PLOTTER PRINTER

Radio Shack
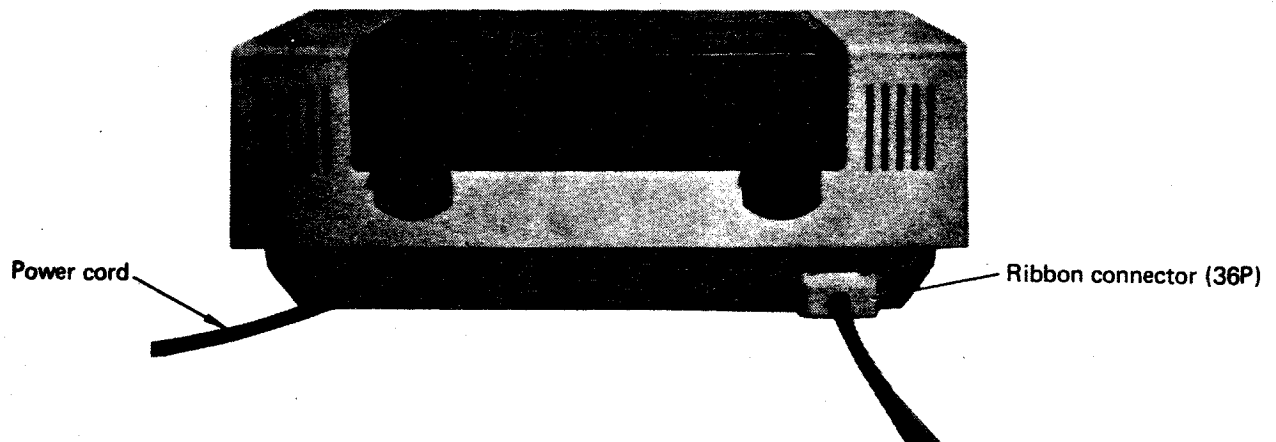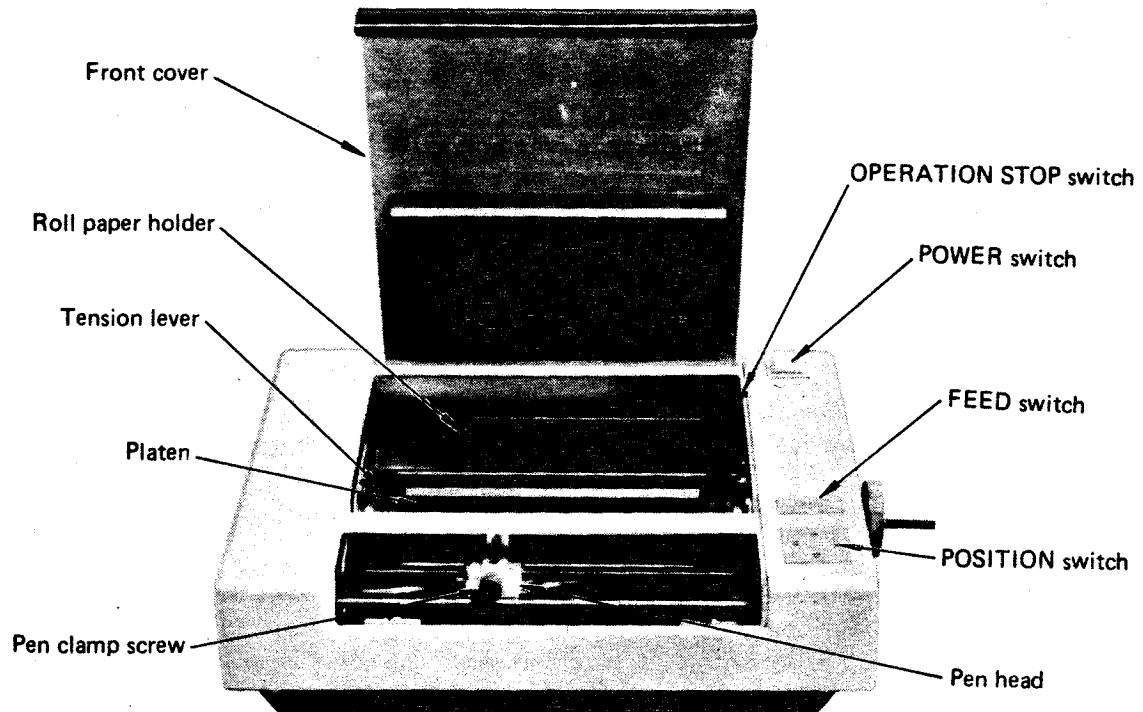## TRS-80 MICRO COMPUTER SYSTEM

HARDWARE
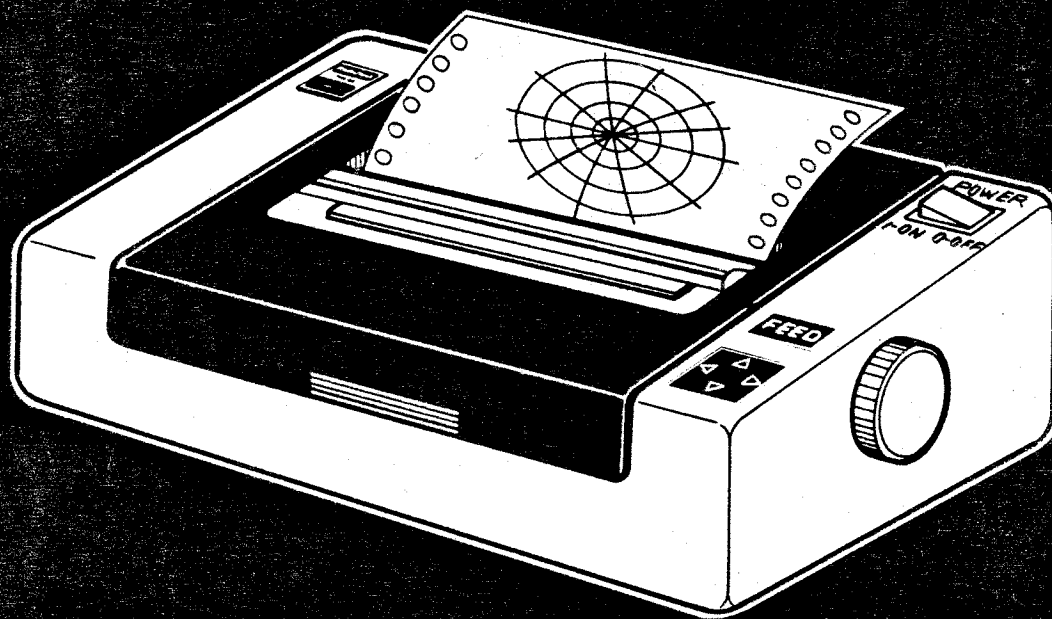
Catalog Number 26-1190A

Congratulations for selecting this
Radio Shack Computer product!

The TRS-80 Plotter Printer can be programmed with simple BASIC LPRINT statements to draw an infinite variety of points, lines and curves – as well as the standard ASCII text characters (excluding lowercase letters). The drawing mechanism is very simple, easy to maintain, and reliable. An easily replaceable ball-point pen is the writing device – no hammer, armature, or wire to wear out

Other exceptional features include:

- Fast-response solenoid control of the pen point assures precision drawings.
- Ballpoint pen produces clean, clear, reproduceable copies.
- Compact, lightweight design.
- Character size can be controlled by software (twice, four times, or eight times normal size).
- Alphanumeric characters can be rotated 90, 180, or 270 degrees (software controllable).
- Two modes of operation – plotter and character – software selectable.
- Built-in programming simplifies the drawing of many geometric shapes.
- Ultra-simple control mechanism (two motors and one magnet) means fewer moving parts – resulting in superior reliability and low-noise operation.
- Modular design and construction combined with a mechanism which requires no lubrication keeps service and maintenance to a minimum.

CONTROLS AND FUNCTIONS

Front cover

Roll paper holder

Tension lever

Platen

Pen clamp screw

OPERATION STOP switch

POWER switch

FEED switch

POSITION switch

Pen head

Power cord

Ribbon connector (36P)

SETTING UP

Loading the Paper

1. Open the plastic cover.
2. Place a roll of paper in the compartment behind the platen with the paper coming off the bottom of the roll.
3. Pull the tension lever forward and thread the paper under the platen and behind the paper guide.
4. Align the paper holes over the sprockets on the platen and return the tension lever to its original position.

Setting the Ballpoint Pen

1. Loosen the pen clamp screw.
2. Insert the pen into the pen holder and tighten the pen clamp screw.

Note: Be sure to test the pen first before inserting it, as the pen tip may be dry. Also, any time that you use the Plotter Printer after it hasn't been used recently, slip a piece of scrap paper between the pen and the platen and smear it against the pen tip to get the ink flowing.
Thread the paper up through the slot in the plastic cover and close the cover.
Firmly attach the connector provided to the back of the Plotter Printer.
Plug the power cord into a source of 120 volts, 60 Hz AC power (220/240 VAC for European and Australian models).
Your Plotter Printer is ready for use.

OPERATION

POSITION Switch: Press the appropriate arrow to move printing position. For continuous movement, hold down for 1/2 second.

Notes: 1. Don't push the switch while the Printer is operating.
2. When changing the direction of movement, release the switch for a moment to allow the pen head to stop, and then press the desired direction arrow.
3. While this switch is down, a busy signal is sent to the Computer.
4. This switch only functions to move the pen (it does not engage the pen against the paper). If the switch is operated while the pen is "on", the pen will be set to "off" before it is moved.
5. The coordinates of the pen position will be the same. The coordinate system is shifted along with the pen.

FEED Switch: Press to advance paper.

Notes: 1. Don't push the switch while the Printer is operating.
2. While this switch is down, a busy signal is sent to the Computer.
3. This switch only functions to move the paper. If the switch is operated while the pen is "on", the pen will be set to "off" before the paper is advanced.

Range of Movement by POSITION Switch

The illustration below shows the limits of pen movement using the POSITION Switch.
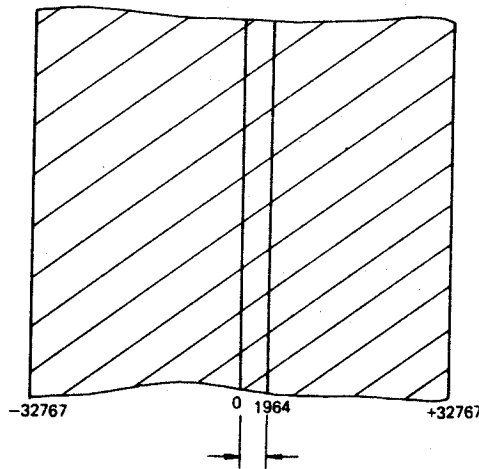
X-axis: −32767 to +32767

Y-axis: no limit

Movement speed: 0 to +32767 Plotter mode = approx 33 sec
Character mode = approx 50 sec
0 to −32767 Plotter mode = approx 28 sec
Character mode = approx 45 sec

Note: The pen will physically move only over an X axis length of 1964 steps, which is the width of the paper. If you continue to press the POSITION switch the pen will stop at the edge of the paper, but the Plotter Printer will internally keep the pen's "imaginary position" as if it is still moving. The imaginary position can be anywhere between −32767 and +32767.

Interlock Switch (inside the unit, next to the cover)

When the cover is opened, the following occurs:

1. The operation stops.

2. A Busy status exists and no data can be received.

3. The POSITION and FEED switches become inoperative.

When the cover is closed operation continues from its previous status.

