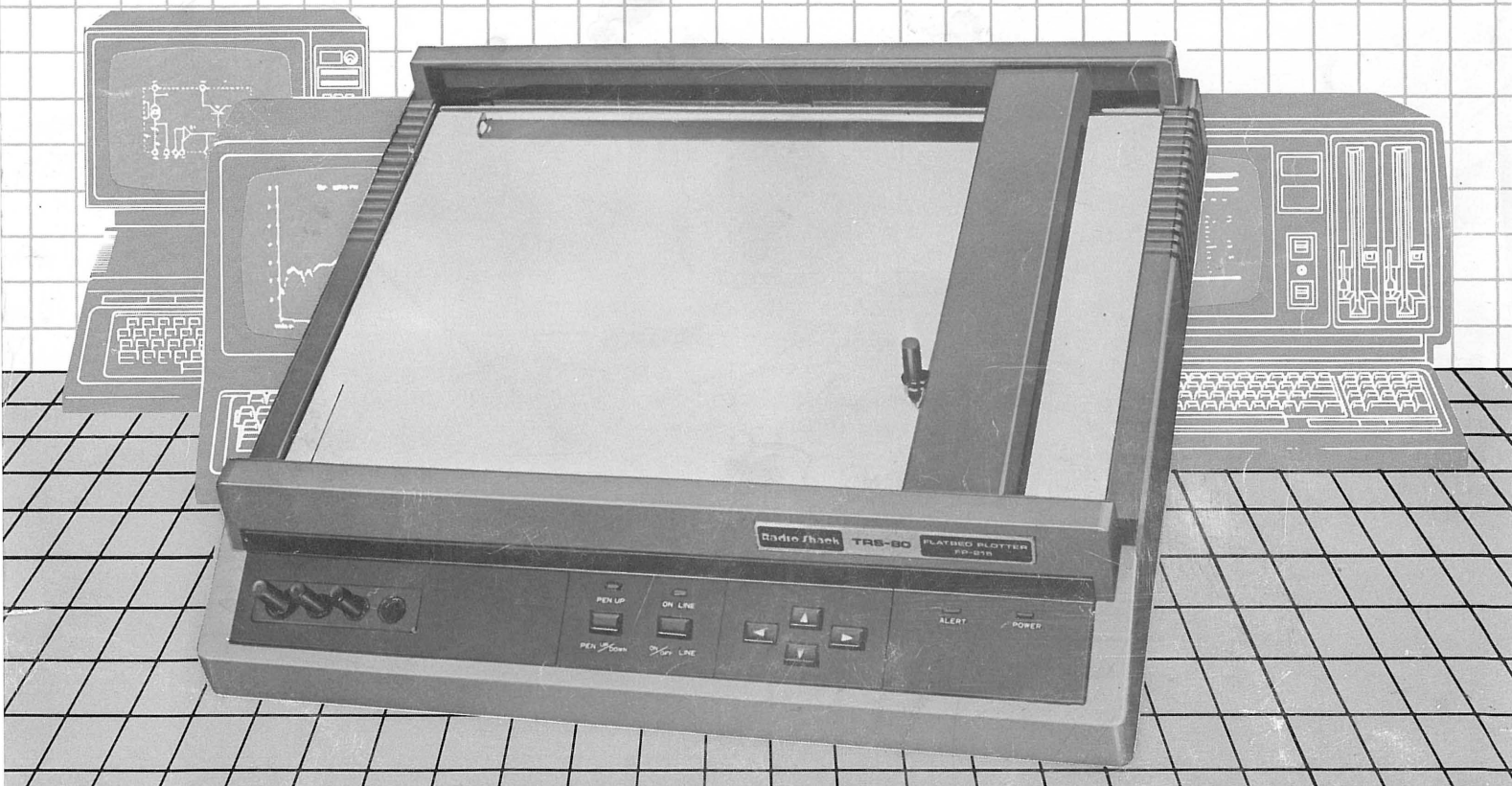
TRS-80®

FP-215

OPERATION MANUAL

Catalog Number 26~1193



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TRS-80
COMPUTER PRODUCTS

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The FP-215 is unique among other graphic plotters in that its special features include:

- Graphic patterns drawn using simple commands and parameters.
- Letter size or full size plotting area.
- Horizontal and vertical formats for use as a printer.
- Manual Mode for drawing without using a computer.
- Capability for use with Serial or Parallel interface or any TRS-80 with interface capabilities.

The Flat Bed Plotter can be used with a TRS-80:

- Model I
- Model II
- Model III
- Model 16
- Color Computer

This manual will:

- Describe the Flat Bed Plotter.
- Show you how to install paper and Pen.
- Show you how to connect the Plotter to your TRS-80.
- Provide programming commands.
- Provide sample programs with subroutines.

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1/Description of the Flat Bed Plotter

Before doing anything else, be sure the following accessories are included in the Plotter package:

- 1 Flat Bed Plotter
- 1 Package Pens
- 1 2-Amp Fuse
- 1 Paperweight

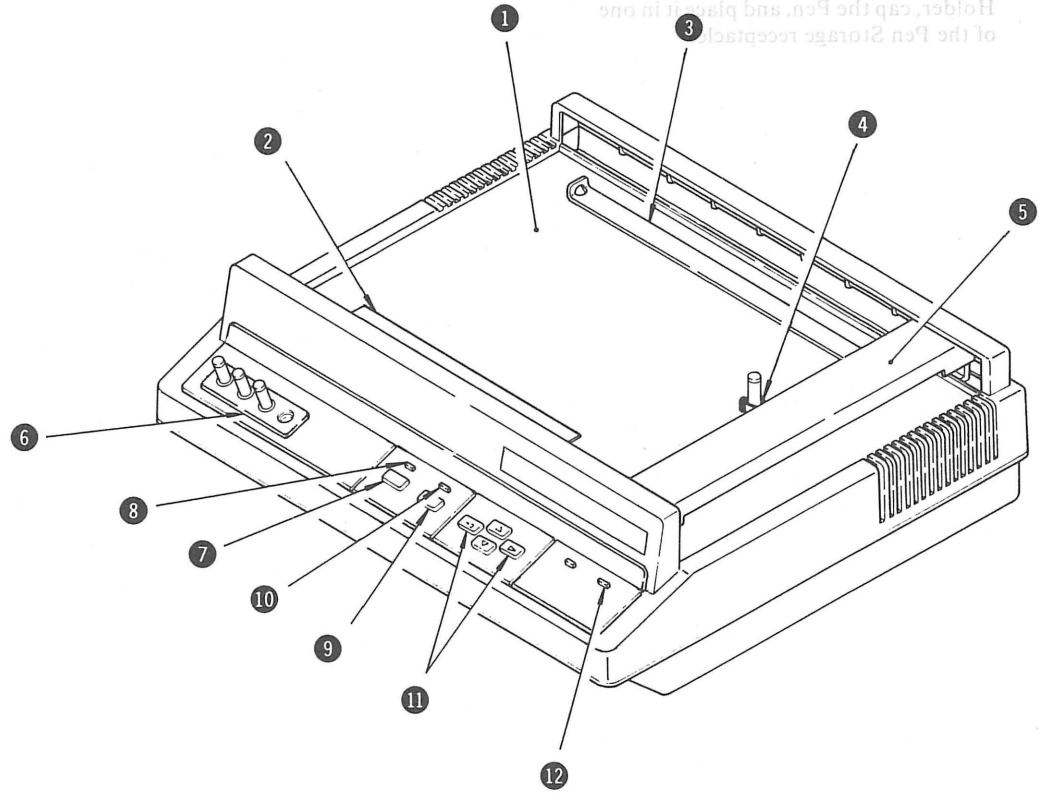


Figure 1. Flat Bed Plotter (Front View)

1. **Magnetic Plotting Surface.** Provides a flat plane for plotting. Paper is securely held between the magnetic surface, the Paper Clamp, and the Paperweight.
Warning: Never set diskettes on the magnetic surface as the magnetic field will erase data.

2. **Paper Clamp.** Sets paper in position. Raise the Paper Clamp, then push the paper's edge against the paper positioning plate. Release the clamp and the paper is held securely between the clamp and the magnetic plotting surface.

3. **Paperweight.** Holds the rear edges of paper. When setting paper, slide the Paperweight from the front to the rear side to remove paper slack.

4. **Pen Holder.** Holds the Pen and moves along the Plotter's Y-axis.

5. **Beam.** Moves the Pen and Pen Holder along the Plotter's X-axis.

6. **Pen Storage.** When not using the plotter, remove the Pen from the Pen Holder, cap the Pen, and place it in one of the Pen Storage receptacles.

7. **PEN UP/DOWN Switch.** Press to manually raise the Pen from, or lower the Pen onto the plotting surface.

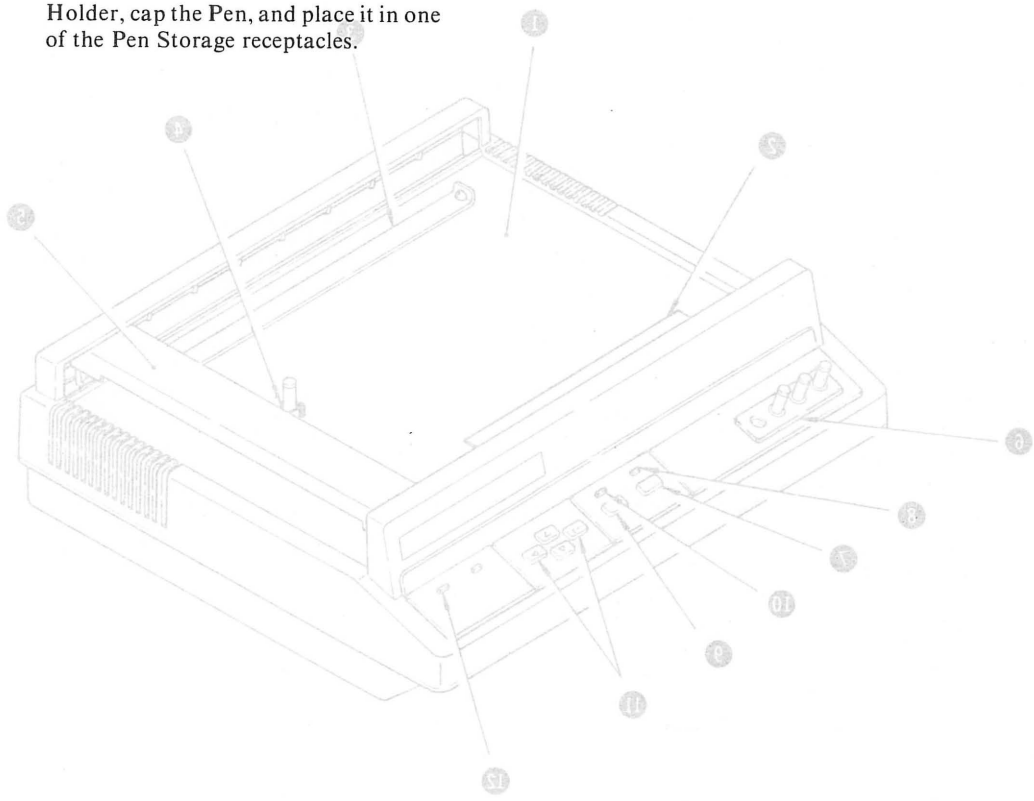
8. **PEN UP Indicator.** This Indicator illuminates when the Pen is in the Up position.

