PROGRAM TITLE: FLOATING POINT PLOTTER SUBROUTINE

PROGRAM CLASSIFICATION: Subroutine

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PURPOSE: Given the coordinates of a point
                               (X,Y) as a pair of floating point
                               numbers, (a) plot as straight a
                               line as possible from the present
                               pen position to the given point,
                               or (b) move the pen (in the raised
                               position) as fast as possible to
                               the given point. This subroutine
                               is essentially a combination of
                               the "Floating Point to Plotter
                               Increment Conversion", "Line
                               Plotter", and "Point Plotter"
                               routines.

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1. Purpose: Given the coordinates of a point (X,Y) as a pair of floating point numbers, (a) plot as straight a line as possible from the present pen position to the given point, or (b) move the pen (in the raised position) as fast as possible to the given point. This subroutine is essentially a combination of the "Floating Point to Plotter Increment Conversion," "Line Plotter," and "Point Plotter" routines.

2. Restrictions: The coordinates of the point must be normalized floating point numbers, and should be consistent with scale factors and available plotting space.

3. Method

3.1 The method of "Floating Point to Plotter Increment Conversion" subroutine is used determine the number of increments the pen is to be moved.

3.2 The method of "Line Plotter" subroutine is used to plot with the pen down.

3.3 The method of "Point Plotter" is used to move the pen in the raised position.

4. Use:

4.1 Definition of coordinates:

When facing the plotter
+x is the direction a line is drawn when the drum moves down
-x is the direction a line is drawn when the drum moves up
+y is the direction a line is drawn when the carriage moves left
-y is the direction a line is drawn when the carriage moves right

4.2 Initialization:

Before plotting the pen should be positioned manually and the following values supplied to the subroutine. This is to be accomplished by storing them in the V-loop and transferring to initialization entry $(L_0 + 2)$.

7770	X_0	= x coordinate of the initial pen position
72	Y_0	= Y " " " " " "
74	X_s	= x scale factor in units/inch
76	Y_s	= y scale factor in units/inch

X, Y (and X_0, Y_0) are given in arbitrary units of the users choice; the scale factors X_s, Y_s are the desired number of these arbitrary units per inch of pen motion.

4.3 Calling Sequences:

To move the pen, in the raised position, to the point:

    CLA KW
    TRA L_0
    RETURN

To plot a line to the point (it is <u>not</u> necessary that the pen be down before calling):

    CLA KW
    TRA L_0 + 1
    RETURN

where (KW) = + 00 XXXX 0 + 00 YYYY 0

  with XXXX = location of floating point X coordinate
       YYYY =   "   "   "   "   "   Y   "

To initialize:

    CTV (initialization data as described in 4.2)
    TRA L_0 + 2
    RETURN

To reset (return pen, in raised position, to initial position X_0, Y_0)

    TRA L_0 + 3
    RETURN

5. <u>Coding Information</u>

5.1 Locations used:

This routine occupies 210_8 locations (from L_0 to L_0 + 207). It destroys both loops and all registers.

5.2 Constants

    L_0 + 52 02_8 at b = 18 ⎫
         53   01_8 "   ⎪
         54   10_8 "   ⎬ basic pen commands for line plot
         55   04_8 "   ⎭

    L_0 + 63   +1. at b = 39

    L_0 + 112 P_{+X} ⎫
          113   P_{-X} ⎪ Alphanumeric words. Basic pen
          114   P_{+Y} ⎬ commands for point plot. See
          115   P_{-Y} ⎭ paragraph 3.1 of "Line Plot" description

$$L_o + 145 \quad +1., \; b = 39$$
$$+ 146 \quad +7., \; b = 39$$

$$L_o + 171,2 + 100.0 \quad \text{floating point}$$
$$L_o + 202,3 + 0.5 \qquad " \qquad "$$

5.3 Variables

$$L_o + 174,5 \quad X_o \quad \text{floating point}$$
$$176,7 \quad Y_o \qquad " \qquad "$$

$$L_o + 200 \quad x_p \quad b = 39$$
$$201 \quad Y_p \quad b = 39$$

$$L_o + 202,3 \quad X_s \quad \text{floating}$$
$$204,5 \quad Y_s \quad \text{point}$$