PROGRAMMING

Note: All of the sample programs are written in BASIC. The apostrophe signifies a remark, material that you don't need to type in.

Incremental Stepped Pen Motion

The pen does not move in one continuous line; it is digitally controlled in increments of 0.09525 mm (approximately .004 inch). Effective paper width is 1964 steps, or 187 mm (7-3/8").

Note: Each movement of the POSITION switch moves printing position by 10 steps (increments) in the direction of the arrow pressed.

Mode Change

The Printer has two modes of operation: Character Mode and Plotter Mode. Control Code 1 sets to C mode (Character); Control Code 2 sets to P mode (Plotter).

Note: On power-up, the Printer is automatically set to C mode.

```
1Ø LPRINT CHR$ (2) :          'SETS TO P MODE

2Ø LPRINT "G5Ø X75Ø Y19Ø" :   'MOVE PEN TO POINT 750, 190

3Ø LPRINT CHR$ (1) :          'SETS TO C MODE

4Ø LPRINT "PLOTTER PRINTER" : 'PRINTS MESSAGE
```

The above sample program will print PLOTTER PRINTER from the X, Y position defined as 750,190. We'll explain line 20 later.

Character Mode (C Mode)

In the C mode the Printer prints the standard ASCII alphanumerics and symbols. The internal buffer stores up to 14 characters.

CAUTION: Printing is made in capital letters even when small letters (26 letters a through z) specifying codes are input. The printer passes other codes when they are input. (They are neglected and it does not function.)

Character Size

The base scale provides the following sizes:

Character spacing	24 steps (approx 11 characters/inch)
Line feed spacing	44 steps
Character width	16 steps (varies depending on character)
Character height	30 steps (varies depending on character)
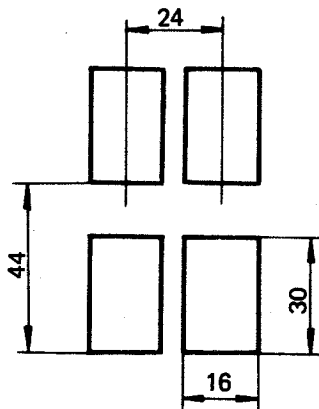
Note for Model II users: During printing operations the Plotter Printer will be busy; this may result in "Printer Not Ready" errors. To prevent this, you may need to insert pauses in your program after long-printing instructions. See line 55 in the next program.

Changing the Character Size

The size of the characters can be changed via control codes as follows:

Code (decimal)	Size
3	All following characters will be twice base size.
4	All following characters will be four times base size.
5	All following characters will be eight times base size.
6	All following characters will be base size (this is the initial size, automatically set on power-up).

Example:

```
1Ø LPRINT CHR$ (1);            'SETS TO C MODE
2Ø LPRINT CHR$ (3) "TWICE BASE SIZE"
3Ø LPRINT CHR$ (2)            'SETS TO P MODE
4Ø LPRINT "G5Ø U0 V−2ØØ"      'MOVE DOWN 200 STEPS
5Ø LPRINT CHR$ (1) CHRS (4) "FOUR TIMES BASE"
55 INPUT "PRESS <ENTER> AFTER PRINTING IS FINISHED"; X
6Ø LPRINT CHR$ (2)            'SETS TO P MODE
7Ø LPRINT "G5Ø U0 V−4ØØ"      'MOVE DOWN 400 STEPS
8Ø LPRINT CHR$ (1) CHR$ (5) "8 TIMES"
9Ø LPRINT CHR$ (6) "BACK TO NORMAL AGAIN"
```

Model I and III users may delete line 55. Model II users see previous Note.

Rotating Characters

The orientation of the writing can be set for 0°, 90°, 180°, or 270° via control codes as follows:

Code (decimal)	Rotation (degrees)
17	0 (normal upright position) This is the initial state.
18	90 (reading from the left side)
19	180 (upside down)
20	270 (reading from the right side)

ENLARGED LETTERS AND TURNED LETTERS

H

(One fold)

H

(Two fold)

H

(Four fold)

H

(Eight fold)

ABC — 0°

JKL — 270°

DEF — 90°

IHG — 180°
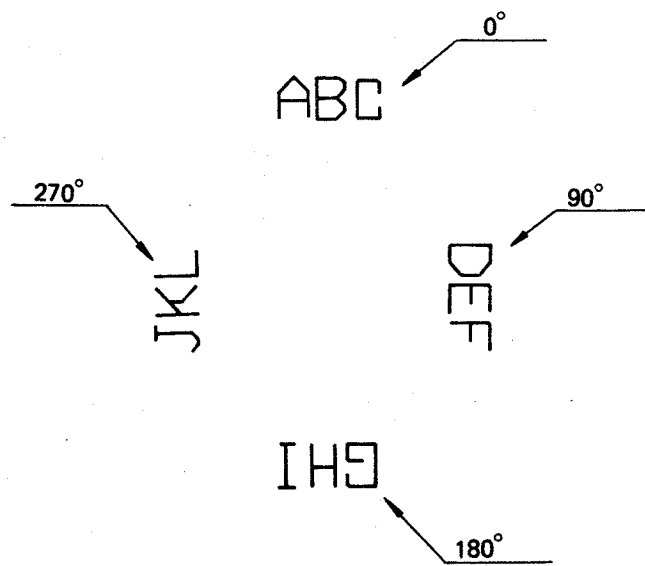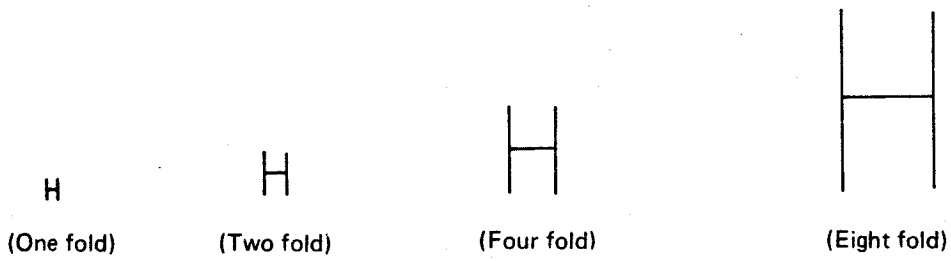
Example:

        1∅ LPRINT CHR$ (2)

        2∅ LPRINT "G5∅ X15∅∅ Y19∅"   'MOVING PRINT POSITION

        3∅ LPRINT CHR$ (1) CHR$ (18) "90 DEGREE PRINTING";

        4∅ LPRINT CHR$ (2)

        5∅ LPRINT "G5∅ U–3∅∅ V–3∅∅"   'MOVING PRINT POSITION

        6∅ LPRINT CHR$ (1) CHR$ (19) "180 DEGREE PRINTING";

        7∅ LPRINT CHR$ (2)

        8∅ LPRINT "G5∅ U–3∅∅ V3∅∅"   'MOVING PRINT POSITION

        9∅ LPRINT CHR$ (1) CHR$ (20) "270 DEGREE PRINTING";

        1∅∅ LPRINT CHR$ (2)

        11∅ LPRINT "G5∅ U4∅∅ V3∅∅"   'MOVING PRINT POSITION

        12∅ LPRINT CHR$ (1) CHR$ (17) "BACK TO NORMAL"

Note: When changing from P-mode to C-mode, the Rotation and Character-size states are automatically reset to 0 degrees and base size, respectively.

Other Control Codes

The Printer accepts the following additional codes and ignores all others:

        8   Backspace by one character (BS)

        10   Linefeed (LF)

        13   Carriage return with linefeed (CR)

Note: Input character automatic return function is equipped on the Plotter Printer. 81st character and subsequent are printed in the next line.

Pen Positioning (Alphanumeric mode)

1. At rest the pen is positioned in the center of a character.

   Example: After A is printed, the pen moves to the position ① . (24 steps from the center of "A".
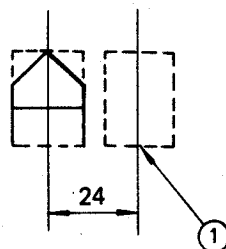
2. If the Printer receives a full line of printable characters without a carriage return, it will perform an automatic line advance upon receipt of the next printable character.
   This is called wraparound, since the text automatically wraps to the next line without loss of characters. At 81st position of one-fold character wraparound takes place.

   DEF }} ABC
   80th character
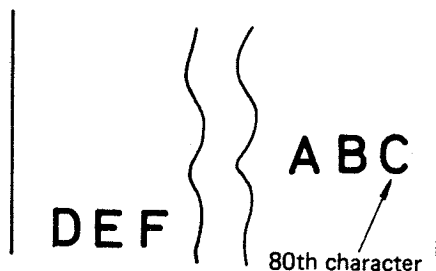
3. When a BS (Back Space, CHR$ (8)) is input for more than the number of spaces to the left margin, the pen will move to the left margin, then the imaginary pen point will be internally set as though it were at an imaginary position represented by the BS spacing.

   Example: When BS is input three times after A is printed, the pen will be internally set to the equivalent of "imaginary" position ③ .
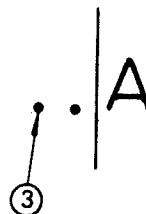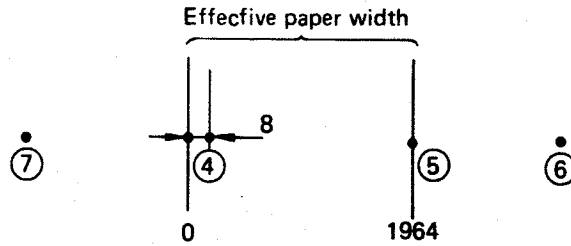
Pen Position on Power-up or with CR Code Input

The pen moves to the right by a half-character space and then will write the first character transmitted.

8 [STEPS] (Base size mode)
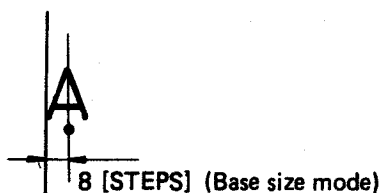
Function of CR Code

When a CR Code is input, the pen moves to the left margin and will begin printing in that position.

Effecfive paper width

⑦   ⑧   ④   ⑤   ⑥

0   1964

Whenever a CR Code is input, regardless of pen position – at ⑤ or "imaginary positions" ⑥ or ⑦ , the pen will return to position ④

A ———→ B ———→ C .

Example: When in the P Mode the pen is set to (3500, −1000) and then C Mode and CR are input, the pen will move as illustrated.

3500

Effective paper width

A

1000

C   1964   B

0   Imaginary position of pen
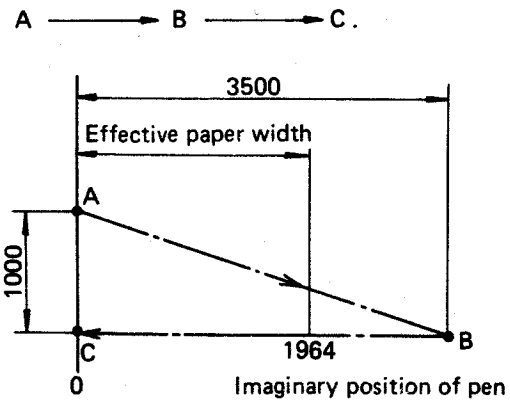
CR Timing Considerations

When the pen is positioned at the imaginary points D or E and a CR code is input, it will take approximately three seconds before the pen moves to the left margin. (The process "thinks" the pen is at that position and will calculate motions accordingly.) It will take approximately 400 mS for the pen to return to the left margin when automatic return is made at the 80th character.