9. **ON/OFF LINE Switch.** Press to select On–Line if Plotter is connected to a Computer or Off–Line for Manual Mode.

10. **ON LINE Indicator.** This Indicator illuminates when the Plotter is On-Line.

11. ◄,►,▲,▼. The Manual Positioning Switches move the Pen and Beam in the indicated directions.

12. **POWER ON Indicator.** This indicator illuminates when the Plotter's power switch is set to ON.



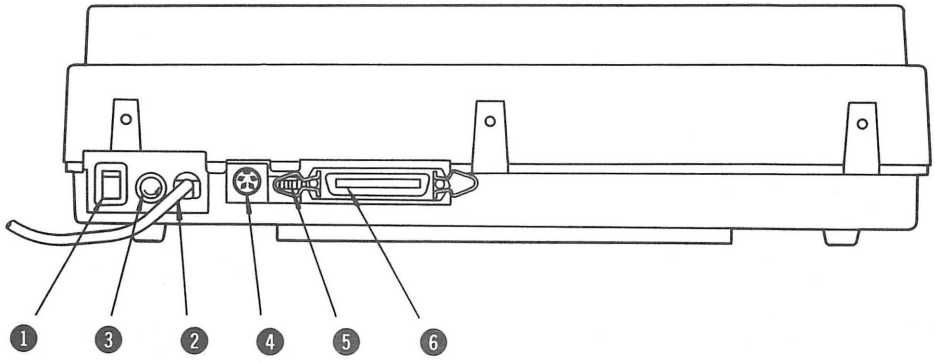


Figure 2. Flat Bed Plotter (Rear View)

1. **POWER ON/OFF Switch.** Press the white dot to turn the power ON. Press again to turn the power OFF.
2. **POWER Cord.** Plug this power cord into the AC 120V electrical outlet.
3. **Fuseholder.** Holds the 2-Amp fuse used to protect your Plotter from a circuit malfunction. Replace only with the same type and rating of Fuse.
4. **Serial I/O Connector.** Connect the Plotter to a Color Computer via this connector. Use the 4-Pin DIN to 4-Pin DIN Cable (Radio Shack Catalog Number 26-3020).
5. **DIP Switch.** Selects Serial (600 to 1200 baud) or Parallel Interface.
6. **Parallel I/O Connector.** Connect the Plotter to the Model I, II, III, 16, and the DT-1 via this Connector. For Model I/III, use the 34-Pin Card Edge to 36-Pin Plug (26-1401); for Model II/16 use the 34 Pin Header to 36-Pin Plug (26-4401).

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2/Setting Up the Flat Bed Plotter

To set up your TRS-80 Plotter, follow these steps:

Connect the Plotter's AC cord to a standard 120V AC outlet or approved a strip such as Radio Shack's Automatic Power Controller (26-1429). (Always use a 3-prong grounded outlet.)

Connecting the Flat Bed Plotter to a Computer

When connecting the Flat Bed Plotter 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 finding the printer connection location on TRS-80's. See your TRS-80 owner's manual for complete details on connecting printers.

1. Be sure the Computer's and Plotter's power are OFF.

2. Connect one end of the appropriate cable (see Table 1) to the Flat Bed Plotter.

   - If you're using a Color Computer, connect one end of the DIN cable to the round, 4-pin SERIAL I/O Connector on the rear panel of the Plotter.

   - If you're using a Model I/II/III/16,connect the DB-25 connector to the PARALLEL I/O Connector at the rear panel of the Plotter.

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

4. Power-up the system as described in your owner's manual.

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 Connector, do not have a cable connected to the Serial I/O Connector and vice versa.

TRS-80 Connection Cables

TRS-80	Cable	Interface
Model I/III	26-1401	Parallel
Model II/16	26-4401	Parallel
Color Computer	26-3020	Serial

Table 1

TRS-80 Connection Points

TRS-80	Location
Model I	Left Side of Expansion Interface
Model II/16	Rear Panel
Model III	Underneath
Color Computer	Rear Panel

Table 2

Paper Loading

Important Note: When you handle paper that is to be loaded into the Plotter, do not touch the area which is to be printed on. Handle the paper by the edges only! Fingerprints leave a slight residue on the paper which can affect the quality of plotting .

When you are ready to load the paper onto the plotter, refer to Figures 3 through 5 and use the following sequence:

1. Return the Pen to the Home position by pressing the ON/OFF LINE Switch.

2. Remove the Paperweight from the plotter surface.

3. Raise the Paper Clamp.

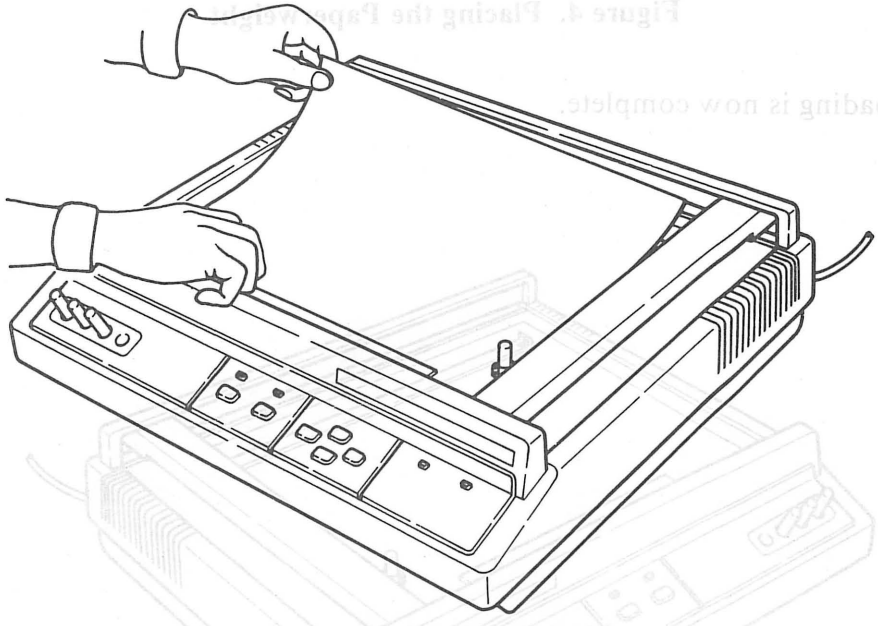


Figure 3. Raising the Paper Clamp

4. Push the paper end against the positioning plate on the platen corner and release the Paper Clamp.

5. Place the Paperweight on the paper and slide it from the front to the back to remove the paper slack.

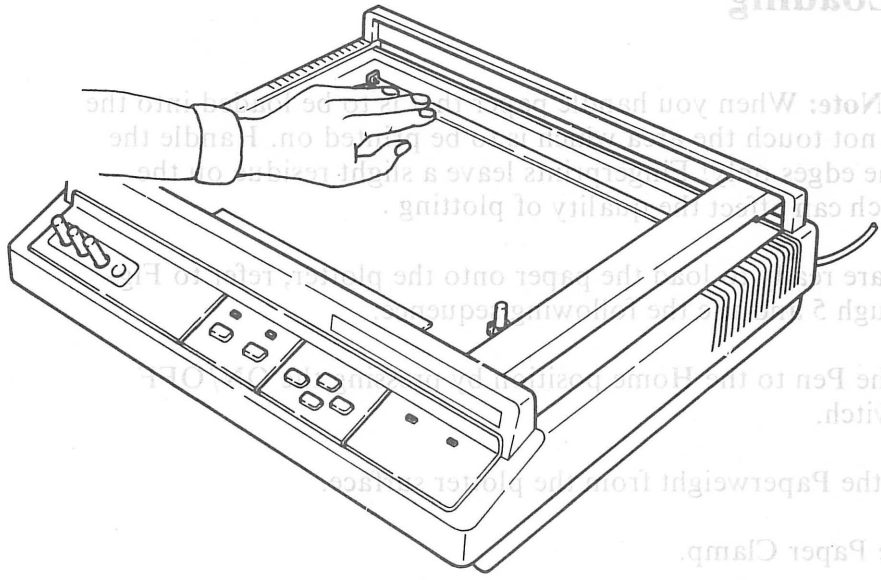


Figure 4. Placing the Paperweight

6. Paper loading is now complete.

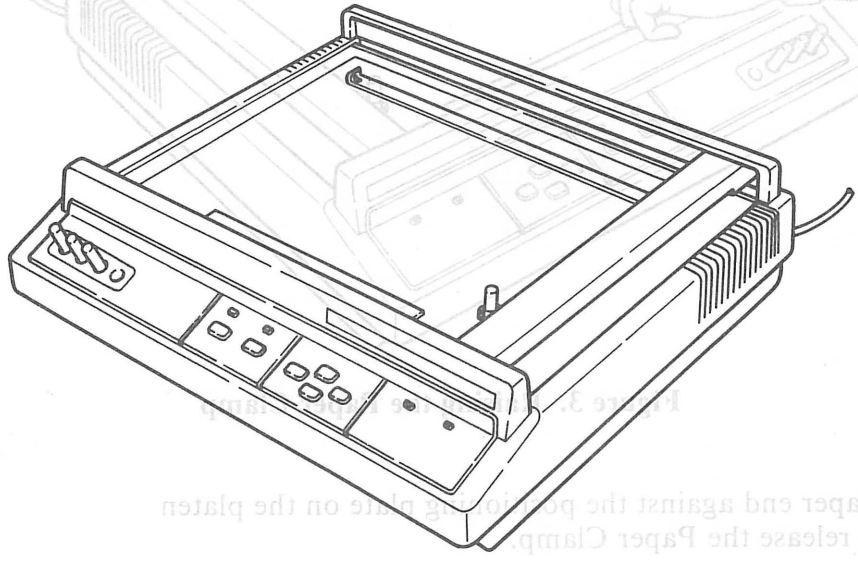


Figure 5. Completed Paper Loading

Pen Installation

Be sure to use only Radio Shack Flat Bed Plotter Pens (Catalog Numbers 26-1343, 1344, 1345, 1346) with your Plotter. Using other Pens may damage the Plotter.