5.4 Unused locations

None

5.5 Erasable Locations

$$L_o + 10$$
$$64$$
$$66$$
$$67$$

5.6 This subroutine is relocatable by the method of AN-076

6. <u>Remark</u>: Change of Coordinate System

The coordinate system as defined by 4.1 is such that, when facing
the plotter, the x axis is positive upward and the y axis is positive
to the left. It is frequently convenient to have the coordinate
system defined in such a manner that the y axis is positive upward
and the x axis is positive to the right (i.e., a 90 degree clock-
wise rotation of the standard plotter coordinate system). This
result may be achieved by altering the following locations to read
(in command format):

$$L_o + 52 \quad + 00 \; 00040 \; 0 \; 00 \; 00000$$
$$53 \quad + 00 \; 00100 \; 0 \; 00 \; 00000$$
$$54 \quad + 00 \; 00020 \; 0 \; 00 \; 00000$$
$$55 \quad + 00 \; 00010 \; 0 \; 00 \; 00000$$

$$L_o + 112 \quad - 20 \; 41020 \; 0 \; 20 \; 41020$$
$$113 \quad - 41 \; 02040 \; 0 \; 41 \; 02040$$
$$114 \quad - 10 \; 20410 \; 0 \; 10 \; 20410$$
$$115 \quad - 04 \; 10201 \; 0 \; 04 \; 10201$$

```
0000.0
 +  SAX  0010.0    +  TRA  0004.1
 +  SAX  0010.0    +  TRA  0006.0
 +  SAX  0010.0    +  TRA  0160.0
 +  SAX  0010.0    +  ADD  0012.0
 +  TRA  0040.0    +  CTL  0010.0
 +  ADD  7762.0    +  TRA  7763.0
 +  PNC  0020.0    +  CTL  0010.0
 +  ADD  7761.0    +  TRA  7763.0

0010.0
 +  CLA  1174.0    +  CLA  1176.0
 +  70   0050.0    +  TRA  0000.1
 +  70   0110.0    +  TRA  0000.1
 +  STO  0157.0    +  STA  0044.0
 +  CLA  7760.0    +  CTV  0200.0
 +  STA  7766.0    +  STA  0026.1
 +  FCA  0174.0    +  FDV  7774.0
 +  CTL  0020.0    +  TRA  7760.0

0020.0
 +  TPL  7761.1    +  FSB  7772.0
 +  TRA  7762.0    +  FAD  7772.0
 +  XAR  0000.0    +  ALS  0001.0
 +  SUB  7764.0    +  STA  7764.1
 +  XAR  0000.0    +  ARS  0047.0
 +  STO  0200.0    +  SUB  7770.0
 +  STO  7770.0    +  FCA  1176.0
 +  CTL  0030.0    +  TRA  7760.0

0030.0
 +  FDV  7776.0    +  TPL  7762.0
 +  FSB  7772.0    +  TRA  7762.1
 +  FAD  7772.0    +  XAR  0000.0
 +  ALS  0001.0    +  SUB  7765.0
 +  STA  7765.1    +  CLA  7770.0
 +  XAR  0000.0    +  ARS  0047.0
 +  STO  0201.0    +  SUB  7771.0
 +  CTL  0040.0    +  TRA  7763.1

0040.0
 +  STA  0041.1    +  CLA  0042.0
 +  TRA  0000.0    +  TRA  3071.1
 +  CLA  0174.0    +  CLA  0176.0
 +  70   0000.0    +  XAR  0000.0
 +  CTV  1110.0    +  TZE  7776.0
 +  FST  7776.0    +  TPL  7767.0
 +  CLA  7773.0    +  TRA  7767.1
 +  CLA  7772.0    +  XAR  0000.0

0050.0
 +  CTL  0060.0    +  TPL  7760.0
 +  CLA  7775.0    +  TRA  7760.1
 +  CLA  0002.0    -  CLA  0000.0
 +  CLA  0001.0    -  CLA  0000.0
 +  CLA  0010.0    -  CLA  0000.0
 +  CLA  0004.0    -  CLA  0000.0
 +  XAR  0000.0    +  TZE  0157.1
 +  XAR  0000.0    +  TRA  7765.0

0060.0
 +  CLA  7774.0    +  FST  7774.0
 +  CLA  7776.1    +  SUB  7777.1
 +  TZE  0104.0    +  TPL  7765.0