Effecfive paper width

E   D

−32767   0 1964   +32767
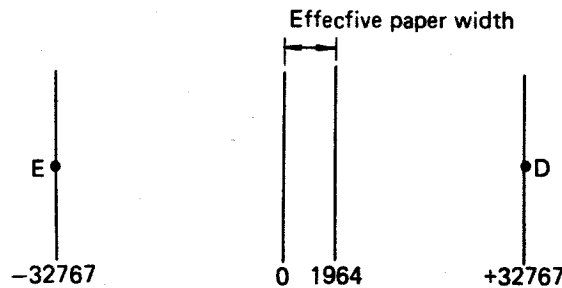
Note: In the rotated character mode, CR functions just as normal, but LF does not. That is, CR causes the pen to move to the left margin. LF, if in the 90 and 270 modes, will be ignored. In the 180 mode, LF feeds paper in reverse.

Plotter Mode (P Mode)

In the Plotter mode, the printing position is determined by a system of coordinate values. If a command tells the pen to move to a point off the paper, the pen will remain stationary at the paper's edge, but the pen's imaginary position off the paper will be kept internally and the next move or print will start at that imaginary position.

Absolute Coordinate System

The coordinate axes are defined with respect to the paper as follows:

Paper feeding direction
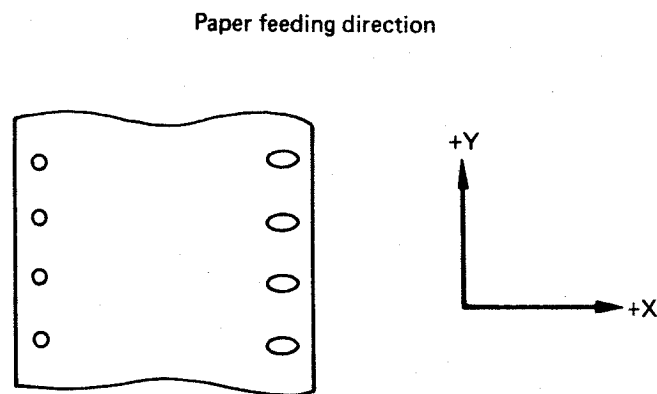
When the mode is set to P Mode the reference point for the absolute coordinate system is as follows if the POSITION switch is not used.
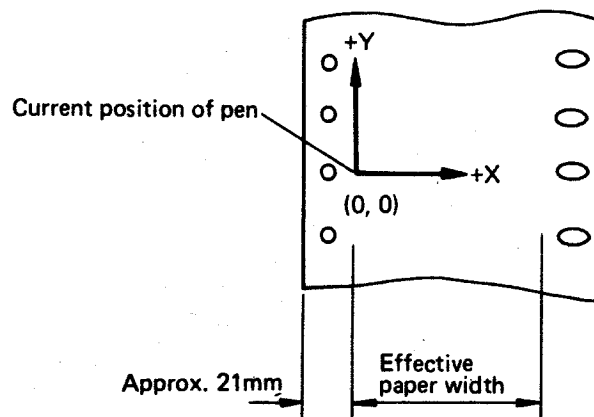
The zero-point of the X axis (X=0) is defined as the left margin. The zero-point of the Y axis (Y=0) is defined as the current pen position.

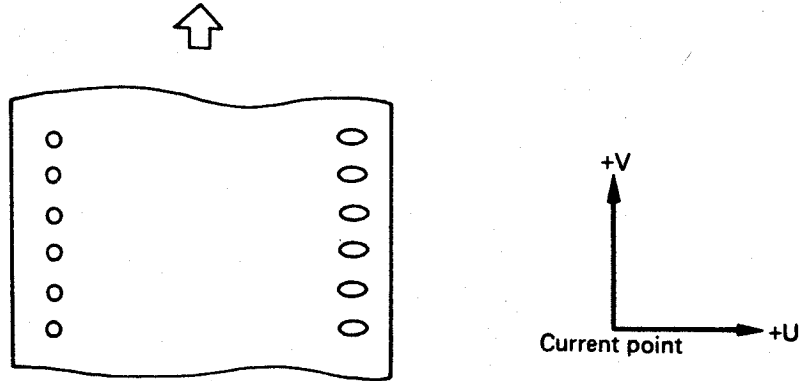# Relative Coordinate System

The relative coordinate values, compared with the current position of the pen, are determined as follows:

(X, Y) value and (U, V) value agree only when the pen is in the original position (0, 0).

You can change the location of the origin position by using the POSITION and/or the FEED switch.
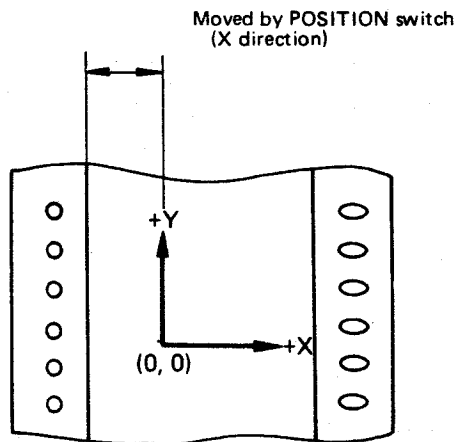
Remember that the X and Y coordinates move with the pen when the POSITION or FEED switch is used. Thus, when these switches are pressed the absolute origin and the absolute coordinate system also shift with the pen.

Example:
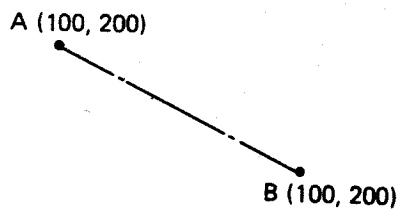
A (100, 200)

B (100, 200)

When the pen is moved from A to B with the POSITION switch, the new coordinate value of B becomes the original coordinate value that A had (100, 200).

The origin can also be moved by use of the GØ2 and GØ3 commands (See page 17).

G Functions

G Functions control the action of the pen and the paper. These control statements consist of the ASCII character "G" plus a series of ASCII numbers and letters defining the line and/or figure segments desired.

There are seven G functions as noted below:

G Function Table

G Code	Function	Remarks
G∅∅	Straight line segment	Dotted Line
G∅1	Straight line segment	Solid Line
G∅2	Arc segment (drawn clockwise)	Solid Line
G∅3	Arc segment (drawn counter-clockwise)	Solid Line
G5∅	Pen up movement	
G9∅	Rectangular figure	Solid Line
G91	Triangular figure	Solid Line

G∅∅   Function: Draws a dotted line between the current point and the point specified by the X and Y coordinates.

Format: G∅∅ Xnn Ynn CR

Example: LPRINT "G∅∅ X8∅∅ Y5∅∅"
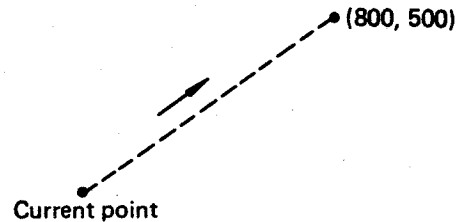
G∅1   Function: Draws a solid line between the current point and the point specified by the X and Y coordinates.

Format: G∅1 Xnn Ynn CR

Example: LPRINT "G∅1 X1∅∅∅ Y12∅∅"

(1000, 1200)
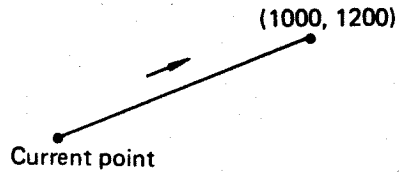
Current point

G∅2   Function: Draws an arc in a clockwise direction between the current point and the point specified by the X and Y axes. The center of the arc is specified by I and J, which show the coordinate distance of the current point on the X axis and Y axis to the center point.

Format: G∅2 Xnn Ynn Imm Jmm

Example: LPRINT "G∅2 X6∅∅ Y2∅∅ I2∅∅ J346"

(400, 546)
Current point

J=346

Center
(200, 200)

(600, 200)

I=300
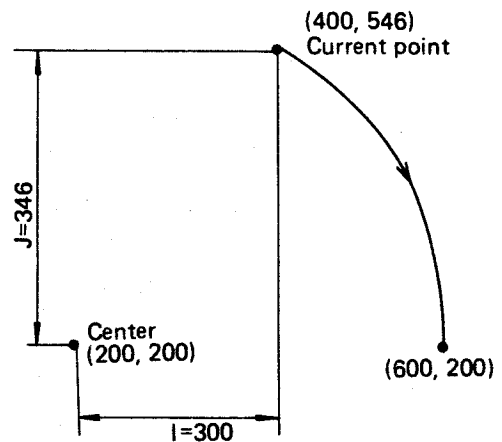
The value of I is the distance on the X axis from the current point to the center point. The value of J is the distance on the Y axis from the current point to the center point. One complete circle is drawn by specifying only I and/or J.

Example: LPRINT "G∅2 I2∅∅ J2∅∅"

LPRINT "G02 I200"

200

Current point

LPRINT "G02 J200"

Current point

200
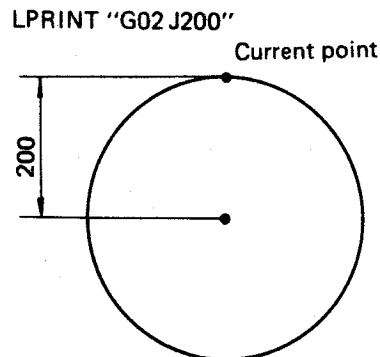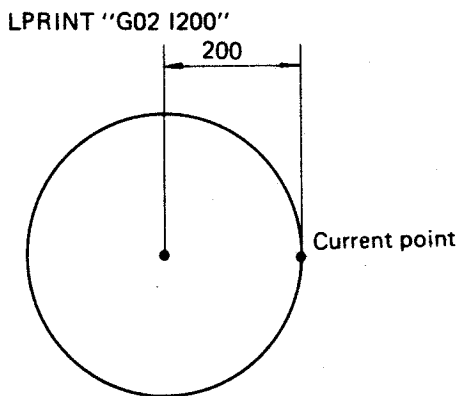
Even when the X and/or Y coordinate of the point specified is not present on a circumference (determined by the current point and the center point (I, J)) the pen moves to the point specified. However, when both coordinates of the point specified are outside the radius of the circle, the pen will move along a maximum of 1-1/2 times the circumference and then stop. Under this condition, the relative relationship between the Absolute coordinate value and the pen position will be lost.