1. Remove the protective cap from a Pen. (Be sure to keep the cap in a safe place.)

2. Rub the Pen point on a scrap piece of paper until the ink begins to flow.

3. Insert the Pen into the Pen Holder. Be sure the largest diameter of the Pen is properly seated and secured in the socket by the retainer fingers of the Pen Holder.

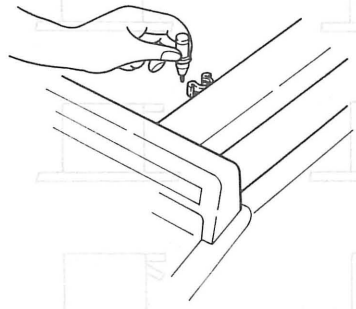


Figure 6. Pen Installation

Pen Removal

Gently remove the Pen from the Pen Holder, being careful not to bend the Holder.

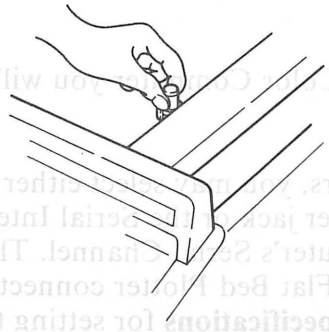


Figure 7. Pen Removal

Note: When the Pens are not in use, always replace the protective cap.

Setting the Plotter Parameters (DIP Switch)

The DIP Switch is at the rear panel of the Plotter (as shown in Figure 2). The DIP Switch setting determines the baud rate of the Plotter, or whether the Plotter is set for Serial or Parallel interface. The switch can be set externally with a tool such as a small screwdriver, pencil point, or tweezers.

Use one of the following settings for the Plotter:

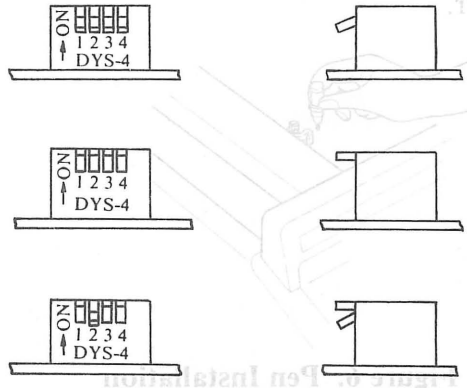


Figure 8. DIP Switch

- **Parallel Interface.** Set all of the switches in the DOWN position.
- **Serial Interface 600 Baud.** Set all switches in the UP position.
- **Serial Interface 1200 Baud.** Set switches 1, 3, and 4 UP. Set switch 2 DOWN.

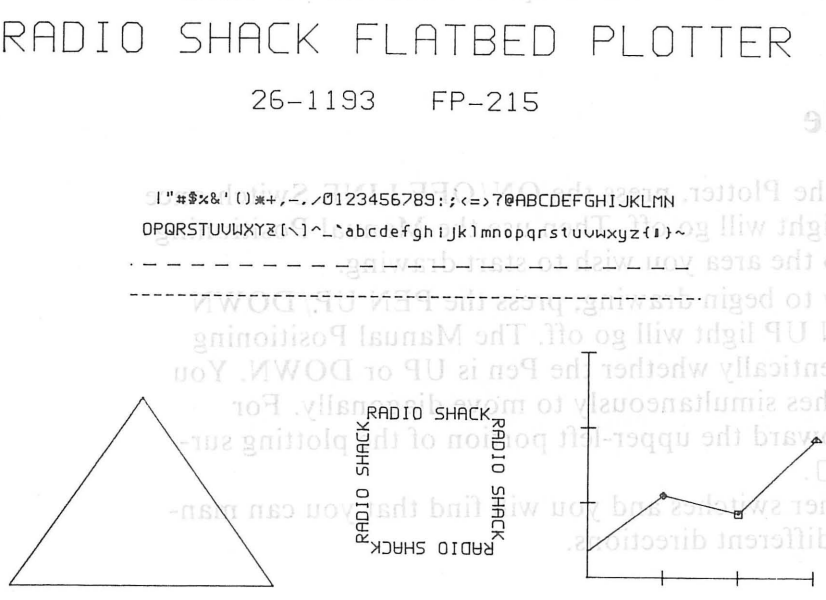
If you are using the Plotter with the Color Computer you will use the Serial Interface 600 Baud position.

For use with other TRS-80 Computers, you may select either Parallel Interface to use the Computer's Printer jack or the Serial Interface 1200 Baud interface with your Computer's Serial Channel. This may enable you to have a printer and the Flat Bed Plotter connected to your TRS-80 at the same time. See **Specifications** for setting the communications parameters of your TRS-80's Serial Channel.

3/A Little Background Information

Self-Test

The Plotter has a built-in self-test that demonstrates some of the amazing feats of "high-tech" visuals it can perform. Be sure that you have a pen installed and a piece of paper covering the plotting surface. Make sure the Plotter is On-Line. Hold down all four Manual Positioning Switches simultaneously and press the ON/OFF LINE button again. The Self-Test demonstration will start and produce a sample such as the following:



The BASIC command to send information to the printer is LPRINT. The same command for the Color Computer is PRINT #-2. (be sure include the comma after 2!) For example:

```
LPRINT "V" (ENTER)
```

or

```
PRINT#-2,"V" (ENTER)
```

Before printing, the Plotter checks to see if the character sent is an instruction (telling it what to do) or data (to be plotted).

Manual Mode, Graphic Mode, and Print Mode

The Flat Bed Plotter has three modes of operation:

- Manual Mode lets you go Off-LINE, and use the manual Positioning Switches for drawing.
- Graphic Mode for generating graphs and other visual creations that you program with your TRS-80.
- Print Mode for note writing, program listings and program output.

On initial power-up, the Plotter is in Graphic Mode and On-LINE status.

Manual Mode

After powering-up the Plotter, press the ON/OFF LINE Switch once and the ON-LINE light will go off. Then use the Manual Positioning Switches to move to the area you wish to start drawing.
When you are ready to begin drawing, press the PEN UP/DOWN Switch and the PEN UP light will go off. The Manual Positioning Switches operate identically whether the Pen is UP or DOWN. You can press two Switches simultaneously to move diagonally. For example, to move toward the upper-left portion of the plotting surface, press ◄ and ▲.
Experiment with other switches and you will find that you can manually move in eight different directions.

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 (horizontally) and the Y-axis going up and down (vertically).

Positive is up (away from the operation panel) and to the right. Negative is down (towards operation panel) and to the left.

The Origin may be set anywhere on the paper. When you first enter Graphic Mode, the Origin is at the left bottom margin (note that HOME Position is not the same as the Power-On Origin).
To enter Graphics Mode, send a decimal code 19 to the Plotter. From BASIC, use the command CHR $ (19).

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 specified relative to the current Pen position).
- 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.
When you enter manual (off-line) mode from graphic mode, you may press the ◄ whitch while, at the same time, pressing the ON/OFF LINE switch. The pen will move to the home position and the Plotter will be initialized.

How Far does the Pen Move?

In both horizontal and vertical directions, Pen movement is measured in "steps." Each step is 0.1 mm long (about the size of a period). There can be up to 2980 steps horizontally and up to 2160 steps vertically, depending on the size of the paper.

Print Mode

In the Print mode, you can use your Plotter like an ordinary printer.
To enter Print mode either by hardware or software commands.
To enter Print mode via hardware, power-up the Plotter, simultaneously press ▲ and ▼ for vertical format printing (Print mode B). To do so via software, send a CHR $ (18).
For horizontal printing, press ◄ and ► to enter Print mode A via hardware or send decimal 18 via software. From BASIC, that's CHR $ (18).

Note: It is not possible to go directly from Print Mode A to Print Mode B (or vice versa).
To go from one print mode to the other, go from a print mode to graphic mode, then to the other print mode. For instance, go from Print Mode A, to graphic Mode, to print Mode B.

Alert Indicator

The ALERT lamp will light when:
- Illegal characters are entered as a command input.
- Parameter limit exceeded (over 5 digits).
- Limits of pen movement exceeded: must be within the range of ±16,383 steps with home position as the center.
- If you enter a parameter that has a non-integer value.

To clear, press the ON/OFF LINE Switch once to enter the Off-Line mode. Press again to return to On-Line status. The ALERT lamp will go off and printing restores to normal.

However, if you want to restart from the beginning, you must initialize plotter (see page 13). The initialization is a must when pen moved outside the permissible ±16383 steps, horizontally or vertically.

4/Using the Flat Bed Plotter

Once the Plotter and Computer are properly connected and powered-up, be sure the Plotter is On-Line.

Before you can begin using the system, you'll have to become familiar with the commands the Plotter understands.

The codes which are used in Plotter languages consist of ASCII characters transmitted from your TRS-80 to the Plotter. Plot command instructions may consist of single or dual character(s), or the character(s) may be followed by additional information. All the commands are contained in **Appendix C.** Each of these commands will be discussed in more detail later in this section.

Programming Hints and Tips

- A number without a sign is a positive value. A negative number must always be specified with a minus sign (−14, −616, etc.).

If you need to change pens while you are plotting, include a "pause" in your program. We suggest an INKEY $ loop just before the program line which will use the different color pen.
Before changing the pen, slip a piece of scrap paper on top of the plotting paper and under the pen, this will prevent getting ink on the plotting paper. Try something like this:

```
•
•
•
850 PRINT "Press scrap paper under pen"
860 PRINT "and change the pen. Remove"
870 PRINT "the scrap paper and press any key"
880 PRINT "to continue."
890 A$=INKEY$ : IF A$=""THEN 890
•
•
•
```

After connections are completed and your Plotter is On-Line, data can be input to your Plotter.

Converting Plotter "Steps" to Inches

The basic measurement unit for the Plotter is a "step" which is defined as a 0.1 mm increment in either the X or Y direction. There are 254 steps in one inch.

You'll have to keep this in mind when writing programs for the Plotter. If you need to plot a line four inches long, your program will need to multiply 4 (inches) times 254 steps per inch to get 1016 steps to produce that line.

The maximum size of the Plotting area is 2980 steps horizontally (11.73") and 2160 steps vertically (8.5").

Plotter Commands

Command syntax is a command's general form (like the grammar or structure of an English sentence). The syntax tells how to use Plotter commands together with the necessary parameters and punctuation.

In the following discussion of Plotter commands, we will tell you:

- What the keys-combination is you'll have to type to enter Graphic or Print commands.
- What the Command syntax is.
- A brief discussion of what the Command does.
- And, in most cases, an example of how to use the command.

Graphic Commands

If you are currently in either Print Mode, be sure to send a CHR $ (19) to enter Graphics mode before using the following commands.

B

Line Scale

B ***scale***

scale specifies the size of the dots used to make dotted (or dashed) lines and is a numeric expression from 1-127. The greater the scale number, the farther apart are the dashes.