 +  FCA  7776.0    +  XAR  0000.0
 +  FST  7776.0    +  TRA  7766.1
 +  FCA  7774.0    +  XAR  0000.0
 +  FST  7774.0    +  CLA  7774.0
 +  CTL  0070.0    +  TRA  7760.0

0070.0
 +  ADD  7766.0    +  STO  7766.0
 +  ADD  7775.0    +  STA  7767.0
 +  CLA  7777.1    +  DSR  7776.1
 +  STO  7760.0    +  XAR  0000.0
 +  CLA  7776.1    +  CTV  0100.0
 +  TRA  7770.0    +  70   0000.0
 +  PNC  0020.0    +  TRA  7767.1
 +  PNC  0020.0    +  XAR  0000.0
```

```
0100.0
+ SUB  7773.0      + TMI  0157.1
+ XAR  0000.0      + ADD  7760.0
+ TOV  7767.0      + TRA  7766.0
+ CLA  0000.0      - CLA  0000.1
+ CTL  0070.0      + STO  7760.0
+ XAR  0000.0      + ADD  7766.0
+ ADD  7774.0      + STO  7766.0
+ TRA  7764.0      + 70   0000.0

0110.0
+ CTL  0120.0      + TPL  7760.0
+ CLA  7775.0      + TRA  7760.1
- 10   2041.0      - 10   2041.0
- FAD  1020.1      - FAD  1020.1
- ALS  0204.0      - ALS  0204.0
- DSL  4102.0      - DSL  4102.0
+ TRA  7765.0      + 70   0000.0
+ TRA  0167.1      + FCA  0176.0

0120.0
+ CLA  7774.0      + FST  7774.0
+ CLA  7776.1      + SUB  7777.1
+ STO  0144.0      + TPL  7765.0
+ FCA  7774.0      + XAR  0000.0
+ FST  7774.0      + TRA  7767.0
+ FCA  7776.0      + XAR  0000.0
+ FST  7776.0      + FCA  7774.0
+ CTL  0130.0      + TRA  7760.0

0130.0
+ ADD  7775.0      + FST  0146.0
+ CLA  7776.1      + CTV  0140.0
+ SUB  7775.0      + TMI  7765.1
+ XAR  0000.0      + CLA  7776.0
+ PNC  7760.0      + XAR  0000.0
+ TRA  7762.0      + ADD  7775.0
+ TZE  7771.0      + ALS  0001.0
+ ADD  7770.0      + STO  7770.0

0140.0
+ CLA  7776.0      + PNC  7760.0
+ CTL  0150.0      + CLA  7774.1
+ XAR  0000.0      + TRA  7761.0
+ CLA  0000.0      - CLA  0000.0
+ CLA  0000.0      - CLA  0000.0
+ CLA  0000.0      - CLA  0004.0
- 24   5122.1      - 24   5122.1
- FAD  1020.1      - FAD  1020.1

0150.0
+ XAR  0000.0      + PNC  7760.0
+ CLA  7777.0      + XAR  0000.0
+ SUB  7775.0      + TPL  7760.0
+ ADD  7775.0      + TZE  7767.1
+ ALS  0001.0      + ADD  7766.0
+ STO  7766.0      + 70   0000.0
+ CLA  7777.0      + PNC  7760.0
+ 70   1110.0      + TRA  1041.1

0160.0
+ ADD  0012.0      + STA  0170.1
+ FCA  7774.0      + FDV  0171.0
+ FST  0204.0      + FCA  7776.0
+ FDV  0171.0      + FST  0206.0
+ FCA  7770.0      + FST  0174.0
+ FCA  7772.0      + FST  0176.0
+ CLA  0117.0      + STO  0037.0
+ TRA  0014.1      + CLA  0173.0

0170.0
+ STO  0037.0      + TRA  3061.0
+ 62   0000.0      - CLA  0000.0
+ CLA  0000.0      - CLA  0003.1
+ CTL  0040.0      + TRA  7763.1
- ARS  0000.0      - CLA  0000.0
+ CLA  0000.0      - CLA  0000.1
- ARS  0000.0      - CLA  0000.0
+ CLA  0000.0      - CLA  0000.1
```

0200.0
```
 - CLA 0000.0   - CLA 0062.0
 - CLA 0000.0   - CLA 0062.0
 + ARS 0000.0   - CLA 0000.0
 + CLA 0000.0   - CLA 0000.0
 + TZE 7534.0   - TZE 7534.0
 - CLA 0000.0   - CLA 0003.0
 + TZE 7534.0   - TZE 7534.C
 - CLA 0000.0   - CLA 0003.0
```