Example for when the point specified by X, Y (U, V) is not present on the circumference (but is inside the radius of the specified circle):

LPRINT "GØ2 U−3ØØ V−3ØØ I4ØØ"
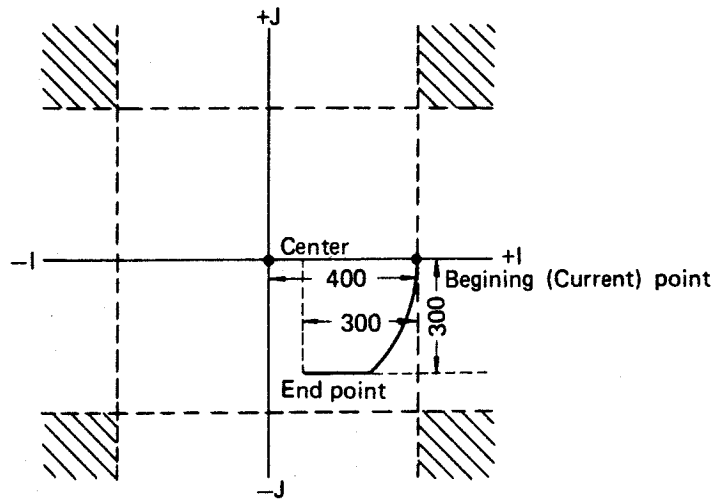
Example for when both coordinates of the point specified are outside the radius of the circle (shaded areas):

LPRINT "GØ2 U1ØØ V5ØØ I4ØØ"
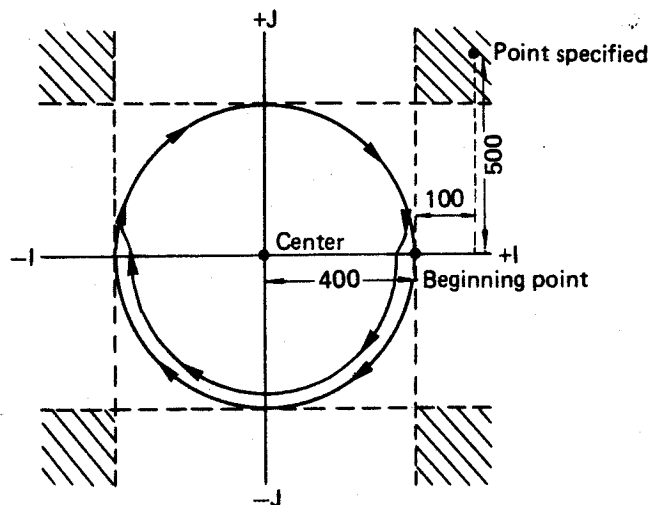
One special application of GØ2 (or GØ3) is to move the coordinate origin. When "GØ2 XØ YØ" (or "GØ3 XØ YØ") is executed, the current pen position becomes the new origin.

Example:

1∅ LPRINT "G∅1 X2∅∅∅ Y1∅∅∅"

2∅ LPRINT "G∅2 X∅ Y∅":   'POINT (2000, 1000) BECOMES NEW ORIGIN

3∅ LPRINT "G∅1 X1∅∅∅ Y−1∅∅∅":   'POINT DESIGNATION FROM NEW COORDINATE
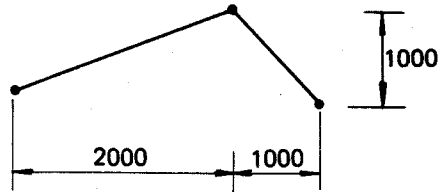
G∅3   Function: Functions the same as G∅2, but draws in a counter-clockwise direction.

Example: LPRINT "G∅3 X2∅∅ Y6∅∅ I3∅∅ J265"
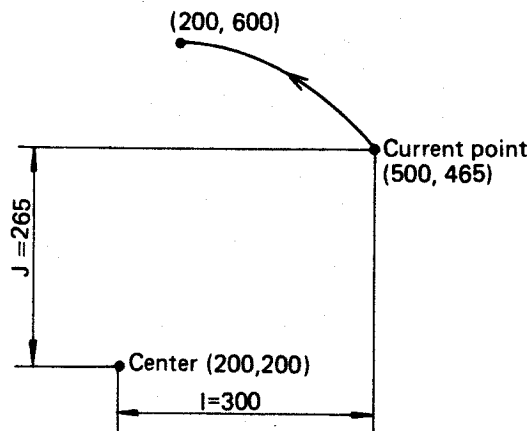
G5∅   Function: Lifts the pen and moves it from the current point to the coordinate point specified.

Example: LPRINT "G5∅ X6∅∅ Y7∅∅"

— 17 —
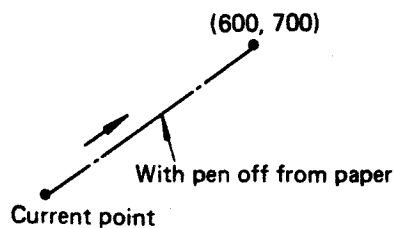
G9Ø   Function: Moves and draws a line first to the specified Y coordinate, then to the X coordinate, then to the original Y coordinate, and then back to the start point. Thus a rectangle can be defined by the positions of two of its diagonal corners. (One of them being the current pen position.)

Example: LPRINT "G9Ø X3ØØ Y9ØØ"
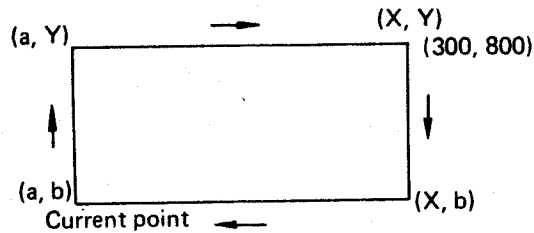
The pen moves and draws a line from the current pen position (a, b) to (a, Y) to (X, Y) to (X, b) and then back to (a, b).

G91   Function: Moves and draws a line to (a, Y), then to (X, b), and then to the starting point (a, b), creating a triangular shape.

Example: LPRINT "G91 X1ØØØ Y13ØØ"
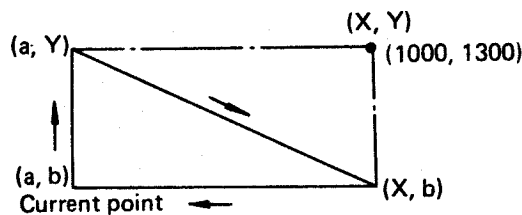
Note on G Functions

When a G function code is not specified, any previously specified G function will continue.

Example: LPRINT "GØØ X8ØØ Y4ØØ" : LPRINT "X1ØØØ Y2ØØ"
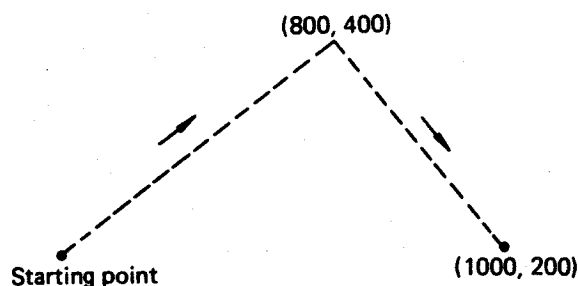
M Function: When MØØ CR is input, the pen moves from the current point to the origin of the absolute coordinate system.

Example: LPRINT "MØØ"

(0, 0) Origin

(300, −200)
Current point
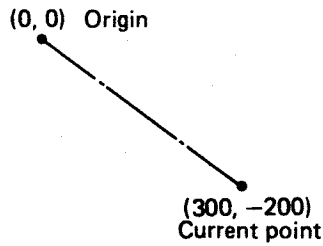
Combining P Mode and C Mode

When changing to the P mode, the current position of the pen becomes the origin of the Y-axis (Y=0). (In the C mode, the absolute coordinate value in the Y direction is not stored.)

Example: 1Ø LPRINT CHR$ (2)

2Ø LPRINT "GØ1 X5ØØ Y−5ØØ"

3Ø LPRINT CHR$ (1) CHR$ (32) "A" CHR$ (8) CHR$ (8)

4Ø LPRINT CHR$ (2)

5Ø LPRINT "GØ1 X1ØØØ Y−5ØØ":

Note regarding line 30: CHR$ (32) is a space code; without it, letter "A" would be printed right on the point. CHR$ (8) is a back-space code to compensate for the normal movement to the right caused by the space code and "A". The pen moves twice (four or eight times) in an enlarged mode, therefore use the appropriate number of back-space codes to compensate.

500 | 500

500

500

A
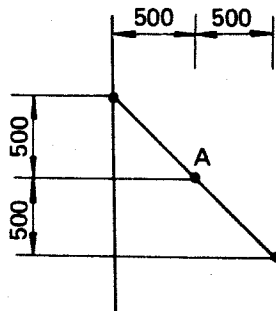
Note that X axis is not changed during mode change-over.

Input Format

After a G function code is input, X, Y, U, V, I, and J can be used in any order.

Examples: LPRINT "GØ1 Y1ØØ X1ØØ" is the same as

LPRINT "GØ1 X1ØØ Y1ØØ"

LPRINT "GØ2 V2ØØ U2ØØ J-1ØØ I-1ØØ" equals

LPRINT "GØ2 I-1ØØ U2ØØ J-1ØØ V2ØØ"

The absolute coordinate value and relative value may be used simultaneously.
However, when X and U, and Y and V are used simultaneously, only the earlier input is valid.

Examples: LPRINT "GØØ X1ØØ V-5ØØ"

LPRINT "GØØ U1ØØ Y-5ØØ"

LPRINT "GØØ X1ØØ U5ØØ Y2ØØ" U5ØØ will be invalidated

LPRINT "GØØ U2ØØ V5ØØ Y3ØØ" Y3ØØ will be invalidated

Handling of Invalid Codes

When using GØØ, GØ1, G5Ø, G9Ø, or G91:

Gmm . . . X(or U) . . . (12345) . . Y(or V) . . . (12345) . . . CR
     (1)   (2)   (3)   (4)   (5)

The following codes are ignored when input in positions 1 through 5 :

1 - - -   Codes other than G, X, Y, U, V, and CR

2 & 4   Codes other than +, − digits, and CR

3 - - -   Codes other than X (U), Y, V, digits, and CR

5 - - -   Codes other than Y (V), digits, and CR

Example: LPRINT "GØ1 AA X AA 2ØØØ AA Y AA 15ØØ AA"

is the same as

LPRINT "GØ1 X2ØØØ Y15ØØ"

When using G∅2 or G∅3:

Gnn . . . X(or U) . . . (12345) . . . Y(or V) . . . (12345) . . . I . . . (12345) . . . J . . . (12345) . . . CR
   (6)   (7)   (8)   (9)   (10) (11)   (12) (13)   (14)

The following codes are ignored when input in positions 6 through 14 :

6 - - -   Codes other than G, X, Y, U, V, I, J, and CR

7, 9, 11, 13 - - - Codes other than +, −, digits, and CR

8 - - -   Codes other than X (U), Y, V, I, J, digits, and CR

10 - - -   Codes other than Y (V), I, J, digits, and CR

12 - - -   Codes other than I, J, digits, and CR

14 - - -   Codes other than J, digits, and CR

      Example: LPRINT "G∅2 BB X BB 5∅∅ BB Y BB 5∅∅ BB I BB 5∅∅ BB J BB 5∅∅ BB"
               is the same as
               LPRINT "G∅2 X5∅∅ Y5∅∅ I5∅∅ J5∅∅"

Range of Values:

Values of U and V are valid within the range of −32767 to +32767.
Values of X, Y, I, and J are valid within the range of −16383 to +16383. (0 value must not have a minus sign.)

CAUTION: If a value outside the range of −32767 to +32767 is input, the value is assumed to be 0.

      Example: LPRINT "G∅1 X4∅∅∅∅" at point A causes the pen to move to point B.
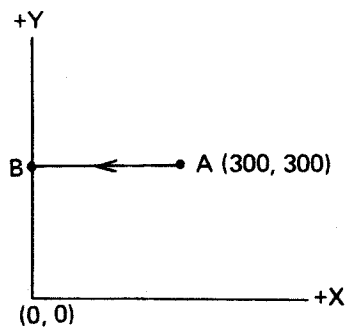
Input Correction

G Functions

When Gmm is to be corrected to Gnn, input Gnn immediately after inputting Gmm.

Example: Changing G∅1 to G5∅, "G∅1G5∅ X1∅∅"
           will function just like "G5∅ X1∅∅"

Other values (X, Y, U, V, I, and J)

When Xmm is to be corrected to Xnn, input Xnn immediately after Xmm (the second value will be used).

Example: Changing X1∅∅∅ to X2∅∅∅, "G∅1 X1∅∅∅ X2∅∅∅"
           will function just like "G∅1 X2∅∅∅".

Y, U, V, I, and J can be corrected in the same way.