B followed by a number between 1-127 tells the Plotter the scale of dotted (or dashed lines.) Upon power-up in Graphic Mode, the scale is automatically set at B30. If you specify Line Scale "Bn", the dashes are 0.1 × n (mm) long. The line-to-space ratio is 1 to 1.

Example

```
10 LPRINT "L1"
20 LPRINT "B10"
30 LPRINT "J-500,0"
40 END
```

The Plotter's actions in sequence are:

1. A dotted line is selected.
2. Line Scale 10 is selected.
3. A dotted line is drawn across the paper at 2 mm pitches.

D

Draw (Absolute)

D *destination*

destination specifies an endpoint and is an X-Y coordinate. (The starting point of the line is the current Pen position.) X and Y are values between —9999 and 9999.

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

This command may be repeated to draw more than one line by specifying more than one coordinate pair. If more than one coordinate pair are specified, then the line will be continued to the second point, and then to the third point, etc. The pen will not move outside the effective area, but the miroprocessor will remember this position and continue the program. Use the M or H command to "move" the pen from this imaginary position.

Example

```
10 LPRINT "M100,100"
20 LPRINT "D100,600,600,600,600,100,100,100"
30 END
```

The example draws a square. Since you did not specify a different Origin, the Pen moves to 100, 100. The corners of the square are: 100, 100 100, 600 600, 600 600, 100.

F
Plotting Area

F*n*
n is 0 or 1.

If *n* is 0, you will be using a plotting area of 10.63 × 7.32 in. (270 × 186 mm), and if *n* is 1 you will be using the maximum size plotting area of 11.73 × 8.5 in. (298 × 216 mm). When you power-up, *n* is automatically set to 0.

Example

```
20 LPRINT "F1"
```

Line 20 sets the plotting area to maximum size plotting area.

H
Return to Home Position

H

The H command moves the Pen in the Up position to the Home position (lower-right corner of the Plotter).

Example

```
100 LPRINT "H"
```

I
Set Origin

I *x, y*
x and *y* are numeric expressions specifying a position on the drawing area as the Origin. On Power-up (in Graphic Mode), 10,0 is used. The values for *x* and *y* must be within the range —9999 to 9999.

I without an *x* and *y* relocates the Origin to the Current Pen Location. As long as it is set within the maximum allowable plotting boundaries, the origin can be assigned anywhere on the plotting surface.

Example

```
50 LPRINT "I500,500"
```

Line 50 defines the point (500,500) as the Origin.

J
Draw (Relative)

J *destination*

destination specifies the endpoint of the point you wish to draw to and is an X-Y coordinate. ***x*** and ***y*** must be in the range —9999 to 9999.

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

The starting point of the line is the current Pen position. The new point is measured from the previous point, and not from the original Pen position. The J command may be repeated to draw more than one line. Once the Pen is at a new position, the line can be continued to another point by supplying another pair of X-Y values.

Example

```
10 LPRINT "M100,100"
20 LPRINT "J 0,500,500,0,0,-500,-500,0"
30 END
```

This draws the same box as the sample for the D command, but specifies the corners differently. Read line 20 like this:

"From where you are, draw a line to the point that is 0 steps to the right (in the X-direction) and 500 steps up (in the Y-direction). Then from that point, draw a line that is 500 steps to the right and 0 steps up, then a line from that point that is 0 steps to the right and 500 steps down.
Finally draw a line that is 500 steps to the left and 0 steps up."

L
Line Type

L *type*
type determines a solid or a dotted line type when drawing a line. 0 is a solid line and 1 is a dotted (dashed) line. If neither is specified, on power-up (in Graphic Mode), L0 is used.

Line Types

Line Specified	Line Drawn
L0	Solid Line
L1	Dotted Line

Table 3. Line Types

Example

```
10 LPRINT "L1"
20 LPRINT "J-100,0"
30 END
```

The program will draw a dotted line across the paper.

M
Move (Absolute)

M *x, y*
x specifies a position on the X-axis and is a numeric expression between —9999 and 9999. ***y*** specifies a position on the Y-axis and is a numeric expression between —9999 and 9999.

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 —9999 and 9999.

Example

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

The Pen will move to the x, y coordinate 100,100.

N
Marker Plotting

N *type*
type specifies the marker type and is a numeric expression between 0 and 5.

Using this command, six special markers can be drawn according to number designation. The following chart shows the markers that can be created using the numbers 0—5.

Code Markers Symbols

Code #	Marker
0	×
1	◇
2	⊡
3	△
4	⧖
5	⊙

Table 4.

The size of each marker is 0.4 (H) × 0.4 (W) mm, unless set to some other size using the S command.

The center of each marker corresponds to the present Pen position.

Example

```
10 LPRINT "M100,100"
20 LPRINT "S4"
30 FOR I=0 TO 5
40 Y=RND(50)
50 LPRINT "J100,";Y
60 LPRINT "N";I
70 NEXT
80 END
```

P
Print Characters

P *characters*
characters specifies either alphabetic (A-Z) or numeric characters to be printed.

The P command lets you print any string or letters or numerals while in Graphic Mode. After the command is executed, the Plotter will remain in Graphic Mode.

Example

```
10 LPRINT "PGraphic Fantasy"
```

The string, Graphic Fantasy, will be printed even though the Plotter is in Graphic Mode.

Q
Rotate Print Direction

Q *direction*
direction specifies the direction of printing and is a numeric expression from 0-3. If omitted, 0 is used.

The following chart illustrates how you can specify the direction using keys 0-3.

Direction Specified	Print Direction
Q0	Left-to-Right
Q1	Top-to-Bottom
Q2	Right-to-Left (Upside-Down)
Q3	Bottom-to-Top

Table 5.

Example

```
10 LPRINT "S5"
20 FOR I=0 TO 3
30 LPRINT "Q";I
40 LPRINT "PA"
50 NEXT I
60 END
```

R

Move (Relative)

R *x, y*
x is the number of steps to move in the X-direction and *y* is the number of steps to move in the Y-direction. Both *x* and *y* must be between —9999 and 9999.

This command moves the Pen without drawing a line 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 LPRINT "M1000,1000"
20 LPRINT "R100,0"
30 LPRINT "R0,-100"
40 LPRINT "J-100,100"
50 END
```

The Plotter's actions are:

1. Line 20 moves the point 100 steps to the right and 0 steps up.
2. Line 30 moves the point 100 steps down and 0 steps to the right.
3. Line 40 draws relative back to the origin, undoing the moves of lines 20 and 30.

S

Character Size

S *size*
size specifies the size of the printed characters drawn using the P command and is a numeric expression from 1-255. If no size preference is indicated, 4 is used.

Selecting S1 will draw the smallest character possible (0.4 mm × 0.6 mm). Selecting S255 will draw the largest character possible (102 mm × 153 mm).

Each character will be 4 times "size" mm wide and 6 times "size" mm high.

The following example will print a string growing larger and larger:

```
10 FOR I=2 TO 15
20 LPRINT "S";I
30 LPRINT "PA"
40 NEXT I
50 END
```

X

Draw X-Y Axes

X ***axis, step, times***

axis specifies axis to be drawn and is a numeric expression of either 1 (X-axis) or 0 (Y-axis). ***step*** specifies the number of steps between measurement marks on the axis and is a numeric expression between 0 and 9999. ***times*** is the number of times that the step is to be repeated and is a numeric expression from 1-255.

Using the x command, you can make the Plotter draw Coordinate (x, y) axes, divide the axes into specific units of measurement, and designate how many units of measurement are to be drawn on the axes. The axes can also be divided into segments.

Since each step is 0.1 mm, the exact distance between segment marks can be set easily. You may have from 1 to 255 intervals, and each one will be from 1 to 9999 steps long.

Example

```
10 LPRINT "M100,100"     (move to specific point)
20 LPRINT "X1,200,3"     (draw X-axis to right)
30 LPRINT "M100,100"     (move to specific point)
40 LPRINT "X0,100,6"     (draw X-axis to top)
```

The program will produce a coordinate axis such as the following:

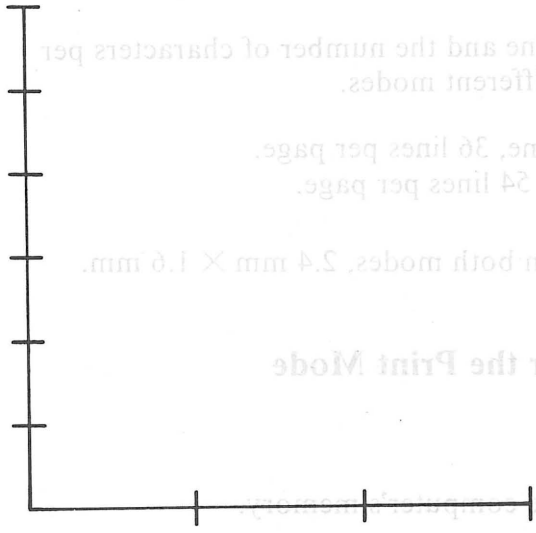


Figure 9. Coordinate Axis

Print Mode

To enter Print Mode A (horizontal printing) from Graphics mode, send a CHR $ (17). To enter Print Mode B (vertical printing) from Graphic mode, send a CHR $ (18).

To do this via hardware turn the power on while simultaneously pressing either ▲ and ▼ switches (for vertical format), or the ◄ and ► switches (for horizontal format).

Note: It is not possible to go directly from Print Mode A to Print Mode B (or vice versa).
To go from one print mode to the other, go from a print mode to graphic mode, then to the other print mode. For instance, go from Print Mode A, to graphic Mode, to print Mode B.

The Pen will move from home position to print start position. The start position differs in each mode.

Horizontal printing will start at (255,1650)
Vertical printing will start at (260,250)

The number of characters per line and the number of characters per page are different for the two different modes.

Horizontal: 92 characters-per-line, 36 lines per page.
Vertical: 64 characters-per-line, 54 lines per page.

The Character size is the same in both modes, 2.4 mm × 1.6 mm.

Programming Examples for the Print Mode

```
LLIST (ENTER)
```

lists the program currently in the computer's memory.

```
LPRINT "FLAT BED PLOTTER" (ENTER)
```

will result in FLAT BED PLOTTER being printed.

