PY <= 0 THEN ST = 0
950 FOR Y = ST TO EN STEP -PITCH(I)
960 J = 0
970 RA = SQR(R*R-Y*Y)

```

```

980 IF Y = 0 THEN RS = PI/2 : GOTO 1010
990 RS = ATN(RA/Y)
1000 IF RS < 0 THEN RS = RS + PI
1010 IF QS < RS AND RS < PS THEN D(J) = INT(RA) : J = J + 1
1020 RS = P2 - RS
1030 IF QY = 0 THEN GOTO 1090
1040 X = QX/QY*Y
1050 IF SGN(X) <> SGN(QX) THEN GOTO 1090
1060 IF SGN(Y) <> 0 AND SGN(QY) <> SGN(Y) THEN GOTO 1090
1070 RT = SQR(X*X+Y*Y)
1080 IF RT <= R THEN D(J) = INT(X) : J = J + 1
1090 IF PY = 0 THEN GOTO 1150
1100 X = PX * Y / PY
1110 IF SGN(X) <> SGN(PX) THEN GOTO 1150
1120 IF SGN(Y) <> 0 AND SGN(PY) <> SGN(Y) THEN GOTO 1150
1130 RT = SQR(X*X+Y*Y)
1140 IF RT <= R THEN D(J) = INT(X) : J = J + 1
1150 IF QS < RS AND RS < PS THEN D(J) = INT(-RA) : J = J + 1
1160 IF Y = 0 AND J <> 2 THEN D(J) = 0 : J = J + 1
1170 IF J <= 2 THEN 1250
1180 FOR K = 0 TO J-1
1190 MIN = D(K) : MN = L
1200 FOR L = K+1 TO J-1
1210 IF D(L) < MIN THEN MIN = D(L) : MN = L
1220 NEXT L
1230 D(MN) = D(K) : D(K) = MIN
1240 NEXT K
1250 K = 0
1260 IF J < 2 THEN 1290
1270 LPRINT "M";D(K);", ";Y : LPRINT "D";D(K+1);", ";Y
1280 K = K + 2 : IF K < J-1 THEN GOTO 1270
1290 NEXT Y
1300 NEXT I
1310 RETURN
1320 REM *****
1330 REM *      DATA TABLE      *
1340 REM *****
1350 REM DATA R,N,M,UNIT$
1360 DATA 100,5,100,%
1370 REM DATA NAME, UAL., COLOR, PITCH
1380 DATA LSI,40,1,2
1390 DATA IC,25,0,3
1400 DATA TRANSISTOR,20,2,4
1410 DATA DIODE,10,3,2
1420 DATA OTHER,5,0,4
1600 REM MODEL II ONLY
1610 IF ERR = 56 THEN RESUME : REM IF I/O ERROR KEEP WAITING
1620 ON ERROR GOTO 0 : REM SOME OTHER ERROR

```

Appendix C/Color Graphic Printer Command Summary

Each command must be sent with either LPRINT for all TRS-80 Computers except Color Computer or PRINT #-2 for Color Computer.

10 LPRINT CHR\$(17) PRINT#-2, "M0,100"

CHRS (8)	Backspace in Text Mode. LPRINT CHR\$(8) PRINT #-2, CHR\$(8)
CHRS (11)	Reverse Line Feed in Text Mode. Moves paper down one row. LPRINT CHR\$(11) PRINT #-2, CHR\$(11)
CHRS (17)	Select Text Mode. LPRINT CHR\$(17) PRINT #-2, CHR\$(17)
CHRS (18)	Select Graphic Mode. LPRINT CHR\$(18) PRINT #-2, CHR\$(18)
CHRS (29)	Change color in TEXT mode.
A	Reset Pen moves to left margin (without drawing) and returns to Text Mode. LPRINT "A" PRINT #-2, "A"
C <i>number</i>	Change color to specified Pen. <i>number</i> from 0-3. LPRINT "C1" PRINT #-2, "C4"
D <i>destination</i>	Draw from current coordinate to specified destination. If there is more than one point the line continues to the second point, etc. Current Origin is used. LPRINT "D";X", ";Y PRINT#-2, "D240,100".