Relative Coordinate System
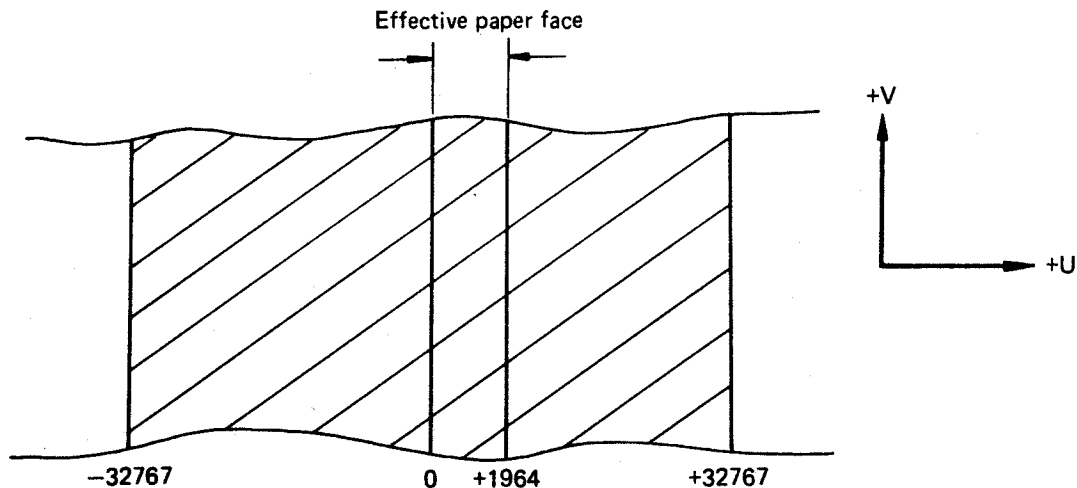
When plotting characters or illustrations, the pen position (whether actual of imaginary) must stay within the limits represented by shading in the above figure. This refers to the cumulative pen motion, not only the motion for one command.

For the X-direction, stay within the range of −32767 to +32767.

For the Y-direction, the pen motion is limited only by the length of your paper roll.

If an attempt is made to draw a figure or character outside the shaded area, the relationship with the relative coordinate system will be lost. (The mathematical location of the origin will be deleted, leaving no reference point for the coordinate system.)

Example: When GØ1 U4ØØ V2ØØ" is input at point A, to move the pen to point B, the relationship with the relative coordinate system will be lost.
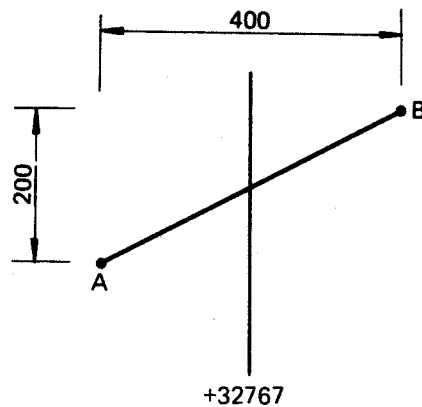
Absolute Coordinate System

When the origin in the X-axis is on the left margin:
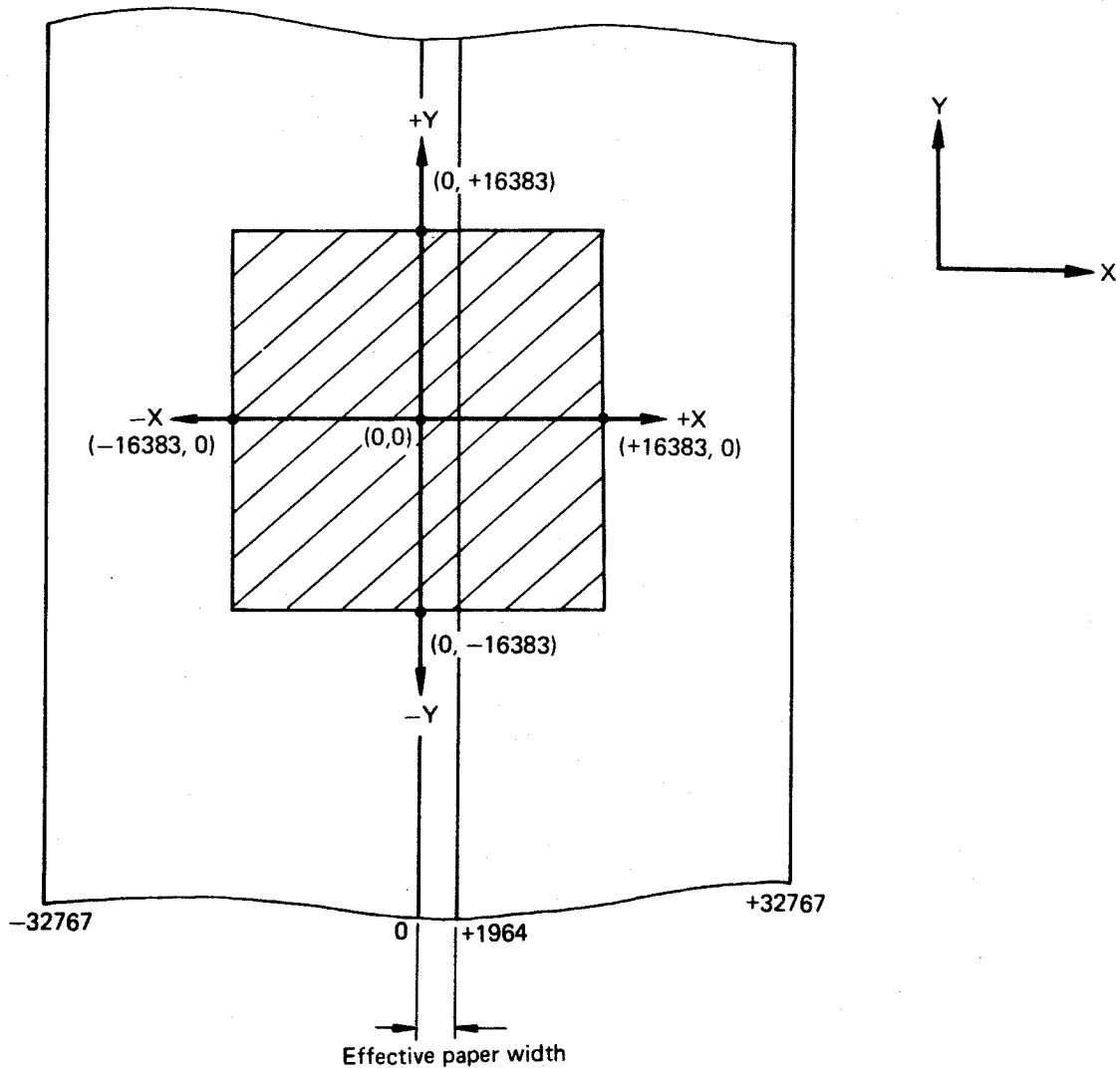
When drawing characters or illustrations, use only the area represented by shading in the above figure. If an attempt is made to draw a character or illustration outside the shaded area, the relationship with the absolute coordinate system will be lost.

Example: When "GØ1 U–2ØØØØ Y1ØØØ" is input to move the pen from the origin to point D, the relationship with the absolute coordinate system will be lost.
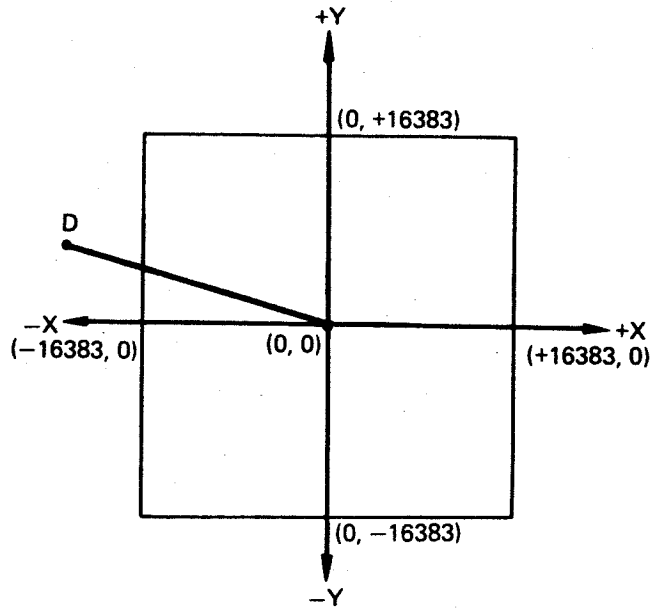
When the origin in the X-direction is not on the left margin part of the absolute coordinate system may be shifted off the useable X-value range.
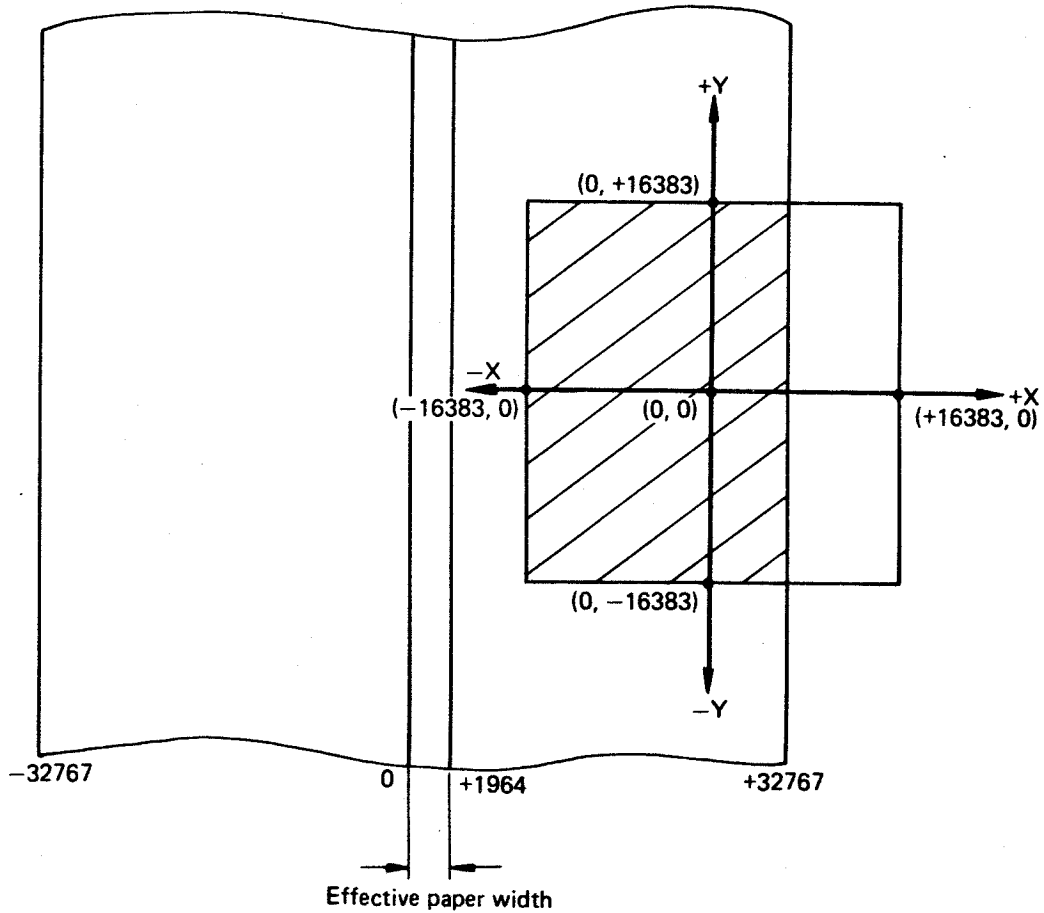
When drawing characters or illustrations, use only the area represented by shading in the above figure.
If an attempt is made to draw a character or illustration outside the shaded area, the relationship with the absolute coordinate system will be lost.