```
LPRINT "THIS PLOTTER IS TOPS";:LPRINT "FOR
PLOTTING PROJECTS" (ENTER)
```

will result in both sentences being printed on one line (because of the semicolon used in the first LPRINT command).

When the end of a page is reached (i.e. 92nd character on 36th line in Horizontal mode, 64th character on 54th line in Vertical mode), or the Plotter has finished printing the entire block, the Pen will automatically stop.

Press the ON/OFF LINE Switch to return to Home position and change the paper. Press On-Line again and printing will restart from the Start position.

To stop printing, press the ON/OFF LINE Switch. To escape Print Mode, turn the power OFF then ON again.

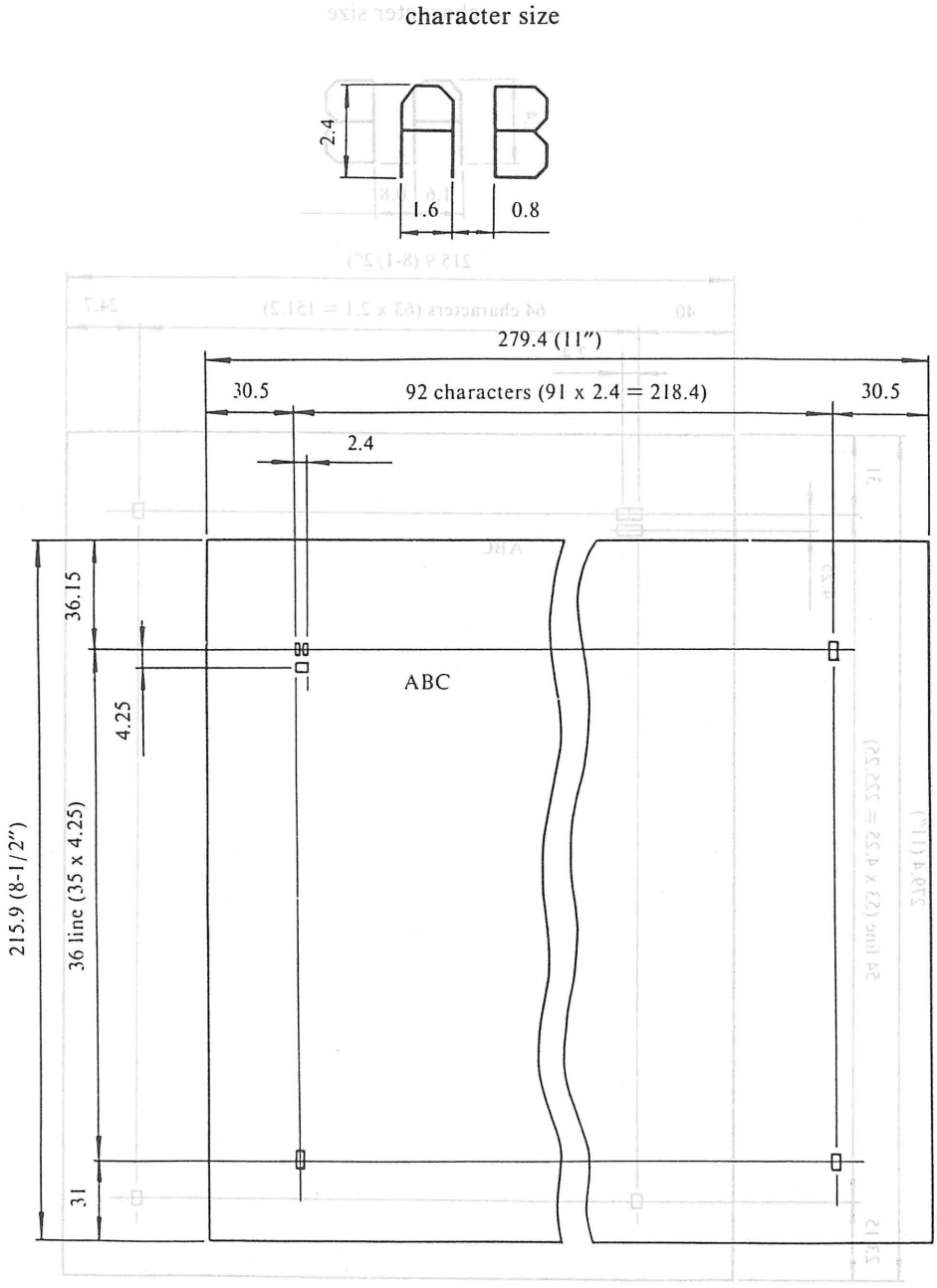


Figure 10. Horizontal Printing

Note: The paper is always assumed to be placed on the plotter with it's longer side parallel to operational panel.

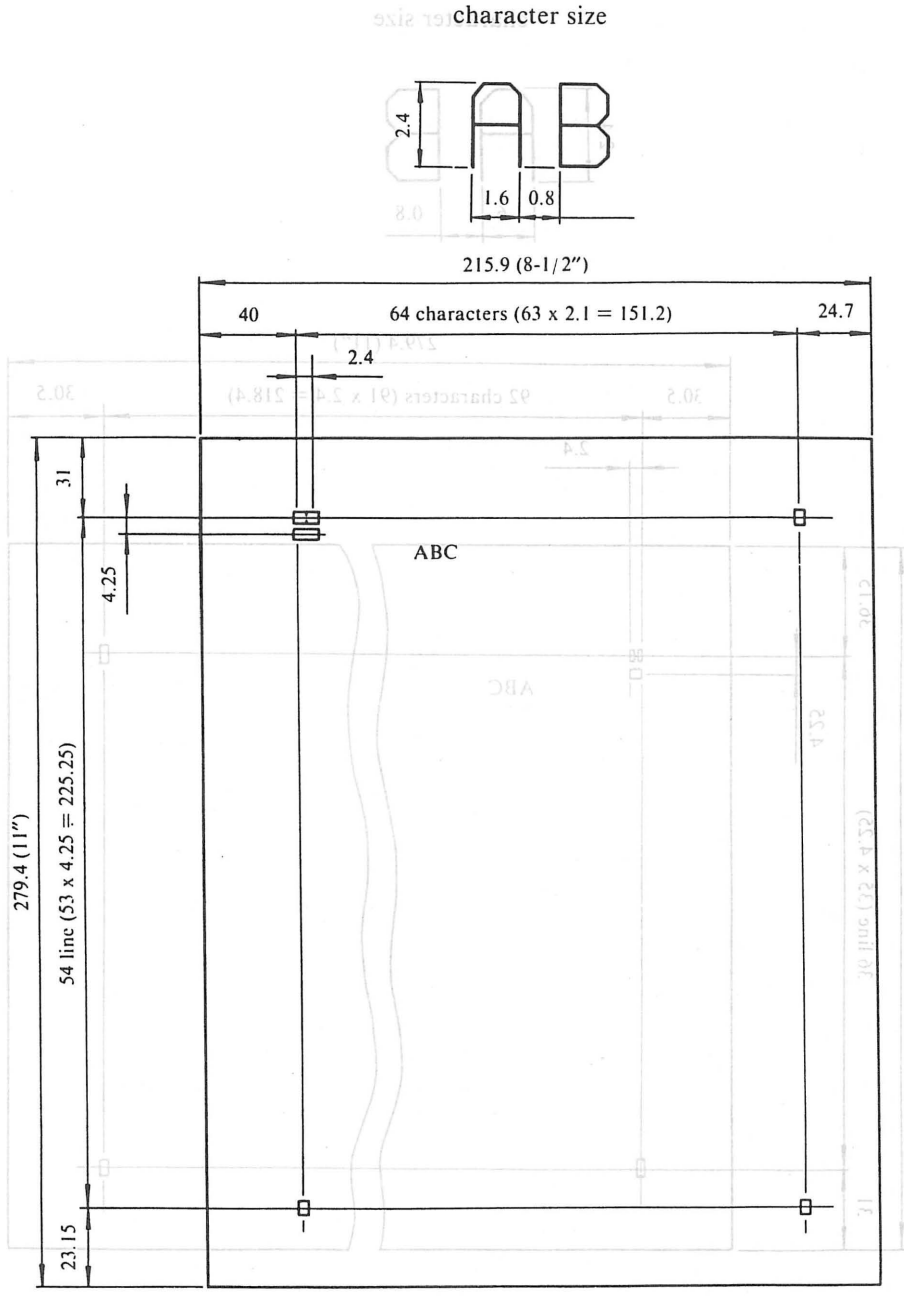


Figure 11. Vertical Printing

Note: The paper is always assumed to be placed on the plotter with it's longer side parallel to operational panel.

5/Care and Maintenance

The Flat Bed Plotter is a very reliable unit that should give years of satisfactory service. Follow the guidelines below during installation and when using the Plotter:

- The Plotter should always be placed in a horizontal position.
- Keep the Plotter away from direct sunlight or direct heating or cooling system ducts.
- Keep the Plotter away from dust or moisture as either can cause damage to the Plotter.
- Do not block the ventilation openings on the sides of the Plotter.
- Never use the Plotter in an environment with iron dust or debris since the plotting surface emits a magnetic field.
- Never place a diskette on top of this magnetic plotting surface area.
- Do not attempt to use a power supply other than 120VAC.
- Never touch the plotting surface or put heavy materials on it.
- Never place the Plotter in an area with heavy mechanical vibrations or electrical noise.
- Cover the Plotter with a cloth or vinyl sheet when not in use. Obtain the Flat Bed Plotter Dust cover (catalog Number 26-523) at your local Radio Shack Computer Center for a truly reliable means of protecting your Plotter.
- If the Plotter becomes dusty, wipe off carefully with a soft clean cloth. If necessary, water or alcohol can be used.
- When the Plotter is not being used, cap and store the Pens in the built-in storage area.

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- When the Plotter is not being used, cap and store the Pens in the built-in storage area.

6/Specifications

Effective Plotting Area:

F0:	X-axis 270 mm (10.63 in.) Y-axis 186 mm (7.32 in.)
F1:	X-axis 298 mm (11.73 in.) Y-axis 216 mm (8.5 in)

Plotting Speed	100 mm/sec (3.93 ips)
Character Size	2.4 × 1.6 mm (0.094 × 0.063 in.)
Step Size	0.1 mm (0.00393 in.)
Internal Processing	0.05 mm (0.00197 in.)
Accuracy	
Repetition	0.3 mm max. (0.012 in. max.)
Distance	1% max
Dimensions	410 mm wide (16.1 in.) 372 mm deep (14.6 in.) 121 mm high (4.8 in.)
Weight	11 kg (24 lbs)

Pens

Pen	Catalog Number
Black	**26-1343**
Red	**26-1344**
Blue	**26-1345**
Green	**26-1346**

Paper Size

Large	364 × 257 mm (14.3 × 10.1 in.)
Small	279.4 × 216 mm (11 ×8.5 in.)

Paper Setting	Magnet Plate
Parallel Interface	8 bit parallel. Uses BUSY Handshaking, STROBE, and ACKNOWLEDGE.
Serial Interface	RS-232-C using DATA and BUSY, 600 or 1200 baud, 7 or 8-bit charater, non-parity, 2 stop bits.
Selectable Modes	
On Line:	
Graphic Mode	Image Plotting using the Various commands (Dec. 19)
Print Mode A	Horizontal Printing (Dec. 17)
Print Mode B	Vertical Printing (Dec. 18)
Off Line:	Plotting and Printing of internal commands.
Manual Mode	Move Pen using the Manual Positioning switches.
Temperature Range	5 to 40°C (41 to 104°F)
Storage	−40 to 70°C (−40 to 158°F)
Humidity Range	
Operation	30% to 80% RH
Storage	10% to 90% RH
Power Supply	AC 105 to 135 V 50/60Hz Max 90 W
Static Discharge	2.0 kV (100 pF)
Acoustic Noise Generation	Less than 65 dB A at 1 m (at 39.4 in.)
Reliability (MTFB)	1000 hours (50% duty)

Appendix A/Using the Flat Bed Plotter with the Model II/16

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

If you do receive an I/O error message, the following programming routine may be useful:

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

```
10 ON ERROR GOTO 2000
```

Any errors will then send program execution to line 2000.

2. Then, starting at line 2000, type:

```
2000 IF ERR=56 THEN RESUME
2010 ON ERROR GOTO 0
```

The instruciton at line 2000 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 2010.

Line 2010 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 2000. See your Computer's owner's manual (BASIC section) for more details.

Appendix B/Sample Programs

Several sample programs have been included here as examples of software which can be used with the Flat Bed Plotter. These programs are not intended to be "Applications Software" but they may help you understand how the Flat Bed Plotter works and help you get started 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.

Sine Curve Plot

This program draws sine curves.