H	Moves Pen to current origin without drawing line. LPRINT "H" PRINT#-2, "H"

I	Sets new Origin (i.e., the current Pen location). LPRINT "I" PRINT#-2, "I"
J destination	Draws a line from current Pen location <i>X</i> steps to the right and <i>Y</i> steps up. LPRINT "J100, 200, 300, -200"
Ltype	Change Line Type from 0 to 15. 0 is a solid line. 1-15 draws dotted (dashed) lines. LPRINT "L3" PRINT #-2, "L15"
Mx,y	Move (Absolute). Move without drawing to location <i>x</i> steps right (left) and <i>y</i> steps up (down) of present origin. PRINT#-2, "M100, -100"
Pcharacters	Print characters in Graphic Mode. PRINT#-2, "PTODAY IS ";DATE\$
Q direction	Change print direction. <i>direction</i> is 0-3. 0, normal, left-to-right: 1, top-to-bottom: 2, upside down: 3, bottom-to-top. PRINT #-2, "Q3" LPRINT "Q2"
Rx,y	Move (Relative). Move without drawing from present location to location <i>x</i> steps to the right (left) and <i>y</i> steps up (down). LPRINT "R200, -200" PRINT #-2, "R30, 20"
S size	Specifies size of printed characters drawn with the P command. LPRINT "PTODAY S10 IS S63 A GOOD DAY"
Xaxis, step, intervals	Draw a coordinate axis from present location in direction specified by <i>axis</i> using increments of <i>step</i> and marking <i>intervals</i> of them. LPRINT "X0, -20, 16" PRINT#-2, "X1, 5, 100"

Appendix D/ASCII Character Set

The following table lists each character the Graphic Printer will print and the ASCII code that will print it.

ASCII Code	Character	ASCII Code	Character
33	!	80	P
34	..	81	Q
35	#	82	R
36	\$	83	S
37	%	84	T
38	&	85	U
39	,	86	V
40	(87	W
41)	88	X
42	*	89	Y
43	+	90	Z
44	,	91	[
45	-	92	\
46	.	93]
47	/	94	^
48	0	95	_
49	1	96	`
50	2	97	a
51	3	98	b
52	4	99	c
53	5	100	d
54	6	101	e
55	7	102	f
56	8	103	g
57	9	104	h
58	:	105	i
59	;	106	j
60	<	107	k
61	=	108	l
62	>	109	m
63	?	110	n
64	@	111	o
65	A	112	p
66	B	113	q
67	C	114	r
68	D	115	s

ASCII Code	Character	ASCII Code	Character
69	E	116	t
70	F	117	u
71	G	118	v
72	H	119	w
73	I	120	x
74	J	121	y
75	K	122	z
76	L	123	{
77	M	124	
78	N	125	}
79	O	126	~
		127	☒

Control Codes and the ASCII Code Required

08	BACKSPACE
10	LINEFEED
11	REVERSE LINEFEED
13	CARRIAGE RETURN
17	SET TEXT MODE
18	SET GRAPHIC MODE
29	CHANGE COLOR

IMPORTANT INFORMATION

This equipment generates and uses radio frequency energy. If it is not installed and used properly, that is, in strict accordance with the manufacturer's instructions, it may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- reorient the receiving antenna
- relocate the computer with respect to the receiver
- move the computer away from the receiver
- plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: *How to Identify and Resolve Radio- TV Interference Problems*. This booklet is available from the United States Government Printing Office, Washington, DC 20402, Stock No. 004-000-0035-4.

Warning: This equipment has been certified to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of FCC Rules.

LIMITED WARRANTY

For a period of 90 days from the date of delivery, Radio Shack warrants to the original purchaser that the computer hardware unit shall be free from manufacturing defects. This warranty is only applicable to the original purchaser who purchased the unit from Radio Shack company-owned retail outlets or duly authorized Radio Shack franchisees and dealers. This warranty is voided if the unit is sold or transferred by purchaser to a third party. This warranty shall be void if this unit's case or cabinet is opened, if the unit has been subjected to improper or abnormal use, or if the unit is altered or modified. If a defect occurs during the warranty period, the unit must be returned to a Radio Shack store, franchisee, or dealer for repair, along with the sales ticket or lease agreement. Purchaser's sole and exclusive remedy in the event of defect is limited to the correction of the defect by adjustment, repair, replacement, or complete refund at Radio Shack's election and sole expense. Radio Shack shall have no obligation to replace or repair expendable items.

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