Example: When "G∅1 X12∅∅∅ Y12∅∅∅" is input to move the pen from point E to point F, the relationship with the absolute coordinate system will be lost.
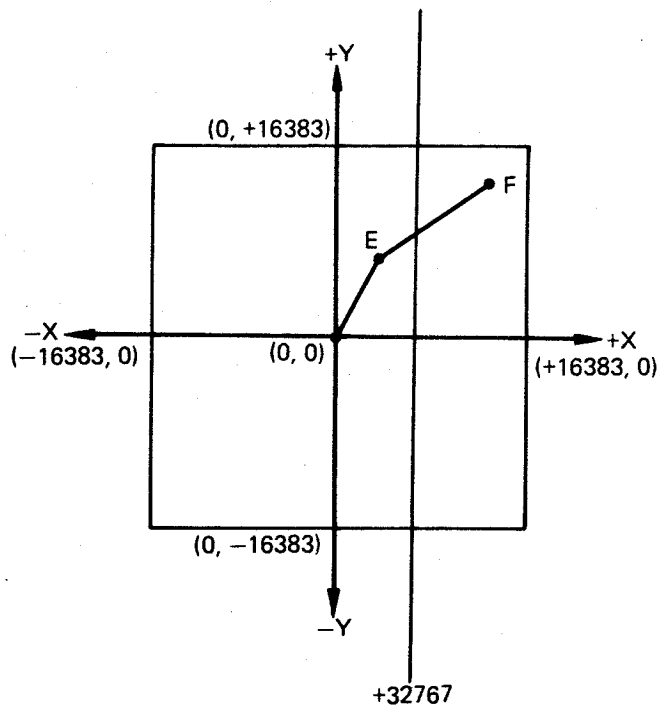
Some Functional Examples

Since the incremental steps are extremely small (0.09525 mm), you can draw "curves" with the Plotter Printer. (Actually these "curves" are made up of a series of very short straight lines.)

This sample program will draw a Sine Curve. First we draw the coordinate axes. Then the sine value is multiplied by 300 in the Y-axis direction to establish the amplitude of the sine wave and this figure is printed on the previously drawn axes.

```
1∅ LPRINT CHR$(2):              'TO BE SURE WE'RE IN P MODE
2∅ LPRINT "G5∅ X9∅∅ Y−73∅":     'MOVE PEN TO ABOUT CENTER OF PRINTING AREA
3∅ LPRINT "G∅3 X∅ Y∅":          'SET THIS POINT TO NEW ORIGIN
4∅ LPRINT "G5∅ X−7∅∅":          'MOVE PEN TO START OF X AXIS
5∅ LPRINT "G∅1 X7∅∅":           'DRAWING X AXIS
6∅ LPRINT "G5∅ X∅ Y−7∅∅":       'MOVE PEN TO START OF Y AXIS
7∅ LPRINT "G∅1 Y7∅∅":           'DRAWING Y AXIS
8∅ LPRINT "G5∅ X−7∅∅ Y∅":       'MOVE PEN TO START OF SINE CURVE
9∅ FOR X=−7∅∅ TO 7∅∅ STEP 2∅
1∅∅ Y=SIN(X/111.4)*3∅∅:         'CALCULATE SIN X AND MULTIPLY BY 3∅∅
11∅ LPRINT "G∅1 X"; INT(X); "Y"; INT(Y):  'DRAWS ONE STEP OF SINE CURVE
12∅ NEXT:                       'NEXT X VALUE
```

ClibPDF - www.fastio.com

PLOT OF SINE CURVE
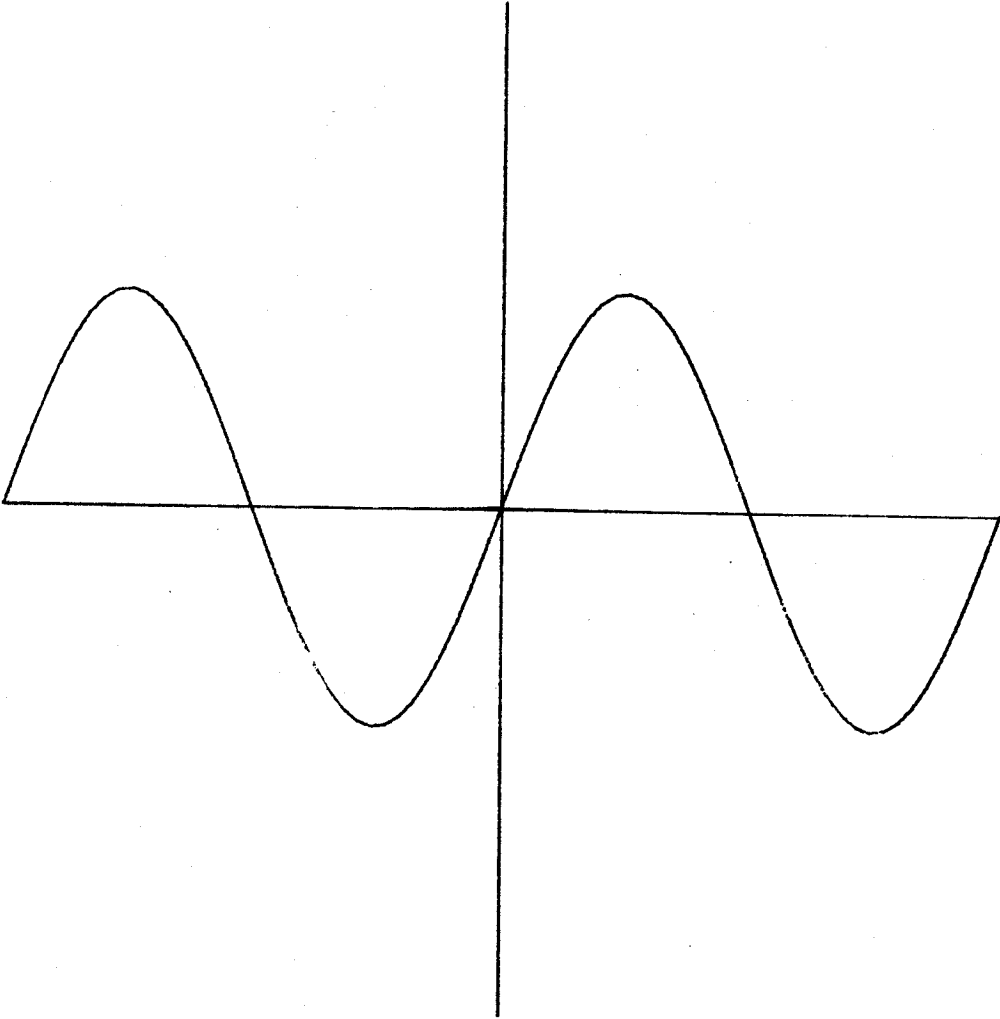
The following is a listing of a much more complex program. It will demonstrate most of the capabilities of the Plotter Printer. We suggest you take a little time to study the program along with the resulting output. It should help you understand some of the features and the required programming techniques.

10	REM SAMPLE PROGRAM				
20	DEFINT A–Z:LPRINT CHR$(1)CHR$(6)CHR$(17)				
30	LPRING CHR$(2)				
40	LPRINT"G50 U300 V50				
50	LPRINT"G02 X0 Y0				
60	REM		DRAWING "RADIO"		
70	LPRINT"G01	X0	Y180		
80	LPRINT"G01	X90	Y180		
90	LPRINT"G02	X105	Y85	I10	J50
100	LPRINT"G01	X140	Y0		
110	LPRINT"G01	X80	Y0		
120	LPRINT"G01	X60	Y35		
130	LPRINT"G03	X50	Y35	I5	J3
140	LPRINT"G01	X50	Y0		
150	LPRINT"G01	X0	Y0		
160	LPRINT"G50	X39	Y85		
170	LPRINT"G02	I–22	J0		
180	LPRINT"G50	X150	Y95		
190	LPRINT"G01	X150	Y140		
200	LPRINT"G01	X230	Y140		
210	LPRINT"G02	X265	Y105	I0	J35
220	LPRINT"G01	X265	Y0		
230	LPRINT"G01	X175	Y0		
240	LPRINT"G02	X180	Y85	I–10	J–42
250	LPRINT"G01	X195	Y85		
260	LPRINT"G03	X195	Y95	I0	J–5
270	LPRINT"G01	X150	Y95		
280	LPRINT"G50	X172	Y50		
290	LPRINT"G02	I–22	J0		
300	LPRINT"G50	X340	Y0		
310	LPRINT"G02	X340	Y140	I–4	J–70
320	LPRINT"G01	X360	Y140		
330	LPRINT"G01	X360	Y180		
340	LPRINT"G01	X415	Y180		
350	LPRINT"G01	X415	Y0		
360	LPRINT"G01	X340	Y0		
370	LPRINT"G50	X346	Y27		
380	LPRINT"G02	I0	J–22		