```
10 REM Sample Program < Sine Curve Plot >
20 LPRINT"I1500,1000"
30 DR=ATN(1)/45
40 FOR N=1 TO 2 STEP .5
50 R=300
60 FOR I=0 TO 360 STEP 2
70 X=I*2:Y=INT(R*SIN(I*N*DR))
80 LPRINT"D";X;",";Y
90 R=R-2:NEXT:NEXT
100 LPRINT"M0,-300"
110 LPRINT"X1,180,4":D$="0":X=0
120 FOR I=1 TO 5
130 LPRINT"M";X;",-350"
140 LPRINT"P";D$
150 D=D+90:D$=STR$(D):X=I*180-50:NEXT
160 LPRINT"M-50,-300":LPRINT"X0,150,4"
170 FOR I=300 TO -300 STEP -150
180 READ D$:LPRINT"M-200,";I
190 LPRINT"P";D$:NEXT:END
200 DATA +1,+.5,0,-.5,-1
```

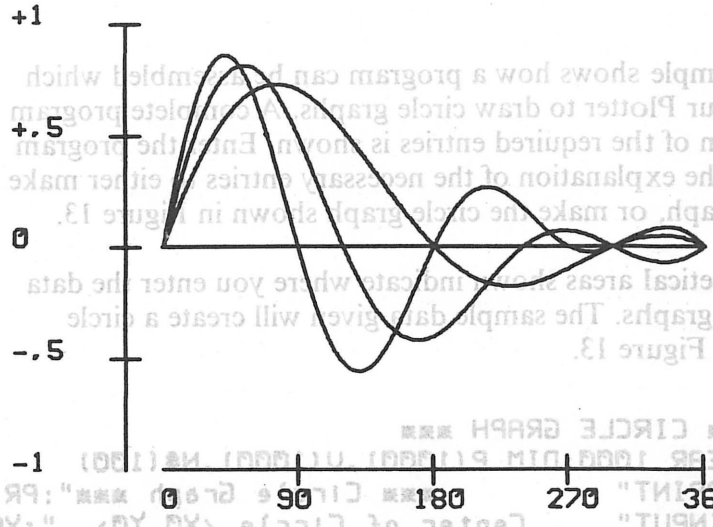


Figure 12. Sine Curve

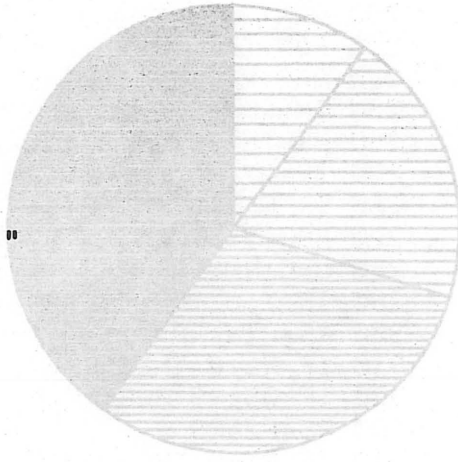
Circle Graph

The following example shows how a program can be assembled which will let you use your Plotter to draw circle graphs. A complete program and an explanation of the required entries is shown. Enter the program and then refer to the explanation of the necessary entries to either make your own circle graph, or make the circle graph shown in Figure 13.

Note: The parenthetical areas shown indicate where you enter the data to construct circle graphs. The sample data given will create a circle graph as shown in Figure 13.

```
10 REM *** CIRCLE GRAPH ***
20 CLS:CLEAR 1000:DIM P(1000),V(1000),N$(100)
25 PRINT:PRINT"          *** Circle Graph ***":PRINT:PRINT
30 PRINT:INPUT"     Center of Circle <X0,Y0>  ";X0,Y0
40 PRINT:INPUT"     Radius of Circle   < R >  ";R
45 PRINT:INPUT"     Title of Circle           ";T$
50 PRINT:INPUT"     Number of Sections < N >  ";N
60 FOR I=1 TO N
70 PRINT:PRINT"     Name?,Value?,Pitch?"
80 INPUT "     ";N$(I),V(I),P(I)
90 NEXT I
100 PAI=3.14159:P2=PAI*2:A$="M"
110 LPRINT"I";INT(X0);",";INT(Y0)
120 FOR I=0 TO 100
130 S=I/100*P2
140 X=INT(SIN(S)*R):Y=INT(COS(S)*R)
150 LPRINT A$;X;",";Y:A$="D":NEXT I:S=0
160 FOR I=1 TO N
170 S=S+V(I)*P2/100
180 X=INT(SIN(S)*R):Y=INT(COS(S)*R)
190 LPRINT"M0,0":LPRINT"D";X;",";Y
200 NEXT I:P=0
210 FOR I=1 TO N
220 Q=P:P=P+V(I):QS=Q*P2/100:PS=P*P2/100
230 QX=INT(SIN(QS)*R):QY=INT(COS(QS)*R)
240 PX=INT(SIN(PS)*R):PY=INT(COS(PS)*R):ST=R:EN=-R
250 IF QY>=0 AND PY>=0 THEN EN=0
260 IF QY<=0 AND PY<=0 THEN ST=0
270 FOR Y=ST TO EN STEP -P(I)
280 J=0:RA=SQR(R*R-Y*Y)
290 IF Y=0 THEN RS=PAI/2:GOTO 320
300 RS=ATN(RA/Y)
310 IF RS<0 THEN RS=RS+PAI
320 IF QS<RS AND RS<PS THEN D(J)=INT(RA):J=J+1
330 RS=P2-RS
340 IF QY=0 THEN 400
350 X=QX/QY*Y
360 IF SGN(X)<>SGN(QX) THEN 400
```

```
370 IF SGN(Y)<>0 AND SGN(QY)<>SGN(Y) THEN 400
380 RT=SQR(X*X+Y*Y)
390 IF RT<=R THEN D(J)=INT(X):J=J+1
400 IF PY=0 THEN 460
410 X=PX*Y/PY
420 IF SGN(X)<>SGN(PX) THEN 460
430 IF SGN(Y)<>0 AND SGN(PY)<>SGN(Y) THEN 460
440 RT=SQR(X*X+Y*Y)
450 IF RT<=R THEN D(J)=INT(X):J=J+1
460 IF QS<RS AND RS<PS THEN D(J)=INT(-RA):J=J+1
470 IF Y=0 AND J<>2 THEN D(J)=0:J=J+1
480 IF J<=2 THEN 560
490 FOR K=0 TO J-1
500 MIN=D(K):MN=L
510 FOR L=K+1 TO J-1
520 IF D(L)<MIN THEN MIN=D(L):MN=L
530 NEXT L
540 D(MN)=D(K):D(K)=MIN
550 NEXT K
560 K=0
570 IF J<2 THEN 620
580 LPRINT"M";D(K);",";Y
590 LPRINT"D";D(K+1);",";Y
600 K=K+2
610 IF K<J-1 THEN 580
620 NEXT Y:NEXT I
630 X=INT(R+X0+200):Y=INT(N-1)*30+Y0+80
635 LPRINT"I";X;",";Y:LPRINT"P";T$:Y=Y-80
640 FOR I=1 TO N
650 LPRINT"I";X;",";Y
660 LPRINT"J0,40,60,0,0,-40,-60,0"
670 J=0
680 LPRINT"M0,";J:LPRINT"J60,0"
690 J=J+P(I):IF J<40 THEN 680
700 LPRINT"M100,0":LPRINT"P";N$(I)
710 FOR K=1 TO 11-LEN(N$(I))
720 LPRINT"P ":NEXT K
730 LPRINT"P";V(I);"%"
740 LPRINT"M0,-60"
750 Y=Y-60:NEXT I
760 LPRINT"H"
770 PRINT"     Next Copy? < Y or N >"
780 Z$=INKEY$:IF Z$="" THEN 780
790 IF Z$="Y" THEN 100
800 IF Z$="N" THEN END
810 GOTO 780
```



When running the program, you are asked, CENTER OF CIRCLE (X0, Y0)? Enter the center the position of the circle in coordinates (X0, Y0). To create a duplicate of Figure 13, enter the coordinates (1000, 1000).

Next, the program will ask, RADIUS OF CIRCLE (R)? Enter the radius of a circle. For the sample, enter 300.

For TITLE OF CIRCLE?, enter a title for the circle graph. Figure 13 is *** SAMPLE GRAPH ***.

for NUMBER OF SECTIONS?, enter the number of sections you want to divide your circle graph. Figure 13 is 4.

For NAME, VALUE, PITCH, enter the name, percentage, and hatching pitch of each section. The sample entries are:

(SAMPLE-1, 40, 5)
(SAMPLE-2, 30, 10)
(SAMPLE-3, 20, 15)
(SAMPLE-4, 10, 20)

After the name, value, and pitch have been entered, the graph will be drawn. You are given the opportunity to make multiple copies of the graph.

You are asked, ANOTHER COPY? (Y/N). If you wish to make an additional copy, change the paper and press Y. To end the program, press N.

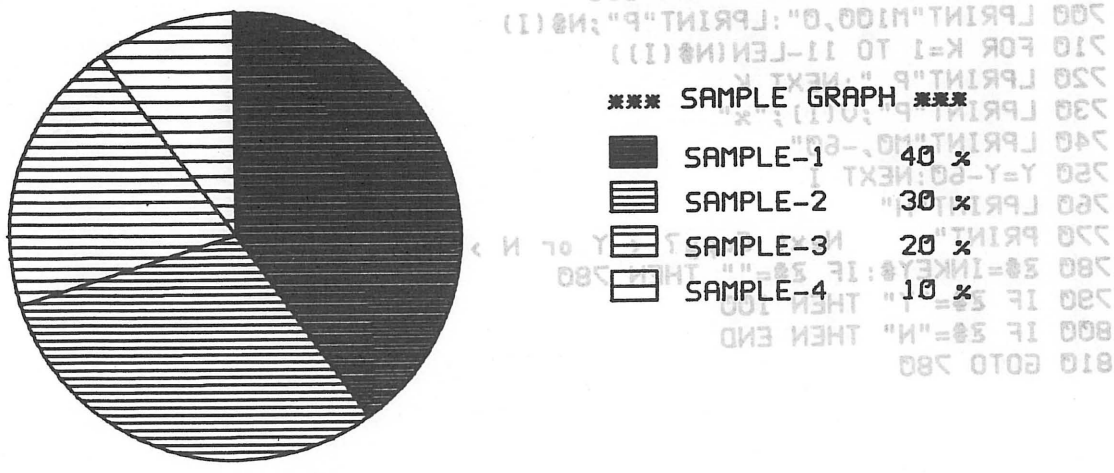


Figure 13. Circle Graph

Plotter Subroutine Demonstration

This program will illustrate how to make new commands for using your Plotter. It adds the following commands:

A Initialize

T Draw a Histogram

W Draw a Circle

% Set Step Size

@ Sets Plotting Scale

To use these subroutines type the lines of the program numbered 7000- into your computer. If you are using a Color Computer substitute PRINT# -2, for every LPRINT.

Then type each sample program in and see how it uses the Subroutines. You can easily add the subroutine package (Lines 7000-9000) to your own Plotting Software.

Here is what each subroutine does:

A
All Initialize

Initialize Plotter parameters. If you're using this Plotter subroutine, you use the A command.

Example