390	LPRINT"G50	X430	Y0		
400	LPRINT"G01	X430	Y140		
410	LPRINT"G01	X490	Y140		
420	LPRINT"G01	X490	Y0		
430	LPRINT"G01	X430	Y0		
440	LPRINT"G50	X570	Y0		
450	LPRINT"G02	I0	J−75		
460	LPRINT"G50	X570	Y33		
470	LPRINT"G02	I0	J−22		
480	REM		DRAWING 'SHACK"		
490	LPRINT"G50	X685	Y0		
500	LPRINT"G01	X685	Y50		
510	LPRINT"G01	X698	Y50		
520	LPRINT"G03	X718	Y70	I0	J−20
530	LPRINT"G01	X720	Y125		
540	LPRINT"G02	X770	Y175	I−50	J0
550	LPRINT"G01	X805	Y175		
560	LPRINT"G01	X805	Y120		
570	LPRINT"G01	X790	Y120		
580	LPRINT"G03	X772	Y102	I0	J20
590	LPRINT"G01	X770	Y50		
600	LPRINT"G02	X720	Y0	I50	J0
610	LPRINT"G01	X685	Y0		
620	LPRINT"G50	X812	Y0		
630	LPRINT"G01	X812	Y175		
640	LPRINT"G01	X865	Y175		
650	LPRINT"G01	X865	Y140		
660	LPRINT"G01	X885	Y140		
670	LPRINT"G02	X935	Y90	I0	J50
680	LPRINT"G01	X935	Y0		
690	LPRINT"G01	X880	Y0		
700	LPRINT"G01	X880	Y85		
710	LPRINT"G03	X866	Y85	I7	J0
720	LPRINT"G01	X866	Y0		
730	LPRINT"G01	X812	Y0		
740	LPRINT"G50	X955	Y95		
750	LPRINT"G01	X955	Y140		
760	LPRINT"G01	X1035	Y140		
770	LPRINT"G02	X1070	Y105	I0	J35
780	LPRINT"G01	X1070	Y0		
790	LPRINT"G01	X980	Y0		
800	LPRINT"G02	X985	Y85	I−10	J−42
810	LPRINT"G01	X1000	Y85		

```
820    LPRINT"G03    X1000    Y95       I0       J−5
830    LPRINT"G01    X955     Y95
840    LPRINT"G50    X977     Y50
850    LPRINT"G02    I−22     J0
860    LPRINT"G50    X1210    Y45
870    LPRINT"G02    X1215    Y60       I63      J−27
880    LPRINT"G01    X1165    Y60
890    LPRINT"G03    X1165    Y45       I20      J7
900    LPRINT"G01    X1210    Y45
910    LPRINT"G50    X1223    Y0
920    LPRINT"G01    X1223    Y170
930    LPRINT"G01    X1263    Y170
940    LPRINT"G01    X1263    Y95
950    LPRINT"G03    X1271    Y97       I−3      J0
960    LPRINT"G01    X1290    Y120
970    LPRINT"G01    X1340    Y120
980    LPRINT"G01    X1315    Y80
990    LPRINT"G01    X1340    Y0
1000   LPRINT"G01    X1285    Y0
1010   LPRINT"G01    X1275    Y42
1020   LPRINT"G03    X1263    Y42       I6       J0
1030   LPRINT"G01    X1263    Y0
1040   LPRINT"G01    X1223    Y0
1050   LPRINT"G50    X120     Y−300
1060   LPRINT CHR$(1)CHR$(5)"TRS−80"CHR$(3):LPRINT
1070   LPRINT CHR$(4)"                    PLOTTER/PRINTER"CHR$(6):LPRINT:LPRINT
1080   LPRINT CHR$(3)"                    WRITING WITH BALL-POINT PEN
1090   LPRINT CHR$(6)"                    YOU CAN PRINT
ALPHANUMERIC CHARACTERS
1100   LPRINT
1105   LPRINT"                           AT FOUR ANGLES OF ROTATION
1106   LPRINT
1107   LPRINT"                           YOU CAN ALSO PLOT
1108   LPRINT
1110   LPRINT"                           'STRAIGHT LINES', 'DOTTED LINES'
AND 'CURVES'
1120   LPRINT
1130   REM                               DRAWING COORDINATE SYSTEM
1140   LPRINT CHR$(2)
1150   LPRINT"G50    X650     Y−730
1160   LPRINT"G02    X0       Y0
1170   LPRINT"G50    X−700
1180   LPRINT"G01    X700
```

```
1190    LPRINT"G50       X0          Y−700
1200    LPRINT"G01                   Y700
1210    REM                              DRAW HYPERBOLA
1220    LPRINT"G50       X−690   Y−30
1230    FOR X=−690 TO 690 STEP 20
1240    Y=21000/X:IF X<19 AND X>−19 THEN 1270
1250    IF X=30 THEN LPRINT"G50 X"X"Y"Y
1260    LPRINT"G01 X"X"Y"Y
1270    NEXT
1280    REM                              DRAW PARABOLA
1290    LPRINT"G50       X−500   Y700
1300    FOR X=−500 TO 500 STEP 10
1310    Y=X*X/357
1320    LPRINT"G01 X"X"Y"Y
1330    NEXT
1340    REM                              DRAW CIRCLE
1350    LPRINT"G50 X500 Y0
1360    LPRINT"G02 I500
1370    REM                              DRAW SINE
1380    LPRINT"G50X−700
1390    FOR X=−700 TO 700 STEP 20
1400    Y=SIN(X/111.4)*300:LPRINT"G01 X"X"Y"Y
1410    NEXT
1420    REM                              DRAW DOTTED LINE
1430    LPRINT"G50       X−700   Y−700
1440    LPRINT"G00       X700    Y700
1450    REM                              ROTATE CHARACTERS
1460    LPRINT"G50       X750    Y190
1470    LPRINT CHR$(1)CHR$(18)"PLOTTER/PRINTER";
1480    LPRINT CHR$(2)
1490    LPRINT"G50       U−570   V−570
1500    LPRINT CHR$(1)CHR$(19)"PLOTTER/PRINTER";
1510    LPRINT CHR$(2)
1520    LPRINT"G50       U−570   V570
1530    LPRINT CHR$(1)CHR$(20)"PLOTTER/PRINTER";
1540    LPRINT CHR$(2)
1550    LPRINT"G50       U100    V140
1560    LPRINT CHR$(1)CHR$(17)"Y=SIN(X)";
1570    LPRINT CHR$(2)
1580    LPRINT"50        U20     V300
```

```
1590    LPRINT CHR$(1)"Y=X";
1600    LPRINT CHR$(2)
1610    LPRINT"G50 V20
1620    LPRINT CHR$(1)"2";
1630    LPRINT CHR$(2)
1640    LPRINT"G50      U430      V-20
1650    LPRINT CHR$(1)"Y=1/X";
1660    LPRINT CHR$(2)
1670    LPRINT"G50      U320      V-150
1680    LPRINT CHR$(1)"Y=X";
1690    LPRINT CHR$(2)
1700    LPRINT"G50      U-420   V-1000
1710    LPRINT CHR$(1)"X=SIN(T), Y=COS(T)";
1720    LPRINT STRINGS (25, 10)
1730    END
```

ASCII Code Table

Decimal	Hex	Function	Decimal	Hex	Character
0	0		21	15	
1	1	C. MODE	22	16	
2	2	P. MODE	23	17	
3	3	2 MUL	24	18	
4	4	4 MUL	25	19	
5	5	8 MUL	26	1A	
6	6	1 MUL	27	1B	
7	7		28	1C	
8	8	BS	29	1D	
9	9		30	1E	
10	A	LF	31	1F	
11	B		32	20	SP
12	C		33	21	!
13	D	CR.LF	34	22	"
14	E		35	23	#
15	F		36	24	$
16	10		37	25	
17	11	Rotate 0	38	26	&
18	12	Rotate 90	39	27	'
19	13	Rotate 180	40	28	(
20	14	Rotate 270	41	29	)

Decimal	Hex	Character	Decimal	Hex	Character
42	2A	*	63	3F	?
43	2B	+	64	40	@
44	2C	'	65	41	A
45	2D	–	66	42	B
46	2E	.	67	43	C
47	2F	/	68	44	D
48	30	0	69	45	E
49	31	1	70	46	F
50	32	2	71	47	G
51	33	3	72	48	H
52	34	4	73	49	I
53	35	5	74	4A	J
54	36	6	75	4B	K
55	37	7	76	4C	L
56	38	8	77	4D	M
57	39	9	78	4E	N
58	3A	:	79	4F	O
59	3B	;	80	50	P
60	3C	<	81	51	Q
61	3D	=	82	52	R
62	3E	>	83	53	S

Decimal	Hex	Character	Decimal	Hex	Character
84	54	T	104	67	H
85	55	U	105	68	I
86	56	V	106	69	J
87	57	W	107	6A	K
88	58	X	108	6B	L
89	59	Y	109	6D	M
90	5A	Z	110	6E	N
91	5B		111	6F	O
92	5C		112	70	P
93	5D		113	71	Q
94	5E		114	72	R
95	5F		115	73	S
96	60		116	74	T
97	61	A	117	75	U
98	62	B	118	76	V
99	63	C	119	77	W
100	63	D	120	78	X
101	64	E	121	79	Y
102	65	F	122	7A	Z
103	66	G			

C. MODE : Sets to character mode

P. MODE : Sets to plotter mode

1 MUL : Base size characters (C)

2 MUL : Twice base size (C)

4 MUL : Four times base size (C)

8 MUL : Eight times base size (C)

CR. LF : Carriage return line feed code (C)

0 : 0 degree code (C)

90 : 90 degree code (C)

180 : 180 degree code (C)

270 : 270 degree code (C)

BS : Back space code (C)

LF : Line feed code (C)

SPECIAL NOTES

Replacement of the ball-point pen.

When the pen runs dry, open the front cover and carefully remove the pen without moving the head position. Replacement black pens can be obtained through your local Radio Shack store or Computer Center. Also many stationery supply stores will have suitable replacements; use Fisher Pen type PR4M (medium reproduceable black). We recommend the use of medium point pens because some Fisher fine point pens do not fit properly in the Plotter Printer.

Other colors are available (Fisher Pen type PR—4). If not available locally, contact:

FISHER PEN CO
Customer Service
743 Circle Avenue
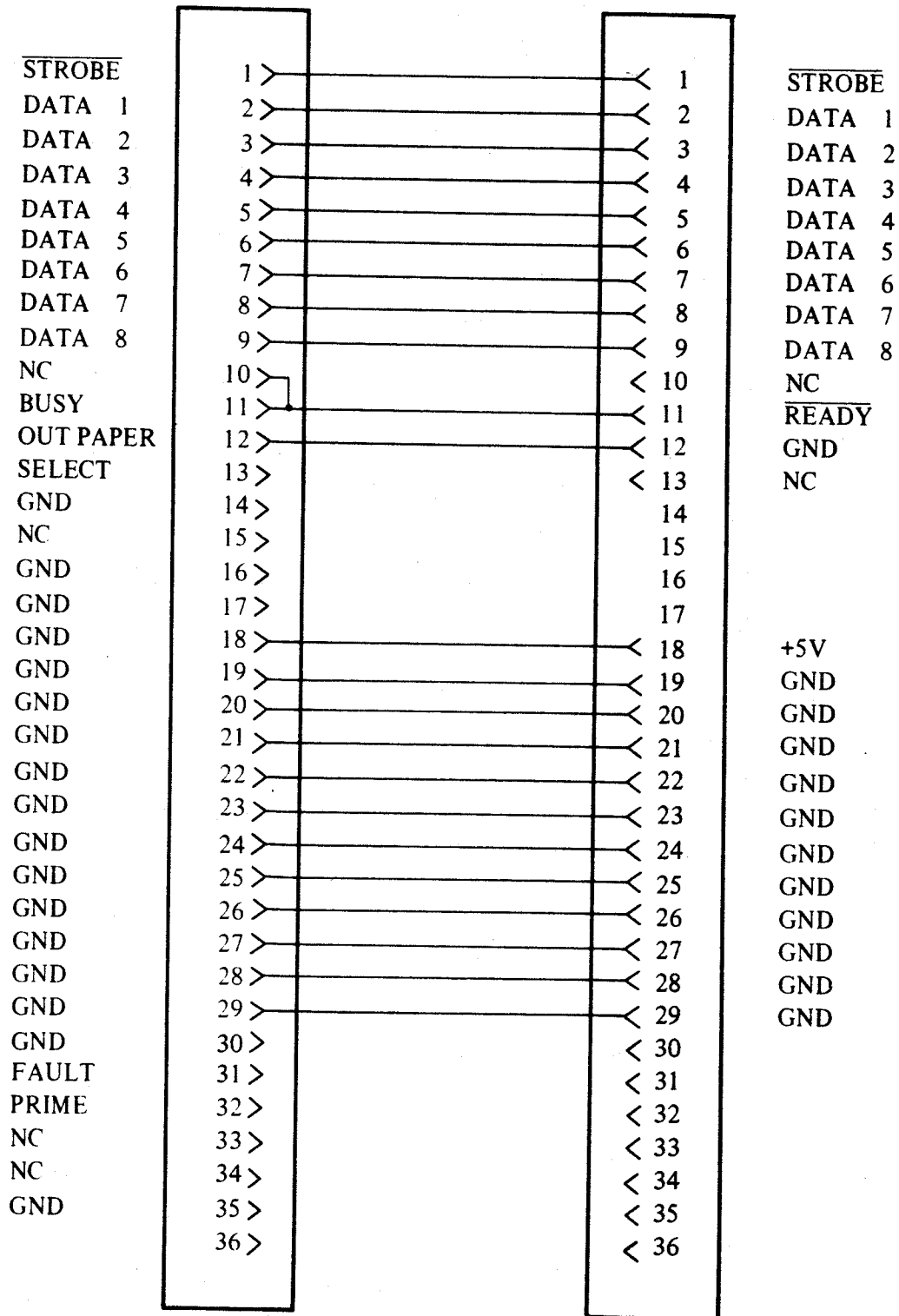Chicago, Illinois 60630
　　　Phone # 800—323—3918

PRECAUTIONS

* When the POWER switch is ON, be sure the pilot lamp is lit.