```
20 C$="A":GOSUB 7000
```

T
Histogram and Hatching

Use the T command to draw a bar with hatching parameters.

XA, YA:	lower left of the Bar (steps)
XB, YB:	upper right of the Bar (steps)
HA:	type of hatching (0-3)

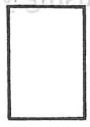
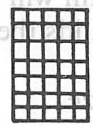
HA	0	1	2	3
Sample				

Table 7. Hatchings

Example

```
100 C$="T":XA=100:YA=200:XB=200:YB=500:HA=2:GOSUB 7000
```

Note: If HA is omitted, 0 is used.

W

Circle (Draws a Circle or Curve)

Parameters

R	radius (steps)
X, Y	center point (coordinates)
S1	start angle (degrees)
S2	end angle (degrees)
R0	rotate direction (0 is clockwise and 1 is counterclockwise.)

Example

```
50 C$="W":R=500:X=1000:Y=800:S1=90:S2=270:R0=1;GOSUB 7000
```

Note: If parameters S1, S2, and R0 are not specified, parameters S1=0, S2=360, R0=0 are used.

%

Plotting size (Specifies Plotter Step Size)

Parameter

N Using 0, 1 step is 1/254 in. (0.1 mm)
Using 1, 1 step is 1/200 in. (0.127 mm)
Using 2, 1 step is 1/100 in. (0.254 mm)
Using 3, 1 step is 1/50 in. (0.507 mm)

Example

```
80 C$="%":N=2:GOSUB 7000
```

If none is specified, 0 is used.

Q

Plotting Scale {Specifies Magnification (X-axis, Y-axis)}

Parameters:

X: X-axis magnification
Y: Y-axis magnification

Example

```
30 C$="@":X=3:Y=2:GOSUB 7000
```

If none is specified, X=Y=1.

Plotter Subroutine Program

```
7000 IF C$="A" THEN 7300 : REM Plotter Subroutine
7010 IF C$="B" THEN 7500
7020 IF C$="D" THEN 7700
7030 IF C$="F" THEN 7500
7040 IF C$="H" THEN 7400
7050 IF C$="I" THEN 7700
7060 IF C$="J" THEN 7700
7070 IF C$="L" THEN 7500
7080 IF C$="M" THEN 7700
7090 IF C$="N" THEN 7500
7100 IF C$="P" THEN 7600
7110 IF C$="Q" THEN 7500
7120 IF C$="R" THEN 7700
7130 IF C$="S" THEN 7500
7140 IF C$="T" THEN 8300
7150 IF C$="W" THEN 8100
7160 IF C$="X" THEN 7800
7170 IF C$="%" THEN 7900
7180 IF C$="@" THEN 8000
7190 RETURN
7300 REM All Initiarise
7310 LPRINT"F0":LPRINT"S4":LPRINT"L0"
7320 LPRINT"Q0":PS=1:SX=1:SY=1:S1=0
7330 S2=360:R0=0
7340 RETURN
7400 REM Home Command
7410 LPRINT"H":RETURN
7500 REM  Command + Parameter + (CR) Group
7510 LPRINT C$;INT(N):RETURN
7600 REM  Print Command
7610 LPRINT C$;D$:RETURN
7700 REM  Command + Parameter + "," + Parameter + (CR) Group
7710 X1=X*PS*SX:Y1=Y*PS*SY:LPRINT C$;INT(X1);",";INT(Y1)
7720 RETURN
7800 REM  Axis Command
7810 IF X=0 THEN 7830
7820 YY=Y*PS*SX:GOTO7840
7830 YY=Y*PS*SY
7840 LPRINT"X";INT(X);",";INT(YY);",";INT(Z)
7850 RETURN
7900 REM Plotting Size : %
7910 ON N+1 GOTO 7920,7930,7940,7950
7920 PS=1:RETURN
7930 PS=1.27:RETURN
7940 PS=2.54:RETURN
7950 PS=5.08:RETURN
```

```
8000 REM Plotting Scale : @
8010 SX=X:SY=Y:RETURN
8100 REM Circle and Curve
8110 NR=360/R*2/PS :DR=ATN(1)/45:NN=0
8115 X0=X:Y0=Y:IF S1>S2 THEN NR=-NR
8120 IF RO=1 THEN 8200
8130 FOR I=S1 TO S2 STEP NR
8140 X=X0+R*COS(I*DR):Y=Y0+R*SIN(I*DR)
8150 IF NN=1 THEN 8170
8160 C$="M":GOSUB 7000
8170 C$="D":GOSUB 7000:NN=1:NEXT
8180 C$="D":X=X0+R*COS(S2*DR):Y=Y0+R*SIN(S2*DR)
8190 GOSUB 7000:S1=0:S2=360:RO=0:C$="W":RETURN
8200 FOR I=S2 TO S1 STEP -NR
8210 X=X0+R*COS(I*DR):Y=Y0+R*SIN(I*DR)
8220 IF NN=1 THEN 8240
8230 C$="M":GOSUB 7000
8240 C$="D":GOSUB 7000:NN=1:NEXT
8250 C$="D":X=X0+R*COS(S1*DR):Y=Y0+R*SIN(S1*DR)
8260 GOTO 8190
8300 REM Histgram
8310 C$="M":X=XA:Y=YA:GOSUB 7000
8320 C$="D":Y=YB:GOSUB 7000
8330 X=XB:GOSUB 7000:Y=YA:GOSUB 7000
8340 X=XA:GOSUB 7000
8350 ON HA+1 GOTO 8360,8370,8380,8390,8400,8410,8420
8360 GOTO 8400
8370 GOSUB 8450:GOTO 8400
8380 GOSUB 8500:GOTO 8400
8390 GOSUB 8450:GOSUB 8500
8400 HA=0:C$="T":RETURN
8410 GOTO 8400
8420 GOTO 8400
8450 FOR HH=YA+20 TO YB-20 STEP 40
8460 C$="M":X=XA:Y=HH:GOSUB 7000
8470 C$="D":X=XB:GOSUB 7000
8480 C$="M":Y=Y+20:GOSUB 7000
8490 C$="D":X=XA:GOSUB 7000:NEXT:RETURN
8500 FOR HH=XA+20 TO XB-20 STEP 40
8510 C$="M":X=HH:Y=YA:GOSUB 7000
8520 C$="D":Y=YB:GOSUB 7000
8530 C$="M":X=X+20:GOSUB 7000
8540 C$="D":Y=YA:GOSUB 7000:NEXT:RETURN
```

Creating Histograms

Use the subroutine to make a Histogram such as the one shown in Figure 14.

```
10 REM Sample Program < Histgram >
20 C$="A":GOSUB 7000
30 FOR J=0 TO 400 STEP 200
40 C$="T":XA=100+J:YA=100:XB=200+J:YB=500+J:GOSUB 7000
50 YB=300+J/2:HA=1:GOSUB 7000:YB=200+J/3:HA=2:GOSUB 7000
60 NEXT:C$="H":GOSUB 7000
70 END
```

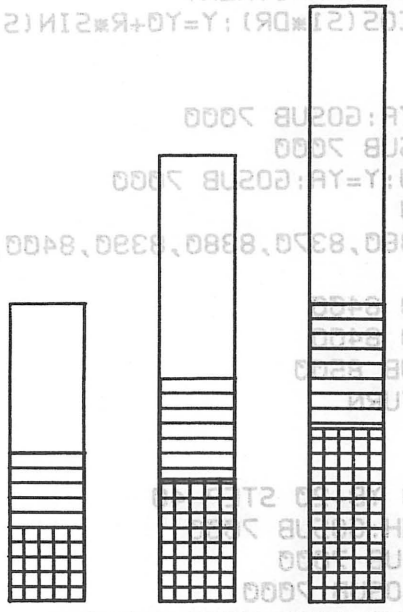


Figure 14. Histogram

Histogram and Plotting Size

Use the subroutine to make a Histogram and determine the Plotting Size. See Figure 15.

```
10 REM Sample Program < Plotting Size and Histgram >
20 C$="A":GOSUB 7000
30 FOR N=0 TO 3
40 C$="%":GOSUB 7000
50 C$="T":XA=0:YA=XA:XB=100:YB=XB:GOSUB 7000
60 NEXT
70 C$="H":GOSUB 7000
80 END
```

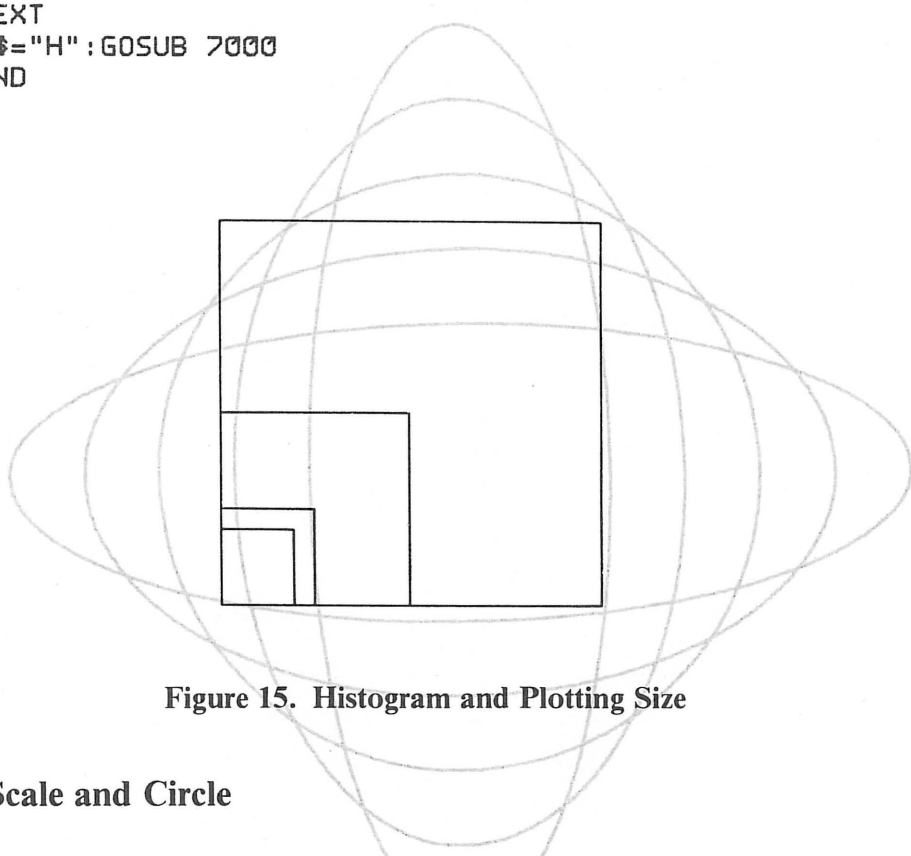


Figure 15. Histogram and Plotting Size

Plotting Scale and Circle

You can use two subroutines to indicate the plotting size and draw a circle. The following program will create a pattern such as the one shown in Figure 16.

```
10 REM Sample Program < Plotting Scale and Circle >
20 C$="A":GOSUB 7000
30 C$="I":X=1000:Y=X:GOSUB 7000
40 FOR M=1 TO 3 STEP .5
50 C$="@":X=M:Y=4-M:GOSUB 7000
60 C$="W":R=200:X=0:Y=0:GOSUB 7000
70 NEXT
80 C$="H":GOSUB 7000
90 END
```

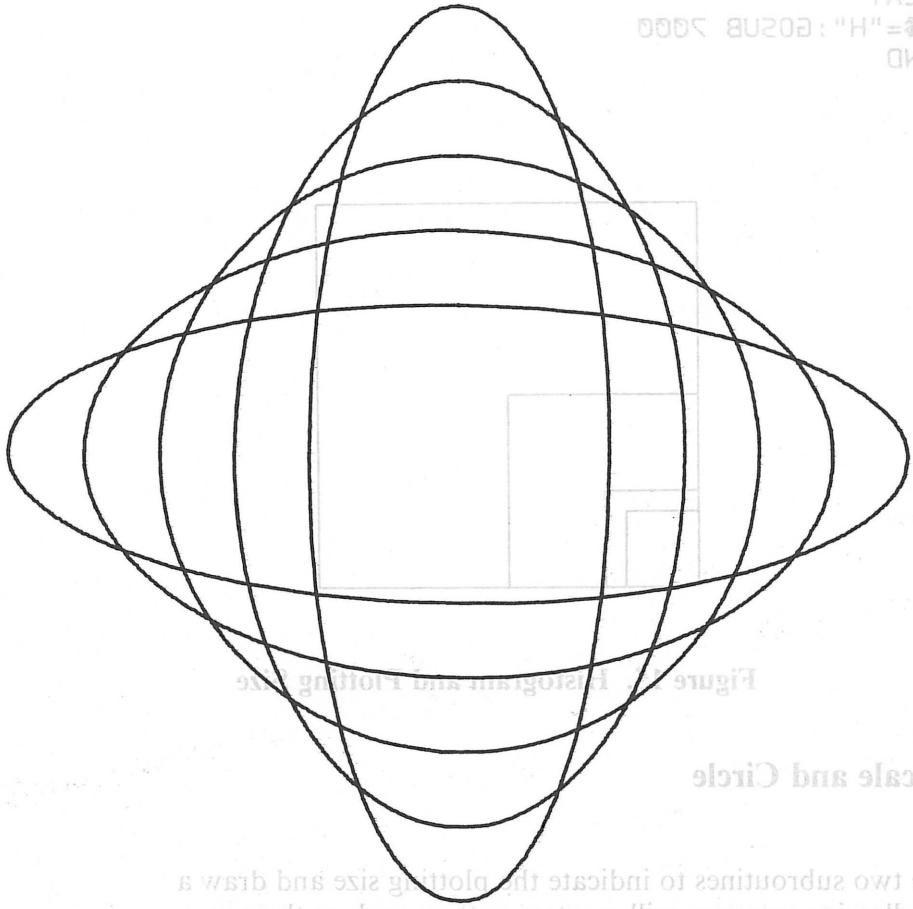


Figure 16. Plotting Scale and Circle

Circle Graph

this subroutine can be used to create a Circle Graph such as the one shown in Figure 17.

```
10 REM Sample Program < Circle Graph >
20 C$="A":GOSUB 7000
30 C$="I":X=1000:Y=X:GOSUB 7000:S1=90
40 FOR J=0 TO 3
50 READ N:S2=N:C$="W":X=0:Y=X:R=300:GOSUB 7000
60 C$="D":X=0:Y=X:GOSUB 7000
70 S1=N:NEXT
80 FOR J=0 TO 3
90 READ D$,X,Y
100 C$="M":GOSUB 7000:C$="P":GOSUB 7000
110 NEXT
120 C$="H":GOSUB 7000
130 END
1000 DATA 120,180,300,450
1100 DATA Apple,-150,330,Orange,-250,100
1110 DATA Tomato,-150,-150,Cabbage, 80,0
```

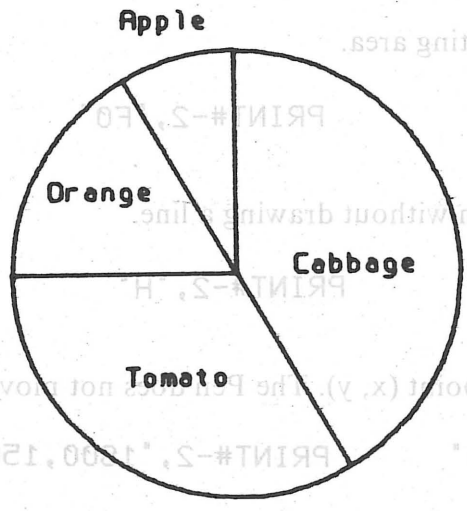


Figure 17. Circle Graph

Appendix C/Command Summary

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

```
10 LPRINT "PJON"
PRINT#-2,"M100,100" (ENTER)
```

B ***scale***
Specifies pitch for a dotted line.

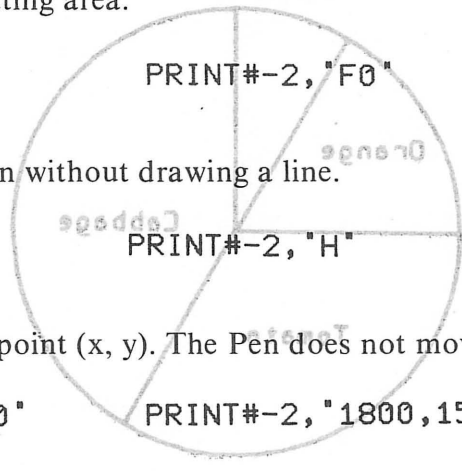
```
LPRINT "B3"        PRINT #-2,"B20"
```

D ***destination***
Draw from current coordinate to specified destination. If there is more than one point, the line continues to the second point, etc.

```
LPRINT "D";X;",";Y      PRINT#-2,"D500,350"
```

F ***number***
specify the effective plotting area.

```
LPRINT "F1"                PRINT#-2,"F0"
```



H ***home***
Moves to Home position without drawing a line.

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

I ***x, y*** set Origin
Reset the Origin to the point (x, y). The Pen does not move.

```
LPRINT "1259,470"          PRINT#-2,"1800,1500"
```

J ***destination*** Draw Relative
Draws a line from the current Pen location X steps horizontally and Y steps vertically.

```
LPRINT "J100,200,300,-200,-400,-100"
```

L *type* Line Type
Specifies solid or dotted line.

```
LPRINT "L1"              PRINT#-2,"L0"
```

M *x, y* Move (Absolute)
Move the Pen without drawing to location (x, y) relative to the Origin.

```
LPRINT "M1900,1400"      PRINT#-2,"M530,470"
```

N *number* Draw special symbols
5 Special Symbols may be specified numbered 0-4. The center of the symbol will be the current pen location.

```
LPRINT "N0"              PRINT#-2,"N5"
```

P *characters* Print characters in Graphic Mode.
Letters of the alphabet and numerals may be printed without putting the Plotter in Print Moide.

```
LPRINT "PSample-1"       PRINT#-2,"P12/16/1982
```

Q direction Change print directions.
Direction is a number from 0-3. 0 is normal (left-to-right), 1 is top-to-bottom, 2 is right-to-left (upside down), and 3 is bottom to top (Letters point left).

```
LPRINT "Q3"              PRINT#-2,"Q1"
```

R *x, y* Move (Relative)
Move the Pen without drawing from present location to a location x steps to the right or left and y steps up or down.

```
LPRINT "R200,400"        PRINT#-2,"R200,400"
```

S *size*
Specifies the character size drawn with the P command. Height = size times 0.6 mm. width = size times 0.4 (mm).

```
LPRINT "S4"              PRINT#-2,"S100"
```

X *axis, interval, times* Draw an axis
Draw a coordinate axis. Axis is 0 for a vertical axis and 1 for a horizontal axis. Interval is the distance between tic marks. Times designates how many tic marks are to be drawn on the axis.

```
LPRINT "X0,100,10"       PRINT#-2,"X1,-50,20"
```

Appendix D/ASCII Character Set

The following table lists each character the Flat Bed Plotter will print and the ASCII code that will print it.

ASCII Code	Character	ASCII Code	Chracter
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	Chracter
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

10	LINEFEED
13	CARRIAGE RETURN
17	SET PRINT MODE A (FROM GRAPHIC MODE)
18	SET PRINT MODE B (FROM GRAPHIC MODE)
19	SET GRAPHIC MODE (FROM PRINT MODE)

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

10	LINEFEED
13	CARRIAGE RETURN
17	SET PRINT MODE A (FROM GRAPHIC MODE)
18	SET PRINT MODE B (FROM GRAPHIC MODE)
19	SET GRAPHIC MODE (FROM PRINT MODE)

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 interferference will not occur in a particuiar 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 receivar 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 hes been certified to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of FCC Rules.

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