* Be sure the connectors are firmly attached.

* Be sure the cover is fully closed.

* Do not operate the Plotter Printer in locations where it will be exposed to direct sunlight, excessive dust or dirt, excessive moisture, or heat sources (such as radiators, hot air vents, etc.).

* Always position the Plotter Printer on a firm, level surface.

* Be sure to start printing with a continuous line (not dots) to get the ink flowing.

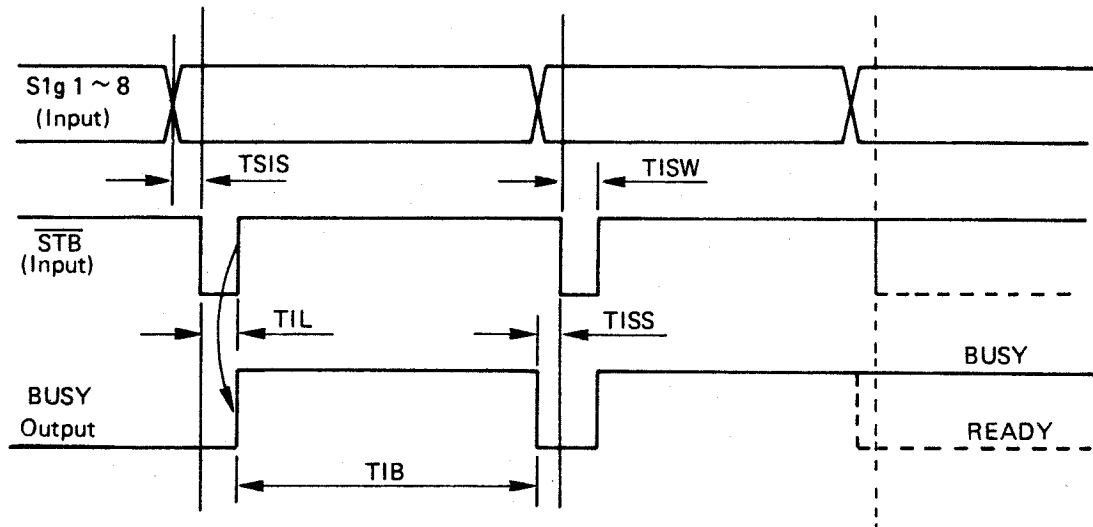* Do not print too many dots consecutively or the pen will dry out. (The ballpoint needs to roll.)

Connector Connection Diagram

TRS-80   PLOTTER PRINTER

STROBE	1 >		< 1	STROBE
DATA 1	2 >		< 2	DATA 1
DATA 2	3 >		< 3	DATA 2
DATA 3	4 >		< 4	DATA 3
DATA 4	5 >		< 5	DATA 4
DATA 5	6 >		< 6	DATA 5
DATA 6	7 >		< 7	DATA 6
DATA 7	8 >		< 8	DATA 7
DATA 8	9 >		< 9	DATA 8
NC	10 >		< 10	NC
BUSY	11 >		< 11	READY
OUT PAPER	12 >		< 12	GND
SELECT	13 >		< 13	NC
GND	14 >		14	
NC	15 >		15	
GND	16 >		16	
GND	17 >		17	
GND	18 >		< 18	+5V
GND	19 >		< 19	GND
GND	20 >		< 20	GND
GND	21 >		< 21	GND
GND	22 >		< 22	GND
GND	23 >		< 23	GND
GND	24 >		< 24	GND
GND	25 >		< 25	GND
GND	26 >		< 26	GND
GND	27 >		< 27	GND
GND	28 >		< 28	GND
GND	29 >		< 29	GND
GND	30 >		< 30	
FAULT	31 >		< 31	
PRIME	32 >		< 32	
NC	33 >		< 33	
NC	34 >		< 34	
GND	35 >		< 35	
	36 >		< 36	

Interface Timing

Note: 1. Input signal level [H] 2V to 5.25V
　　　　　　　　　　　　　　　 [L] 0V to 0.8V
　　　　　 2. When STB is in [L] level continuous-
　　　　　　　　 ly, it will not become READY.

SYM	PARAMETER	MIN	MAX
TSIS	Signal Input set TIME	0.2μS	——
TIL	Input Load TIME	1.0μS	60μS
TIB	Input Busy TIME	110μS	——
TISS	Input Strobe Set TIME	0μS	——
TISW	Input Strobe Pulse Width TIME	2.0μS	——

Radio Shack®
TRS-80
PLOTTER/PRINTER

WRITING WITH BALL-POINT PEN

YOU CAN PRINT ALPHANUMERIC CHARACTERS

AT FOUR ANGLES OF ROTATION

YOU CAN ALSO PLOT

'STRAIGHT LINES' , 'DOTTED LINES' AND 'CURVES'.

$Y=X^2$

$Y=1/X$

$Y=X$

$Y=SIN(X)$

PLOTTER/PRINTER

PLOTTER/PRINTER

$X=SIN(T),Y=COS(T)$
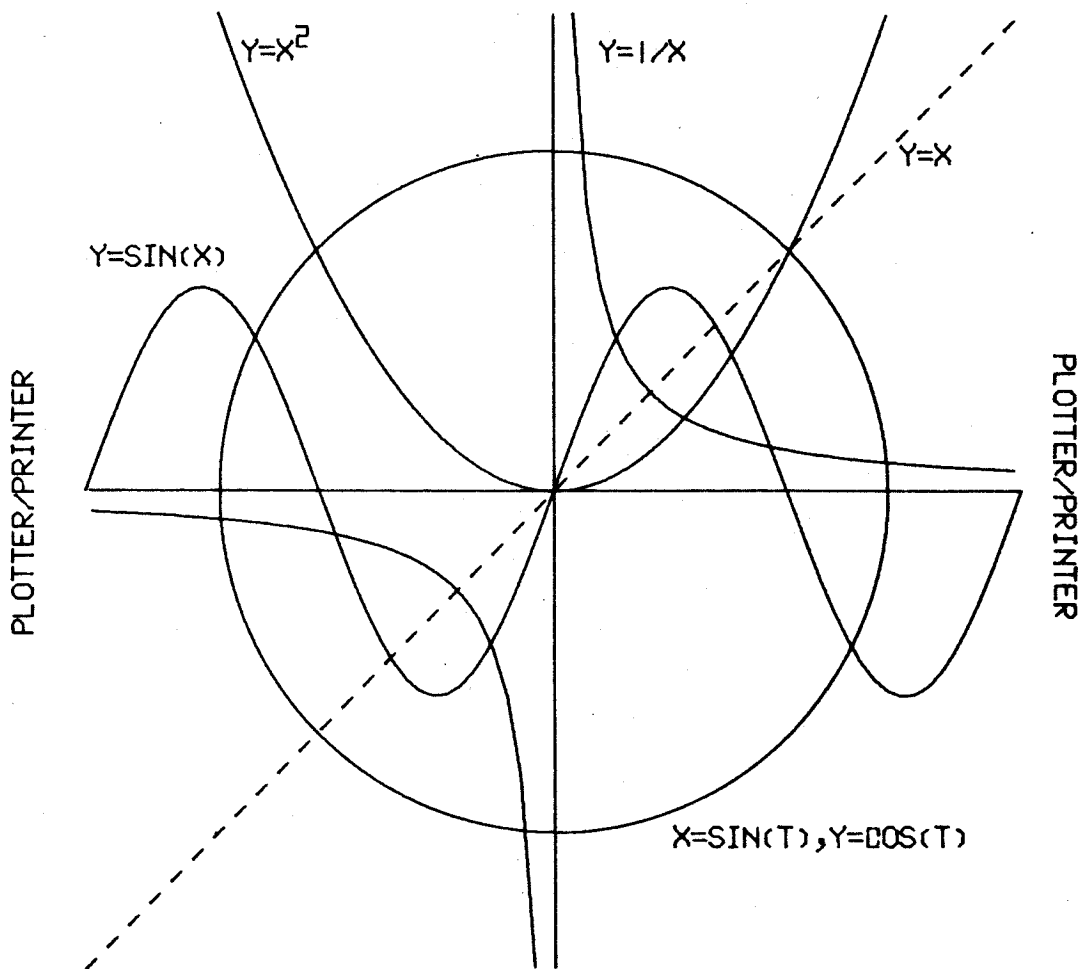
PLOTTER/PRINTER

SPECIFICATIONS

Printing System:	Ball-point pen
Printing Speed:	Average 10 characters/sec (base size characters)
Step-by-step Speed:	667 steps/second
Step Dimensions:	0.09525 mm for both X and Y axes = 3/800 " *inch/step*
Control codes:	Standard ASCII Code (characters & symbols) plus special control codes
Characters-per-line:	80 maximum with auto wraparound
Character Spacing:	2.3 mm (24 steps)
Line-feed Spacing:	4.2 mm (44 steps)
Paper Size:	9" (8-1/2" sprocket width) 7-3/8" effective width for writing (75 characters) (Catalog number 26-1407)
Life of ball-point pen:	Approx 500,000 characters (4500 meters) (Ball-point pen: Radio shack part number ACT-0165)
Power Requirements:	120 Volts, 60 Hz (220/240 VAC on European/Australian models) 120 VA (max inrush current = 25 A for 5mS or less)
Noise Level:	70 dB at 1 meter
Dimensions:	6.4 x 15.9 x 12.3 in (H x W x D) (162 x 405 x 313 mm)
Weight:	15 lbs (7 kg) without paper
Ambient Temperature:	Operation: 41 to 104°F (5 to 40°C) Storage: 14 to 122°F (−10 to 50°C) Operation: 40 to 80% Storage: 20 to 90% (non-condensing)
Recording Accuracy:	*Relative accuracy: 0.15% or less Repeatability: 0.1 mm or less

* Relative accuracy is defined as follows:

$$\frac{(\text{Theoretical Distance}) - (\text{Actual Distance})}{\text{Theoretical Distance}} \times 100 =$$

(Distance refers to the distance that the pen travels/should travel)

Paper rewinding length allowable : 0.5 m

Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which cause the user at his own expense will required to take whatever measures may be required to correct the interference.

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.

Any statements made by Radio Shack and its employees, including but not limited to, statements regarding capacity, suitability for use, or performance of the unit shall *not* be deemed a warranty or representation by Radio Shack for any purpose, nor give rise to any liability or obligation of Radio Shack.

EXCEPT AS SPECIFICALLY PROVIDED IN THIS WARRANTY OR IN THE RADIO SHACK COMPUTER SALES AGREEMENT, THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL RADIO SHACK BE LIABLE FOR LOSS OF PROFITS OR BENEFITS, INDIRECT, SPECIAL, CONSEQUENTIAL OR OTHER SIMILAR DAMAGES ARISING OUT OF ANY BREACH OF THIS WARRANTY OR OTHERWISE.

7-80

RADIO SHACK ▉ A DIVISION OF TANDY CORPORATION

U.S.A.: FORT WORTH, TEXAS 76102
CANADA: BARRIE, ONTARIO L4M 4W5

TANDY CORPORATION

AUSTRALIA	BELGIUM	U. K.
280-316 VICTORIA ROAD RYDALMERE, N.S.W. 2116	PARC INDUSTRIEL DE NANINNE 5140 NANINNE	BILSTON ROAD WEDNESBURY WEST MIDLANDS WS10 7JN